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Technical Specifications
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I N T R O D U C T O R Y I N F O R M A T I O N

T A B L E o f C O N T E N T S

SPECIFICATIONS GROUP

GENERAL REQUIREMENTS SUBGROUP

DIVISION 08: OPENINGS

08 0100 OPERATION AND MAINTENANCE OF OPENINGS

08 1000 DOORS AND FRAMES

08 4000 ENTRANCES, STOREFRONTS, AND CURTAIN WALLS

08 7000 HARDWARE

08 8000 GLAZING

DIVISION 09: FINISHES

09 0000 FINISHES

09 2000 PLASTER AND GYPSUM BOARD

09 5000 CEILINGS

09 6000 FLOORING

DIVISION 22: PLUMBING

22 0500 COMMON WORK RESULTS FOR PLUMBING

22 0500 COMMON WORK RESULTS FOR PLUMBING

22 1000 PLUMBING PIPES AND PUMPS

22 3000 PLUMBING EQUIPMENT

22 4000 PLUMBING FIXTURES

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

23 0500 BASIC HVAC REQUIREMENTS

23 3000 HVAC AIR DISTRIBUTION

DIVISI0N 01: GENERAL REQUIREMENTS

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SECTION 01 1100

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements Summary of Work requirements.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Provisions contained in Division 01 apply to Sections of Divisions 02 through 49 of Specifications. Instructions contained in Specifications are directed to Contractor. Unless specifically provided otherwise, obligations set forth in Contract Documents are obligations of Contractor.

B. Contractor shall furnish total labor, materials, equipment, and services necessary to perform The Work in accordance with Contract Documents.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 1400

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Work Restrictions.

1.2 PROJECT CONDITIONS

A. During construction period, Contractor will have use of premises for construction operations. Contractor will ensure that Contractor, its employees, subcontractors, and their employees comply with following requirements:
   1. Confine operations to areas within Contract limits shown on Drawings. Do not disturb portions of site beyond Contract limits.
   2. Do not allow alcoholic beverages, illegal drugs, or persons under their influence on Project site.
   3. Do not allow use of tobacco in any form on Project Site.
   4. Do not allow pornographic or other indecent materials on site.
   5. Do not allow work on Project site on Sundays except for emergency work.
   6. Refrain from using profanity or being discourteous or uncivil to others on Project Site or while performing The Work.
   7. Wear shirts with sleeves, wear shoes, and refrain from wearing immodest, offensive, or obnoxious clothing, while on Project Site.
   8. Do not allow playing of obnoxious and loud music on Project Site. Do not allow playing of any music within existing facilities.
   9. Do not build fires on Project Site.
   10. Do not allow weapons on Project Site, except those carried by law enforcement officers or other uniformed security personnel who have been retained by Owner or Contractor to provide security services.

B. Existing Facilities:
   1. Provide reasonable access and use of existing site.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 2100

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements to prepare and process Allowances.

1.2 CASH ALLOWANCES

A. Include following Allowances in bid:
   1. Allow $13,000 Signage allowance
   2. Allow $35,000 Owner changes allowance

B. Cash Allowance
   1. Reference the General Conditions and Supplementary Conditions in addition to these requirements.
   2. Cash Allowance:
      a. Description: Cash allowance for all costs associated with the installation of the Work of Owner's Contingency Allowances. Contractor shall include the amounted indicated in the Bid Form in his Base Proposal as a contingency to cover the cost of hidden, concealed or other wise unforeseen conditions which develop during completion of the Work. Contractor shall be allowed to recover all costs associated with the completion of Work under this contingency, however, no overhead or profit will be allowed.
      b. Amount as indicated in the Bid Form.
      c. Include all Allowances in the Contract Sum.
   3. Architect Responsibilities:
      a. Prepare and issue a Construction Change Directive or Request for Proposal/Work Change Proposal Request describing Work required.
      b. Prepare Change Order reflecting adjustments to Contract amount relative to allowance.
   4. Contractor Responsibilities:
      a. Itemize all costs associated with cost request in accordance with the General Conditions and Supplementary Conditions and herein in order to justify all costs affecting the allowance.
      b. Include cost for materials, delivery, un-packaging, unloading, storage if any, taxes and installation costs.

C. Materials Allowance
   1. Reference the General Conditions and Supplementary Conditions in addition to these requirements. Include all Allowances in Contract Sum.
   2. Architect Responsibilities:
      a. Consult with Contractor for consideration and selection of products, suppliers and installers.
      b. Select products in consultation with Owner and transmit decision to Contractor.
      c. Prepare Change Order

D. If actual purchase price differs from Allowance, change order will be issued adjusting Contract Sum by amount of difference.

E. Actual purchase price is actual amount paid by Contractor, including applicable sales and use taxes, before taking into account cash discounts for prompt payment.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 2900

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements to prepare and process Applications for Payments.

1.2 PAYMENT REQUESTS

A. Use Payment Request forms per by Owner direction.

B. Each Payment Request will be consistent with previous requests and payments certified by Architect and paid for by Owner.

C. Request Preparation:
   1. Complete every entry on Payment Request form.
   2. Entries will match data on approved schedule of values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
   3. Submit signed Payment Request to Architect with current Construction Schedule.

D. Provide following submittals before or with submittal of Initial Payment Request:
   1. List of Subcontractors.
   2. Initial progress report.
   3. Contractor's Construction Schedule.
   4. Submittal Schedule.

1.3 SCHEDULE OF VALUES

A. Submit schedule of values on Owner's standard form to Architect 10 days minimum before submission of Initial Payment Request as a necessary condition before payment will be processed. Coordinate preparation of schedule of values with preparation of Contractor's Construction Schedule. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
   1. Contractor's Construction Schedule.
   2. Payment Request form.
   3. Schedule of Allowances.
   4. Schedule of Alternates.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3100

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Project Management and Coordination on Projects.

1.2 PROJECT COORDINATION

A. Project designation for this Project is City of Ontario West End Animal Services Agency (WEASA).

B. This Project designation will be included on documents generated for Project by Contractor and Subcontractors, or be present on a cover letter accompanying such documents.

1.3 MULTIPLE CONTRACT COORDINATION

A. Contractor shall be responsible for accurately maintaining and reporting schedule of The Work from Notice to Proceed to date of Substantial Completion.

B. Contractor shall be responsible for providing Temporary Facilities And Controls for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

C. Contractor shall be responsible for providing Construction Waste Management And Disposal services for those who perform work on Project from Notice to Proceed to date of Substantial Completion.

D. Contractor shall be responsible for Final Cleaning for entire Project and Site.

1.4 PROJECT MEETINGS AND CONFERENCES

A. Preconstruction Conference:
   1. Attend preconstruction conference and organizational meeting scheduled by Architect at Project site or other convenient location.
   2. Be prepared to discuss items of significance that could affect progress, including such topics as:
      a. Construction schedule.
      b. Critical Work sequencing.
      c. Current problems.
      d. Designation of responsible personnel.
      e. Material/Distribution of Contract Documents.
      f. Equipment deliveries and priorities.
      g. General schedule of inspections by Architect and its consultants.
      h. General inspection of tests.
      i. Office, work, and storage areas.
      j. Preparation of record documents and O & M manuals.
      k. Procedures for processing interpretations and Modifications.
      l. Procedures for processing Payment Requests.
      m. Project cleanup.
      n. Security.

o. Status of permits.
p. Submittal of Product Data, Shop Drawings, Samples, Quality Assurance / Control submittals.
q. Use of the premises.
r. Work restrictions.
s. Working hours.

3. Architect will record minutes of meetings and distribute copies to Owner and Contractor.

B. Progress Meetings:
1. Attend progress meetings at Project site at regularly scheduled intervals determined by Architect, at least once a month.
2. Progress meetings will be open to Owner, Architect, Subcontractors, and anyone invited by Owner, Architect, and Contractor.
3. Be prepared to discuss items of significance that could affect progress, including following:
a. Progress since last meeting.
b. Whether Contractor is on schedule.
c. Activities required to complete Project within Contract Time.
d. Off-site fabrication problems.
e. Access.
f. Site use.
g. Temporary facilities and services.
h. Hours of work.
i. Hazards and risks.
j. Project cleanup.
k. Quality and Work standards.
l. Status of pending modifications.
m. Documentation of information for Payment Requests.
n. Maintenance of Project records.
4. Architect will prepare minutes of progress meetings and distribute copies of minutes to Owner and Contractor.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3200

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for documenting the progress of construction during performance of the Work.

1.2 SCHEDULING OF WORK

A. Bar Chart Schedule:
   1. Submit horizontal bar chart schedule before Preconstruction Conference. Provide separate time bar for each construction activity listed on Owner's payment request form. Within each time bar, show estimated completion percentage. Provide continuous vertical line to identify first working day of each week. Show each activity in chronological sequence. Show graphically sequences necessary for completion of related portions of The Work. As The Work progresses, place contrasting mark in each bar to indicate actual completion.
   2. Provide copies of schedule for Architect and Owner and post copy in field office.
   3. Revise schedule monthly. Send copy of revised schedule to Owner and Architect and post copy in field office.

B. Daily Construction Reports:
   1. Prepare daily reports of operations at Project including at least following information:
      a. List of Subcontractors at site.
      b. Approximate count of personnel at site by trade.
      c. High and low temperatures, general weather conditions.
      d. Major items of equipment on site.
      e. Materials or equipment items arriving at or leaving site.
      f. Accidents and unusual events.
      g. Site or structure damage by water, frost, wind, or other causes.
      h. Meetings, conferences, and significant decisions.
      i. Visitors to the job including meeting attendees.
      j. Stoppages, delays, shortages, losses.
      k. Any tests made and their result if known.
      l. Meter readings and similar recordings.
      m. Emergency procedures.
      n. Orders and requests of governing authorities.
      o. Modifications received, carried out.
      p. Services connected, disconnected.
      q. Equipment or system tests and start-ups.
      r. Brief summary of work accomplished that day.
      s. Signature of person preparing report.
   2. Submit daily reports to Architect at least weekly.
   3. Maintain copies of daily reports at field office.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Submittal Procedures.

1.2 SUBMITTAL SCHEDULE

A. Furnish submittal schedule within 10 days after receipt of Notice to Proceed, listing items specified to be furnished for review to Architect including product data, shop drawings, samples, and Informational submittals.
   1. Coordinate submittal schedule with Contractor's construction schedule.
   2. Enclose the following information for each item:
      a. Scheduled date for first submittal.
      b. Related Section number.
      c. Submittal category.
      d. Name of Subcontractor.
      e. Description of part of the Work covered.
      f. Scheduled date for resubmittal.
      g. Scheduled date for Architect's final release or approval.

B. Print and distribute copies to Architect and Owner and post copy in field office. When revisions are made, distribute to same parties and post in same location.

C. Revise schedule monthly. Send copy of revised schedule to Owner and Architect.

1.3 SUBMITTAL PROCEDURES

A. Coordination:
   1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently before performance of related construction activities to avoid delay.
      a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
      b. Coordinate transmittal of different types of submittals required for related elements of The Work so processing will not be delayed by need to review submittals concurrently for coordination. Architect reserves right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
   2. Processing Time:
      a. Allow sufficient review time so installation will not be delayed by time required to process submittals, including time for resubmittals.
         1) Allow 14 days for initial review. Allow additional time if processing must be delayed to allow coordination with subsequent submittals. Architect will promptly advise Contractor when submittal being processed must be delayed for coordination.
         2) If an intermediate submittal is necessary, process same as initial submittal.
         3) Allow 7 days for reprocessing each submittal.

4) No extension of Contract Time will be authorized because of failure to transmit submittals to Architect in sufficient time before work is to be performed to allow processing.

3. Identification:
   a. Place permanent label or title block on each submittal for identification. Include name of entity that prepared each submittal on label or title block.
      1) Provide space approximately 4 by 5 inches on label or beside title block on Shop Drawings to record Contractor's review and approval markings and action taken.
      2) Include following information on label for processing and recording action taken:
         a) Project name.
         b) Date.
         c) Name and address of Architect.
         d) Name and address of Contractor.
         e) Name and address of Subcontractor.
         f) Name and address of supplier.
         g) Name of manufacturer.
         h) Number and title of appropriate Specification Section.
         i) Drawing number and detail references, as appropriate.
4. Transmittal:
   a. Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using transmittal letter. On transmittal, record relevant information and requests for data. Include Contractor's certification that information complies with Contract Document requirements, or, on form or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations.
   b. Submittals received from sources other than Contractor or not marked with Contractor's approval will be returned without action.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Submit Product Data, as required by individual Sections of Specifications.
   2. Mark each copy of each set of submittals to show choices and options used on Project. Where printed Product Data includes information on products that are not required for Project, mark copies to indicate information relating to Project.
   3. Certify that proposed product complies with requirements of Contract Documents. List any deviations from those requirements on form or separate sheet.
   4. Submit electronic copy each required submittal unless otherwise required. Architect will return submittal marked with action taken and with corrections or modifications required.

B. Shop Drawings:
   1. Submit newly prepared graphic data to accurate scale. 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 36 by 48 inches. Highlight, encircle, or otherwise show deviations from Contract Documents. Include following information as a minimum:
      a. Dimensions.
      b. Identification of products and materials included.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
   2. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings. Standard printed information prepared without specific reference to Project is not acceptable as Shop Drawings.
   3. Review and designate (stamp) approval of shop drawings. Unless otherwise specified, submit to Architect electronic copy of shop drawings required by Contract Documents. Shop drawings not required by Contract Documents, but requested by Contractor or supplied by Subcontractor, need not be submitted to Architect for review.

C. Samples:
   1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
      a. Mount, display, or package Samples so as to ease review of qualities specified. Prepare Samples to match samples provided by Architect, if applicable. Include following:
         1) Generic description of Sample.
         2) Sample source.
         3) Product name or name of manufacturer.
         4) Compliance with recognized standards.
         5) Availability and delivery time.
   2. Submit 3 Physical Samples for review of kind, color, pattern, and texture, for final check of these characteristics with other elements, and for a comparison of these characteristics between final submittal and actual component as delivered and installed. Color card is not acceptable.
      a. Where variations in color, pattern, texture or other characteristics are inherent in material or product represented, submit set of three samples minimum that show approximate limits of variations.
      b. Refer to other specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
      c. Refer to other Sections for Samples to be returned to Contractor for incorporation into The Work. Such Samples shall be undamaged at time of use. On transmittal, indicate special requests regarding disposition of Sample submittals.
   3. Where Samples are for selection of color, pattern, texture, or similar characteristics from a range of standard choices, submit full set of choices for material or product. Preliminary submittals will be reviewed and returned with Architect's mark indicating selection and other action.
   4. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three sets. One will be returned marked with action taken.
   5. Samples, as accepted and returned by Architect, will be used for quality comparisons throughout course of construction.
      a. Unless noncompliance with Contract Documents is observed, submittal may serve as final submittal.
      b. Sample sets may be used to obtain final acceptance of construction associated with each set.

1.5 INFORMATIONAL SUBMITTALS

A. Informational submittals are design data, test reports, certificates, manufacturer's instructions, manufacturer's field reports, and other documentary data affirming quality of products and installations. Submit electronic copy of each required submittal unless otherwise required. Architect will return electronic copy marked with action taken and with corrections or modifications required.
   1. Certificates: Describe certificates intended to document affirmations by Contractor or others that the work is in accordance with the Contract Documents, but do not repeat provisions of Parts 2 or 3.
   2. Delegated Design Submittals / Design Data: Describe submittals intended to demonstrate design work prepared by Contractor’s licensed professionals.
   3. Test And Evaluation Reports: Describe submittal of test reports or evaluation service reports intended to document required tests.
   4. Manufacturer Instructions: Describe submittals intended to document manufacturer instructions.
   5. Source Quality Control Submittals: Describe submittal of source quality control documentation.
   6. Field Quality Control Submittals: Describe submittal of field quality control documentation.
   7. Manufacturer Reports: Describe submittal of Manufacturer reports as documentation of manufacturer activities.
   8. Special Procedure Submittals: Describe submittals intended to document special procedures. An example would be construction staging or phasing for remodeling an existing facility while

keeping it in operation. While the Contractor would normally be responsible for managing this, submittal of his plan as documentation could be specified.

9. Qualification Statements: Describe submittals intended to document qualifications of entities employed by Contractor.

1.6 CLOSEOUT SUBMITTALS

A. This title groups submittals that occur during project closeout. Coordinate with section 01 7800 Closeout Submittals.
   1. Maintenance Contracts: Describe submittal of the maintenance contract.
   2. Operations & Maintenance Data: Describe submittal of operation and maintenance data necessary for products of the Section.
   3. Bonds: Describe submittals of bonds specific to this Section.
   4. Warranty Documentation: Describe submittal of final executed warranty document.
   5. Record Documentation: Describe submittal of record documentation specific to this Section.
   6. Software: Describe submittal of extra copy operating system and other utility software necessary to operate and maintain software during life of product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. This title groups maintenance material submittals required by Section.
   1. Spare Parts: Describe spare parts necessary for Owner's use in facility operation and maintenance. 'Parts' are generally understood to be items such as filters, motor drive belts, lamps, and other similar manufactured items that require only simple replacement.
   2. Extra Stock Materials: Describe extra stock materials to be provided for Owner's use in facility operation and maintenance. Extra stock materials are generally understood to be items such as ceiling tiles, flooring, paint etc.
   3. Tools and Software:
      a. Describe tools to be provided for Owner's use in facility operation and maintenance. Tools are generally understood to be wrenches, gauges, circuit setters, etc, required for proper operation or maintenance of a system.
      b. If necessary, describe submittal of an extra copy of operating system and other utility software necessary to operate and maintain the software during expected life of product.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 3500

SPECIAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Special Procedures.

1.2 ACCELERATION OF WORK

A. Complete The Work in accordance with Construction Schedule. If Contractor falls behind schedule, take such actions as are necessary, at no additional expense to Owner, to bring progress of The Work back in accordance with schedule.

B. Owner may request proposal for completion of The Work at date earlier than expiration of Contract Time. Promptly provide requested proposal showing cost of such acceleration of The Work. Consult with Owner and Architect regarding possible options to decrease cost of such acceleration. If Owner determines to order acceleration of The Work, change in Contract Sum and Contract Time resulting from acceleration will be included in a Change Order.

1.3 OWNER'S SAFETY REQUIREMENTS

A. Personal Protection:
   1. Contractor shall ensure:
      a. Positive means of fall protection, such as guardrails system, safety net system, personal fall arrest system, etc, is provided to employees whenever exposed to a fall six feet or more above a lower level.
      b. Personnel working on Project shall wear hard hats and safety glasses as required by regulation and hazard.
      c. Personnel working on Project shall wear long or short sleeve shirts, long pants, and hard-toed boots or other sturdy shoes appropriate to type and phase of work being performed.

B. Contractor Tools And Equipment:
   1. Contractor shall ensure:
      a. Tools and equipment are in good working condition, well maintained, and have necessary guards in place.
      b. Ground Fault Circuit Interrupters (GFCI) is utilized on power cords and tools.
      c. Scaffolding and man lifts are in good working condition, erected and maintained as required by governmental regulations.
      d. Ladders are in good condition, well maintained, used as specified by Manufacturer, and secured as required.

C. Miscellaneous:
   1. Contractor shall ensure:
      a. Protection is provided on protruding rebar and other similar objects.
      b. General Contractor Superintendent has completed the OSHA 10-hour construction outreach training course or equivalent.
      c. Implementation and administration of safety program on Project.

d. Material Safety Data Sheets (MSDS) are provided for substances or materials for which an MSDS is required by governmental regulations before bringing on site.
e. Consistent safety training is provided to employees on Project.

2. Report accidents involving injury to employees on Project that require off-site medical treatment to Owner's designated representative.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4000

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Testing and inspecting services are used to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
   1. Specific quality assurance and quality control requirements for individual construction activities are specified in Sections that specify those activities and Section 01 4523. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality control procedures that facilitate compliance with Contract Document requirements.
   3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Requirements:
   1. Section 01 3300: 'Submittal Procedures'.
   2. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   3. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   4. Divisions 01 thru 49 establish responsibility for providing specific testing and inspections.

1.3 REFERENCES

A. Association Publications:
   1. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
   2. International Code Council (IBC):
      a. CBC Chapter 17, 'Structural Tests and Special Inspections'.
   3. The American Institute of Architects. AIA Document A201, *General Conditions of the Contract for Construction*. Washington, DC. 2007.
   4. The Construction Specifications Institute. Project Resource Manual/CSI Manual of Practice, 5th *Edition*. New York, McGraw-Hill, 2005.

B. Definitions:
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.

2. Approved: To authorize, endorse, validate, confirm, or agree to.
3. Contract Documents: Engineering and Architectural Drawings and Specifications issued for construction, plus clarification drawings, addenda, approved change orders and contractor designed elements.
4. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with requirements indicated; and having complied with requirements of authorities having jurisdiction.
5. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
6. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
    a. Inspection: Not required by code provisions but may be required by Contract Documents.
    b. Special Inspection: Required by code provisions and by Contract Documents.
    c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
    d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
7. 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.
    a. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.
8. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish standard by which the Work will be judged.
9. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
10. Owner’s Representative: Owner’s Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner’s approval or authorization.
11. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
12. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
13. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
14. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
15. Service Provider: Agency or firm qualified to perform required tests and inspections.
16. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
17. Special Inspection: See Inspection.
18. Special Inspector: Certified individual or firm that implements special inspection program for project.
19. Special Test: See Test.
20. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.

21. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
22. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
23. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

1.4 CONFLICTING REQUIREMENTS

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

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

1.5 QUALITY ASSURANCE

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

1.6 QUALITY CONTROL

A. 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 performed by Contractor. They do not include inspections, tests or related actions performed by Architect, Owner, governing authorities or independent agencies hired by Owner or Architect.
   1. Where services are indicated as Contractor's responsibility, engage a qualified Testing Agency to perform these quality control services.
      a. Contractor shall not employ same testing entity engaged by Owner, without Owner’s written approval.

B. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality control services with 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.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 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. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with Contract Document requirements for Section 01 7300 “Execution” for Cutting and Patching.

B. Protect construction exposed by or for Quality Assurance and Quality Control activities.

C. Repair and protection are Contractor's responsibility, regardless of assignment of responsibility for Quality Assurance and Quality Control Services.

END OF SECTION

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Regulatory Requirements.

1.2 ASBESTOS

A. Contract Documents for this Project have been prepared in accordance with generally accepted professional architectural and engineering practices. Accordingly, no asbestos or products containing asbestos have been knowingly specified for this Project. Notify Architect immediately for instructions if materials containing asbestos are brought to site for inclusion in the Work.

B. At Architect's direction and with Owner's approval, a certified asbestos inspector will collect samples and an independent testing laboratory will perform testing procedures on suspect materials.

C. Certify that based upon best knowledge, information, inspection, and belief no building materials containing asbestos were used in construction of Project. Submit certification on form provided by Owner.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4200

REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Reference standards, definitions, specification format, and industry standards.

1.2 REFERENCES

A. Definitions:
   1. Approved: The term "approved," when used to convey Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
   2. Directed: The term "directed" is a command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," and "permitted" have the same meaning as "directed."
   3. Experienced: The term "experienced," when used with an entity, means having successfully completed a minimum often previous projects similar in size and scope to this Project; being familiar with the special requirements indicated, and having complied with requirements of authority having jurisdiction.
   4. Furnish: The term "furnish" means supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
   5. General: Basic Contract definitions are included in the Conditions of the Contract.
   6. Indicated: The term "indicated" refers to requirements expressed by graphic representations, or in written form on Drawings, in Specifications, and in other Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference.
   7. Install: The term "install" describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
   8. Installer: An "Installer" is the Contractor or another entity engaged by the Contractor, as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   9. Project Site: The term "Project site" means the space available for performing construction activities. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
   10. Provide: The term "provide" means to furnish and install, complete and ready for the intended use.
   11. Regulations: The term "regulations" includes 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.
   12. Submitted: The terms "submitted," "reported," "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.
   13. Testing Agencies: A "testing agency" is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, or to report on and, if required, to interpret results of those inspections or tests.
   14. Trades: Using terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

B. References Standards:
   1. Specification Format: Specifications will follow MasterFormat™ 2004 for organizing numbers and titles. (The Construction Specifications Institute, Project Resource Manual/CSI Manual of Practice, 5th *Edition*. New York, McGraw-Hill, 2005).
      a. Specification Identifications:
         1) The Specifications use section numbers and titles to help cross referencing in the Contract Documents.
         2) Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
      b. Specification Language:
         1) Specifications should be prepared, with concern and respect for their legal status. Specifications should be Clear, Concise, Correct and Complete.
         2) Streamlining: Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places the subject first and provides keywords for quick reference
      c. Sentence Structure:
         1) Specifications to be written in the “Imperative Mood”.
            a) The verb that clearly defines the action becomes the first word in the sentence.
            b) The imperative sentence is concise and readily understandable.
         2) Streamlining is used to list products, materials, reference standards, and other itemized specifications. This technique places the subject first and provides keywords for quick reference.
      d. Abbreviated Language:
         1) Abbreviations should be used only on drawings and schedules where space is limited.
         2) Abbreviations with multiple meanings should be avoided, unless used in different disciplines where their meaning is clear from the context in which they are used.
         3) Abbreviations should be limited to five or fewer letters
            a) The verb that clearly defines the action becomes the first word in the sentence.
      e. Symbols:
         1) Caution should apply to symbols substituted for words or terms.
      f. Numbers:
         1) The use of Arabic numerals rather that words for numbers is recommended.

C. Industry Standards:
   1. Except where Contract Documents specify otherwise, construction industry standards will apply and are made a part of Contract Documents by reference.
   2. Where compliance with two or more standards is specified and standards apparently establish different or conflicting requirements for minimum quantities or quality levels, refer to Architect for decision before proceeding. Quantity or quality level shown or specified will be minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements. Refer uncertainties to Architect for decision before proceeding.
   3. Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents. Where copies of standards are needed for performance of a required construction activity, Contractor will obtain copies directly from publication source.
   4. Trade Association names and titles of general standards are frequently abbreviated. The following acronyms or abbreviations, as referenced in Contract Documents, are defined to mean association names. Names and addresses are subject to change and are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

AABC	Associated Air Balance Council	Washington	DC	(202) 737-0202	www.aabchq.com
AAMA	American Architectural Man-ufacturers Association	Schaumburg	IL	(847) 303-5664	www.aamanet.org
AASHTO	American Association of	Washington	DC	(202) 624-5800	www.aashto.org

	State Highway & Transportation Officials				
AAMA	American Architectural Manufacturers Association	Schamumburg	IL	(847) 303-5774	www.aamanet.org
AASHTO	American association of State Highways and Transportation Officials	Washington	DC		www.transportation.org www.aashto.org
ACI	American Concrete Institute International	Farmington Hills	MI	(248) 848-3700	www.aci-int.org
AGA	American Gas Association	Washington	DC	(202) 824-7000	www.aga.org
AHRI	Air Conditioning Heating & Refrigeration Institute	Arlington	VA	(703) 524-8800	www.ari.org
AIA	American Institution of Architects	Washington	DC	(202) 626-7300	www.aia.org
AISC	American Institute of Steel Construction	Chicago	IL	(312) 670-2400	www.aisc.org
AISI	American Iron & Steel Institute	Washington	DC	(202) 452-7100	www.steel.org
AITC	American Institution of Timber Construction	Englewood	CO	(303) 792-9559	www.aitc-glulam.org
AMCA	Air Movement & Control Association International	Arlington Heights	IL	(847) 394-0150	www.amca.org
ANSI	American National Standards Institute	New York	NY	(212) 642-4900	www.ansi.org
APA	APA-Engineered Wood Association	Tacoma	WA	(253) 565-6600	www.apawood.org
API	American Petroleum Institute	Washington	DC	(202) 682-8000	www.api.org
AQMD	South Coast Air Quality Management District	Diamond Bar	CA	(909) 396-2000	www.aqmd.gov
ASHRAE	American Society of Heating, Refrigerating, & Air-Conditioning Engineers	Atlanta	GA	(404) 636-8400	www.ashrae.org
ASME	American Society of Mechanical Engineers International	New York	NY	(800) 843-2763	www.asme.org
ASTM	ASTM International	West Conshohocken	PA	(610) 832-9500	www.astm.org
AWI	Architectural Woodwork Institute	Potomac Falls	VA	(571) 323-3636	www.awinet.org
AWPA	American Wood Protection Association	Birmingham	AL	(205) 733-4077	www.awpa.com
AWS	American Welding Society	Miami	FL	(800) 443-9353	www.aws.org
AWWA	American Water Works Assoc	Denver	CO	(303) 794-7711	www.awwa.org
BHMA	Builders Hardware Manufacturers Association	New York	NY	(212) 297-2122	www.buildershardware.com
BIA	Brick Industry Association	Reston	VA	(703) 620-0010	www.bia.org
CFI	International Certified Floorcovering Installers, Inc.	Kansas City	MO	(816) 231-4646	www.cfi-installers.org
CRI	Carpet & Rug Institution	Dalton	GA	(706) 278-3176	www.carpet-rug.com
CRSI	Concrete Reinforcing Steel Institute	Schaumburg	IL	(847) 517-1200	www.crsi.org
CISPI	Cast Iron Soil Pipe Institute	Chattanooga	TN	(423) 892-0137	www.cispi.org
DHI	Door & Hardware Institute	Chantilly	VA	(703) 222-2010	www.dhi.org
DIPRA	Ductile Iron Pipe Research Association.	Birmingham	AL	(205) 402-8700	www.dipra.org
EIMA	EIFS Industry Members As-	Morrow	GA	(800) 294-3462	www.eima.com

	sociation				
FM	FM Global	Johnston	RI	(401) 275-3000	www.fmglobal.com
FSC	Forest Stewardship Council	Bonn, Germany		+49 (0) 228 367 66 0	www.fsc.org
GA	Gypsum Association	Hyattsville	MD	(301) 277-8686	www.gypsum.org
GS	Green Seal	Washington	DC	(202) 872-6400	www.greenseal.org
HPVA	Hardwood Plywood & Veneer Association	Reston	VA	(703) 435-2900	www.hpva.org
ICC	International Code Council	Washington	DC	(888) 422-7233	www.iccsafe.org
ICC-ES	ICC Evaluation Service	Whittier	CA	(562) 699-0543	www.icc-es.org
ICBO	International Conference of Building Officials				(See ICC)
ISO	International Organization for Standardization	Geneva, Switzerland			www.iso.org
ISSA	International Slurry Surfacing Association	Annapolis	MD	(410) 267-0023	www.slurry.org
KCMA	Kitchen Cabinet Manufactures Association	Reston	VA	(703) 264-1690	www.kcma.org
LPI	Lightning Protection Institute	Maryville	MO	(800) 488-6864	www.lightning.org
MFMA	Maple Flooring Manufacturers' Association	Deerfield	IL	(888) 480-9138	www.maplefloor.org
MSS	Manufacturer's Standardization Society of The Valve and Fittings Industry	Vienna	VA	(703) 281-6613	www.mss-hq.com
NAAMM	National Association of Architectural Metal Manufacturers	Glen Ellyn	IL	(630) 942-6591	www.naamm.org
NEC	National Electric Code	(from NFPA).			
NEMA	National Electrical Manufacturer's Association	Rosslyn	VA	(703) 841-3200	www.nema.org
NFPA	National Fire Protection Association	Quincy	MA	(800) 344-3555	www.nfpa.org
NFRC	National Fenestration Rating Council	Greenbelt	MD	(301) 589-1776	www.nfrc.org
NSF	NSF International	Ann Arbor	MI	(734) 769-8010	www.nsf.org
PCA	Portland Cement Association	Skokie	IL	(847) 966-6200	www.cement.org
PCI	Precast / Prestressed Concrete Institute	Chicago	IL	(312) 786-0300	www.pci.org
PEI	Porcelain Enamel Institute	Norcross	GA	(770) 676-9366	www.porcelainenamel.com
RFCI	Resilient Floor Covering Institute	LaGrange	GA	(706) 882-3833	www.rfci.com
SCTE	Society of Cable Telecommunications Engineers	Exton	PA	(800) 542-5040	www.scte.org
SDI	Steel Deck Institute	Fox River Grove	IL	(847) 458-4647	www.sdi.org
SDI	Steel Door Institute	Westlake	OH	(440) 899-0010	www.steeldoor.org
SIGMA	Sealed Insulating Glass Manufacturer's Association	Chicago	IL	(312) 644-6610	www.arcat.com
SJI	Steel Joist Institute	Myrtle Beach	SC	(843) 293-1995	www.steeljoist.org
SMACNA	Sheet Metal & Air Conditioning Contractors National Association	Chantilly	VA	(703) 803-2980	www.smacna.org
SPIB	Southern Pine Inspection Bureau	Pensacola	FL	(850) 434-2611	www.spib.org
SSMA	Steel Stud Manufacturer's Association	Glen Ellyn	IL	(630) 942-6592	www.ssma.com

TCNA	Tile Council of North America	Anderson	SC	(864) 646-8453	www.tileusa.com
TPI	Truss Plate Institute	Alexandria	VA	(703) 683-1010	www.tpinst.org
TPI	Turfgrass Producers International (formally American Sod Producers Association)	East Dundee	IL	(847) 649-5555	www.turfgrasssod.org
UL	Underwriters Laboratories	Camas	WA	(877) 854-3577	www.ul.com
WDMA	Window and Door Manufacturer's Association	Chicago	IL	(312) 321-6802	www.nwwda.org
WWPA	Western Wood Products Association	Portland	OR	(503) 224-3930	www.wwpa.org

D. Federal Government Agencies:
1. Names and titles of federal government standard or specification producing agencies are often abbreviated. Following acronyms or abbreviations referenced in Contract Documents represent names of standard or specification producing agencies of federal government. Names and addresses are subject to change but are believed to be, but are not assured to be, accurate and up to date as of date of Contract Documents.

CS	Commercial Standard (U S Department of Commerce)	Washington	DC	(202) 512-0000	www.doc.gov
EPA	Environmental Protection Agency	Washington	DC	(202) 272-0167	www.epa.gov
FCC	Federal Communications Commission	Washington	DC	(888) 225-5322	www.fcc.gov
FS	Federal Specifications Unit (Available from GSA)	Washington	DC	(202) 619-8925	www.gsa.gov
MIL	Military Standardization Documents (U S Department of Defense)	Philadelphia	PA	(215) 697-2179	www.dod.gov
NIST	National Institute of Standards and Technology, technology Administration (US Department of Commerce)	Gaithersburg	MD	(301) 975-4500	www.ts.nist.gov
OSHA	Occupational Safety & Health Administration (U S Department of Labor)	Washington	DC	202) 219-8148	www.osha.gov
PS	Product Standard of NBS (U S Department of Commerce)	Washington	DC	(202) 512-1800	www.doc.gov

E. Governing Regulations / Authorities:
1. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.
2. Obtain copies of regulations required to be retained at Project Site, available for reference by parties who have a reasonable need for such reference.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4301

QUALITY ASSURANCE - QUALIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:
   1. Section 01 4000: 'Quality Requirements' includes administrative and procedural requirements for quality assurance and quality control.
   2. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.

1.2 REFERENCES

A. Definitions:
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
   2. 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.
   3. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
   4. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.

B. Reference Standards:
   1. ASTM International:
      a. ASTM E329-11a, 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.'

1.3 QUALIFICATIONS

A. Qualifications: Qualifications paragraphs in this Article establish minimum qualification levels required; individual Specification Sections specify additional requirements:
   1. Fabricator / Supplier / Installer Qualifications: Firm experienced in producing products similar to those indicated for this Project and with record of successful in-service performance, as well as sufficient production capacity to produce required units.
      a. Approved:
         1) Where heading '*Approved Suppliers / Distributors / Installers / Applicators / Fabricators*' is used to identify list of specified suppliers / distributors / installers / applicators / fabricators, use only listed suppliers / installers / fabricators.
         2) No substitutions will be allowed.
   2. Factory-Authorized Service Representative Qualifications:
      a. Authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

3. 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.
4. 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.
5. Manufacturer's Field Services Qualifications:
    a. Experienced authorized representative of manufacturer to inspect field-assembled components and equipment installation, including service connections.
6. 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 kind indicated. Engineering services are defined as those performed for installations of system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
7. Specialists:
    a. Certain sections of Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations.
    b. Specialists shall satisfy qualification requirements indicated and shall be engaged for activities indicated.
    c. Requirement for specialists shall not supersede building codes and regulations governing the Work.
8. Testing Agency Qualifications:
    a. Independent Testing Agency with experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
        1) Testing Laboratory:
            a) AASHTO Materials Reference Laboratory (AMRL) Accreditation Program.
            b) Cement and Concrete Reference Laboratory (CCRL).
            c) Nationally Recognized Testing Laboratory (NRTL): Nationally recognized testing laboratory according to 29 CFR 1910.7.
            d) National Voluntary Laboratory (NVLAP): Testing Agency accredited according to National Institute of Standards and Technology (NIST) Technology Administration, U. S. Department of Commerce Accreditation Program.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 4523

TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes testing, inspections, special testing, special inspections, and testing laboratory services for materials, products, and construction methods as specified hereafter for the Work.

B. Specified tests, inspections, and related actions do not limit Contractor's quality control procedures to fully comply with Contract Document requirements in all regards.

C. Costs: Costs for testing and inspection personnel will be paid by Contractor unless otherwise noted.

D. Related Requirements:
1. Section 01 4000: 'Quality Requirements' includes administrative and procedural requirements for quality assurance and quality control.
2. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
3. Divisions 01 thru 49 Establish responsibility for providing specific testing and inspections and Field Tests and Inspections.

1.3 REFERENCES

A. Association Publications:
1. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
2. International Code Council (IBC):
   a. CBC Chapter 17, 'Structural Tests and Special Inspections'.

B. Definitions:
1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
2. Approved: To authorize, endorse, validate, confirm, or agree to.
3. Contract Documents: Engineering and Architectural Drawings and Specifications issued for construction, plus clarification drawings, addenda, approved change orders and contractor designed elements.
4. Experienced: When used with an entity, "experienced" means having successfully completed minimum of five previous projects similar in size and scope to this Project; being familiar with requirements indicated; and having complied with requirements of authorities having jurisdiction.
5. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.

6. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
    a. Inspection: Not required by code provisions but may be required by Contract Documents.
    b. Special Inspection: Required by code provisions and by Contract Documents.
    c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
    d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
7. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operation, including installation, erection, application, and similar operations.
    a. Using term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of corresponding generic name, such as "carpenter."
    b. It also does not imply that requirements specified apply exclusively to trades people of corresponding generic name.
8. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation. They are not samples. Approved mockups establish standard by which the Work will be judged.
9. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
10. Owner’s Representative: Owner’s Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner’s approval or authorization.
11. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
12. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
13. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
14. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
15. Service Provider: Agency or firm qualified to perform required tests and inspections.
16. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
17. Special Inspection: See Inspection.
18. Special Inspector: Certified individual or firm that implements special inspection program for project.
19. Special Test: See Test.
20. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.
21. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
22. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
23. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

C. Reference Standards:
   1. ASTM International:
      a. ASTM C1021-08, 'Standard Practice for Laboratories Engaged in Testing of Building
      b. ASTM D3666-09a, 'Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials.'
      c. ASTM E329-11a: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.'
      d. ASTM E543-09, 'Standard Specification for Agencies Performing Nondestructive Testing.'
      e. ASTM E1212-09, 'Standard Practice for Quality Management Systems for Nondestructive Testing Agencies.'

1.4 SUBMITTALS

A. Informational Submittals:
   1. Certificates:
      a. Testing Agency will submit certified written report of each inspection, test, or similar service.

B. Tests and Evaluation Reports:
   1. Testing and Inspection Reports:
      a. Testing Agency or Agencies will prepare logs, test reports, and certificates applicable to specific tests and inspections and deliver copies (or electronic record) distributed as follows:
         1) 1 copy to Owner's Representative.
         2) 1 copy to Architect.
         3) 1 copy to Consulting Engineers (Engineer of Record).
         4) 1 copy to General Contractor.
         5) 1 copy to Authorities Having Jurisdiction (if required).
      b. Other tests, certificates, and similar documents will be obtained by Contractor and delivered to Owner's Representative and Architect in such time as not to delay progress of the Work or final payment therefore.
   2. Source Quality Control Submittals:
      a. Testing Agency will submit following prior to commencing the Work:
         1) Qualifications of Testing Agency management and personnel designated to project.
         2) Testing Agency "Written Practice for Quality Assurance."
         3) Qualification records for Inspector and non-destructive testing technicians designated for project.
         4) Testing Agency non-destructive testing procedures, equipment calibration records, and personnel training records.
         5) Testing Agency Quality Control Plan for monitoring and control of testing operations.

C. Additional submittal requirements are specified in Individual Sections in Divisions 01 through 49.

1.5 QUALITY ASSURANCE

A. Owner or Owner's designated representative(s) will perform quality assurance. Owner's quality assurance procedures may include observations, inspections, verification, monitoring and any other procedures deemed necessary by Owner to verify compliance with Contract Documents.

B. Contractor to employ independent Testing Agencies to perform specified testing. Contractor's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents.

C. Certification: Product producers and associations, which have instituted approved systems of quality control and which have been approved by document approval agencies, are not required to have further testing. Concrete mixing plants, plants producing fabricated concrete and wood or plywood products certified by agency, lumber, plywood grade marked by approved associates, and materials or equipment bearing underwriters' laboratory labels require no further testing and inspection.

D. Written Practice for Quality Assurance: Testing Agency will maintain written practice for selection and administration of inspection personnel, describing training, experience, and examination requirements for qualification and certification of inspection personnel. Written practice will describe testing agency procedures for determining acceptability of structure in accordance with applicable codes, standards, and specifications. Written practice will describe Testing Agency inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.

1.6 QUALITY CONTROL

A. Quality Control will be sole responsibility of Contractor. Contractor will be responsible for testing, coordination, start-up, operational checkout, and commissioning of all items of the Work included in Project. All costs for these services will be included in Contractor's cost of the Work.

B. Contractor will assign one employee to be responsible for Quality Control. This individual may have other responsibilities and may be Contractor's Project superintendent or Contractor's Project Manager.

C. Notify results of all Testing and Inspection performed by Contractor's independent Testing Agencies to Architect and Owner's Representative within 24 hours of test or inspection having been performed.
   1. Testing and Inspection Reports will be distributed as follows:
      a. 1 copy to Owner's Representative.
      b. 1 copy to Architect.
      c. 1 copy to Consulting Engineer(s) (Engineer of Record).
      d. 1 copy to Authorities Having Jurisdiction (if required).

1.7 TESTS AND INSPECTIONS - GENERAL

A. Testing specifically identified in the Construction Documents, will be performed by an independent entity and will be arranged and paid for by Contractor.

B. Owner may engage additional consultants for testing, air balancing, commissioning, or other special services. Activities of any such Owner consultants are in addition to Contractor testing of materials or systems necessary to prove that performance is in compliance with Contract requirements. Contractor must cooperate with persons and firms engaged in these activities.

C. Scheduling Testing Agency:
   1. Contractor will coordinate the Work and facilitate timeliness of such testing and inspecting services so as not to delay the Work.
   2. Contractor will notify Testing Agency and Architect to schedule tests and / or inspections.
      a. Architect will notify Owner's Representative before each test and / or inspection.

D. For "building-wide" and/or life safety systems, such as emergency lighting, emergency power uninterruptible power supply systems, fire alarm, fire sprinkler systems, smoke evacuation systems, toxic gas monitoring, capturer exhaust systems, etc. formal start-up inspection will be completed prior to requesting Substantial Completion Inspection for any area of Project:
   1. Manufacturer's representatives and installing contractor will demonstrate both operation and compliance to Owner's agents and consultants. If coordinated and scheduled appropriately by Contractor, these equipment and/or systems inspections may also serve to provide required Owner training, if approved in advance by Owner.
   2. Contractor responsible for requesting that Architect arrange for inspection of materials, equipment, and work prior to assembly or enclosure that would make materials, equipment, or work inaccessible for inspection and at other times as may be required.

1.8 ARCHITECT'S RESPONSIBILTY

A. Architect Duties:

1. Notify Owner's Representative before each test and/or inspection.

1.9 CONTRACTOR'S RESPONSIBILITY

A. If Owner's employees of an independent Testing Agency that does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents.

B. Tests and inspections are responsibility of Contractor.

C. Cooperate with Testing Agency(s) performing required inspections, tests, and similar services and provide reasonable auxiliary services as requested. Notify Testing Agency before operations to allow assignment of personnel. Auxiliary services required include but are not limited to:
   1. Providing access to the Work and furnishing incidental labor, equipment, and facilities deemed necessary by Testing Agency to facilitate inspections and tests at no additional cost to Owner.
   2. Taking adequate quantities of representative samples of materials that require testing or helping Testing Agency in taking samples.
   3. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.

D. Contractor will integrate Testing Agency services within Baseline Project Schedule and with other Project activities.

E. For any requested inspection, Contractor will complete prior inspections to ensure that items are ready for inspection.

F. All Work is subject to testing and inspection and verification of correct operation prior to 100% payment to Contractor of line item(s) pertaining to that aspect of the Work.

G. For Mechanical Equipment, inspection and documented approval of individual equipment and/or system(s) must be accomplished prior to requesting Substantial Completion Inspection for any area affected by said equipment and/or system.
   1. Contractor will perform thorough checkout of operations with manufacturer's representatives prior to requesting formal inspection by Owner. Contractor must notify Owner's Representative, in advance, as to when manufacturer's representative is scheduled to arrive at Site.

H. Comply:
   1. Upon completion of Testing Agency's inspection, testing, sample-taking, and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes.
   2. Comply with Contract Documents in making such repairs.

I. Data: Furnish records, drawings, certificates, and similar data as may be required by testing and inspection personnel to assure compliance with Contract Documents.

J. Defective Work (Non-Conforming Work): Non-conforming Work as covered in General Conditions applies, but is not limited to following requirements:
   1. Where results of inspections, tests, or similar services show that the Work does not comply with Contract Document requirements, correct deficiencies in the Work promptly to avoid Work delays.
   2. Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance.
   3. Contractor responsible for any and all costs incurred resulting from inspection that was scheduled prematurely or retesting due to failed tests.
   4. Remove and replace any Work found defective or not complying with contract document requirements at no additional cost to Owner.
   5. Should test return unacceptable results, Contractor will bear all costs of retesting and re-inspection as well as cost of all material consumed by testing, and replacement of unsatisfactory material and/or workmanship.

K. Protection:
   1. Protect construction exposed by or for quality assurance and quality control service activities, and protect repaired construction.

L. Scheduling: Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.
   1. Schedule testing and inspections in advance so as not to delay the Work and to eliminate any need to uncover Work for testing or inspection.
   2. Notify Testing Agency and Architect as noted in Sections in Divisions 01 thru 49 prior to any time required for such services.
   3. Incorporate adequate time for performance of all inspections and correction of noted deficiencies.
   4. Schedule sequence of activities to accommodate required services with minimum of delay.
   5. Schedule sequence of activities to avoid necessity of removing and replacing construction to accommodate testing and inspections.

M. Test and Inspection Log:
   1. Provide system of tracking all field reports, describing items noted, and resolution of each item. Prepare record of tests and inspections. Include following:
      a. Date test or inspection was conducted.
      b. Description of the Work tested or inspected.
      c. Date test or inspection results were transmitted to Architect.
      d. Identification of Testing Agency or inspector conducting test or inspection.
   2. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

1.10 TESTING AGENCY SERVICES AND RESPONSIBILITIES

A. Testing Agency, including independent testing laboratories, will be licensed and authorized to operate in jurisdiction in which Project is located.
   1. Approved Testing Agency Qualifications: Requirements of Section 01 4301 apply.

B. Testing and Inspection Services:
   1. Testing Agency will not release, revoke, alter, or increase Contract Document requirements or approve or accept any portion of the Work.
   2. Testing Agency will not give direction or instruction to Contractor.
   3. Testing Agency will have full authority to see that the Work is performed in strict accordance with requirements of Contract Documents and directions of Owner’s Representative and/or Architect.
   4. Testing Agency will not provide additional testing and inspection services beyond scope of Work without prior approval.

C. Testing Agency Duties:
   1. Independent Testing Agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual specification Sections will cooperate with Architect and Contractor in performance of its duties and will provide qualified personnel to perform required inspections and tests.
   2. Testing Agency will test or obtain certificates of tests of materials and methods of construction, as described herein or elsewhere in technical specification.
   3. Testing Agency will provide management, personnel, equipment, and services necessary to perform testing functions as outlined in this section.
   4. Testing Agency must have experience and capability to conduct testing and inspecting indicated by ASTM standards and that specializes in types of tests and inspections to be performed.
   5. Testing Agency will comply with requirements of ASTM E329, ASTM E543, ASTM C1021, ASTM C1077, ASTM C1093, ASTM D3666, ASTM D3740, and other relevant ASTM standards.
   6. Testing Agency must calibrate all testing equipment at reasonable intervals (minimum yearly) with accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

7. Welding Procedure Review: Testing Agency will provide review and approval or rejection of all welding procedures to be used and will verify compliance with all reference standard requirements.

D. Testing and Inspection Reports:
   1. Conduct and interpret tests and inspections and state in each report whether tested and inspected the Work complies with or deviates from requirements.
   2. Laboratory Reports: Testing Agency will furnish reports of materials and construction as required, including:
      a. Description of method of test.
      b. Identification of sample and portion of the Work tested.
         1) Description of location in the Work of sample.
         2) Time and date when sample was obtained.
         3) Weather and climatic conditions at time when sample was obtained.
      c. Evaluation of results of tests including recommendations for action.
   3. Inspection Reports: Testing Agency will furnish “Inspection at Site” reports for each site visit documenting activities, observations, and inspections. Include notation of weather and climatic conditions, time and date conditions and status of the Work, actions taken, and recommendations or evaluation of the Work.
   4. Reporting Testing and Inspection (Conforming Work):
      a. Submit testing and inspection reports as required within 24 hours of test or inspection having been performed.
   5. Reporting Testing and Inspection Defective Work (Non-Conforming Work):
      a. Testing Agency, upon determination of irregularities, deficiencies observed or test failure(s) observed in the Work during performance of its services of test or inspection having been performed, will:
         1) Verbally notify results to Architect, Contractor, and Owner’s Representative within one hour of test or inspection having been performed (if Defective Work (Non-Conforming Work) is incorporated into project).
         2) Submit written inspection report and test results as required within 24 hours of test or inspection having been performed.
   6. Final Report:
      a. Submit final report of tests and inspections at Substantial Completion, which identify unresolved deficiencies.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Field Tests and Inspections requirements are described in ‘Field Quality Control’ in Divisions 01 thru 49 Sections.

END OF SECTION

SECTION 01 5200

CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Construction Facilities.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Prepare schedule indicating dates for implementation and termination of each temporary facility.

B. Keep facilities clean and neat in appearance. Operate in safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or allow them to interfere with progress of The Work. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on Project site.

C. Maintain facilities in good operating condition until removal.

D. Remove each temporary facility when need has ended, or when replaced by authorized use of permanent facility, or by Substantial Completion. Complete 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 make up temporary facilities are property of Contractor.
   2. By Substantial Completion, clean and renovate permanent facilities used during construction period.

1.3 SANITARY FACILITIES

A. Provide temporary sanitary toilet. Service and maintain temporary toilet in a clean, sanitary condition. Use of existing restroom facilities will not be allowed.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 5400

CONSTRUCTION AIDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Construction Aids.

1.2 SCAFFOLDING, PLATFORMS, STAIRS, ETC

A. Furnish and maintain equipment such as temporary stairs, ladders, ramps, platforms, scaffolds, hoists, runways, derricks, chutes, and elevators as required for proper execution of The Work.

B. Apparatus, equipment, and construction shall meet requirements of applicable laws and safety regulations.

C. Protect walls, floors and ceilings of path of travel to work area during construction.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 5600

TEMPORARY BARRIERS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Temporary Barriers and Enclosures.

1.2 GENERAL

A. Protection Of Existing Improvements: Protect wall, door, ceilings, carpet, etc. including overhead protection where required. Repair damage to existing improvements caused by construction activities.

B. Protection Of Adjacent Property: Provide necessary protection for adjacent spaces and lateral support thereof.

1.3 TEMPORARY DUST BARRIERS

A. The Contractor shall provide any and all dust control barriers required.

1.4 TEMPORARY NOISE BARRIERS

A. The Contractor shall use only such equipment on the work and in such state of repair that the emission of sound there from is within the noise tolerance level of that equipment as established by Cal-OSHA.

1.5 TEMPORARY BARRICADES

A. Comply with standards and code requirements in erecting barricades, warning signs, and lights.

B. Take necessary precautions to protect persons, including members of the public, from injury or harm.

1.6 TEMPORARY FENCING

A. Before construction begins, install 6 foot high enclosure fence with lockable entrance gates. Locate where shown on Drawings. If not shown on Drawings, enclose entire site or portion sufficient to accommodate construction operations.

1.7 TEMPORARY SECURITY BARRIERS

A. Install temporary enclosures of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft, and other violations of security.

B. Secure materials and equipment stored on site.

C. Secure building at the end of each work day.

D. Maintain building security until Substantial Completion.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 5700

TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Temporary Controls.

1.2 TEMPORARY EROSION AND SEDIMENT CONTROL

A. Take precautions necessary to prevent erosion and transportation of soil downstream, to adjacent properties, and into on-site or off-site drainage systems.

B. Develop, install, and maintain an erosion control plan as required by law.

C. Repair and correct damage caused by erosion.

1.3 TEMPORARY ENVIRONMENTAL CONTROLS

A. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and reduce possibility that air, waterways, and subsoil might be contaminated or polluted, or that other undesirable effects might result:
   1. Avoid use of tools and equipment that produce harmful noise.
   2. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near site.

B. Protect building from damage from rain water and all other water:
   1. For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with requirements of applicable local regulations. Where feasible, use permanent facilities.
   2. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.

C. Protect excavation, trenches, and building from damage from rain water, spring water, ground water, backing up of drains or sewers, and all other water:
   1. For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with requirements of applicable local regulations. Where feasible, use permanent facilities.
   2. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.

D. Comply with governing ordinances relating to weed control and removal.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6100

COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Common Product Requirements.

1.2 GENERAL

A. Provide products that comply with Contract Documents, that are undamaged, and, unless otherwise indicated, new and unused at time of installation. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for complete installation and for intended use and effect.

B. Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on surfaces of products that will be exposed to view in occupied spaces or on building exterior.
   1. Locate required product labels and stamps on concealed surface or, where required for observation after installation, on accessible surface that is not conspicuous.
   2. Provide permanent nameplates on items of service-connected or power-operated equipment. Locate on easily accessible surface that is inconspicuous in occupied spaces. Nameplate will contain following information and other essential operating data:
      a. Name of product and manufacturer.
      b. Model and serial number.
      c. Capacity.
      d. Speed.
      e. Ratings.

C. Where specifications describe a product or assembly by specifying exact characteristics required, with or without use of brand or trade name, provide product or assembly that provides specified characteristics and otherwise complies with Contract requirements.

D. Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by manufacturer for application described. General overall performance of product is implied where product is specified for specific application. Manufacturer's recommendations may be contained in published product literature, or by manufacturer's certification of performance.

E. Where specifications only require compliance with an imposed code, standard, or regulation, select product that complies with standards, codes or regulations specified.

F. Where Specifications require matching an established Sample, Architect's decision will be final on whether proposed product matches satisfactorily. Where no product available within specified category matches satisfactorily nor complies with other specified requirements, refer to Architect.

G. Where specified product requirements include phrase ` . . . *as selected from manufacturer's standard colors, patterns, textures* . . . ' or similar phrase, select product and manufacturer that comply with other specified requirements. Architect will select color, pattern, and texture from product line selected.

H. Remove and replace products and materials not specified in Contract Documents but installed in the Work with specified products and materials at no additional cost to Owner and for no increase in Contract time.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6200

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Product Options.

1.2 GENERAL

A. Product Selection:
   1. When option of selecting between two or more products is given, product selected will be compatible with products previously selected, even if previously selected products were also options.

B. Non-Conforming Work:
   1. Non-conforming work as covered in General Conditions applies, but is not limited, to use of non-specified products or manufacturers.

C. Product selection is governed by Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include:
   1. Substitutions And Equal Products:
      a. Generally speaking, substitutions for specified products and systems, as defined in the Uniform Commercial Code, are not acceptable. However, equal products may be approved upon compliance with Contract Document requirements.
      b. Acceptable Products / Manufacturers / Suppliers / Installers:
         1) Use specified products / manufacturers unless approval to use other products / manufacturers has been obtained from Architect by Addendum.
         2) Use 'Equal Product Approval Request Form' to request approval of equal products, manufacturers, or suppliers before bidding or before installation, as noted in individual Sections.
      c. Quality / Performance Standard Products / Manufacturers:
         1) Use specified product / manufacturer or equal product from specified manufacturers only.
         2) Products / manufacturers used shall conform to Contract Document requirements.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 6600

PRODUCT DELIVERY, STORAGE, AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Product Delivery, Storage, and Handling Requirements.

1.2 GENERAL

A. Deliver, store, and handle products according to manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1.3 DELIVERY AND ACCEPTANCE REQUIREMENTS

A. Schedule delivery to reduce long-term storage at site and to prevent overcrowding of construction spaces.

B. 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.

C. Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

D. Inspect products upon delivery to ensure compliance with Contract Documents, and to ensure that products are undamaged and properly protected.

1.4 STORAGE AND HANDLING REQUIREMENTS

A. Store products at site in manner that will simplify inspection and measurement of quantity or counting of units.

B. Store heavy materials away from Project structure so supporting construction will not be endangered.

C. Store products subject to damage by elements above ground, under cover in weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7300

EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for governing Execution of the Work.

1.2 COMMON INSTALLATION PROVISIONS

A. Manufacturer's Instructions: Comply with Manufacturer's installation instructions and recommendations to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents. Notify Architect of conflicts between Manufacturer's installation instructions and Contract Document requirements.

B. Provide attachment and connection devices and methods necessary for securing Work. Secure work true to line and level. Anchor each product securely in place, accurately located, and aligned with other Work. Allow for expansion and building movement.

C. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain best visual effect. Refer questionable choices to Architect for final decision.

D. Install each component during weather conditions and Project status that will ensure best possible results. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.

E. Mounting Heights: Where mounting heights are not shown, install individual components at standard mounting heights recognized within the industry or local codes for that application. Refer questionable mounting height decisions to Architect for final decision.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7400

CLEANING AND WASTE MANAGEMENT

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Administrative and procedural requirements for Cleaning and Waste Management as described in Contract Documents.
   2. Administrative and procedural requirements for Cleaning, Salvaging, Recycling and Disposing of Construction Waste as described in Contract Documents.

1.2 REFERENCES

A. Definitions:
   1. Asphalt Pavement, Brick, and Concrete (ABC) Rubble: Rubble that contains only weathered (cured) asphalt pavement, clay bricks and attached mortar normally used in construction, or concrete that may contain rebar. The rubble shall not be mixed with, or contaminated by, another waster or debris.
   2. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
   3. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
   4. 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.
   5. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

B. Reference Standards:
   1. ASTM International:
      a. ASTM E1609-01, ‘Standard Guide for Development and Implementation of a Pollution Prevention Program.’

1.3 PERFORMANCE REQUIREMENTS

A. General:
   1. Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work.
   2. Practice efficient waste management in the use of materials in the course of the Work.
   3. Use all reasonable means to divert construction and demolition waste from landfills and incinerators.

1.4 SUBMITTALS

A. Action Submittals:
   1. Waste Reduction Progress Reports:
      a. Submit plan within 10 days of date established for the Notice to Proceed.
      b. CDRP Form (Construction and Demolition Recycling Plan)

B. Informational Submittals:
   1. Waste Management Progress Reports:
      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:
   1) Indicate receipt and acceptance of salvageable waste donated to individuals and organizations.
   2) Indicate whether organization is tax exempt.
d. Records of Sales:
   1) Indicate receipt and acceptance of salvageable waste sold to individuals and organizations.
   2) 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.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with hauling and disposal regulations of authorities having jurisdiction (AHJ).

B. Qualifications:
   1. Waste Management Coordinator Qualifications:
      a. Experienced firm, with a record of successful sustainable waste management coordination of Projects with similar requirements.

1.6 WASTE MANAGEMENT PLAN

A. General:
   1. Develop a waste management plan according to ASTM E1609 and requirements of this Section.
   2. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis.
   3. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification:
   1. Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work.
   2. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan:
   1. 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.
      a. Disposed Materials:
         1) Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

b. Handling and Transportation Procedures:
   1) Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
c. Recycled Materials:
   1) Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
d. Salvaged Materials for Donation:
   1) For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
e. Salvaged Materials for Reuse:
   1) For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
f. Salvaged Materials for Sale:
   1) For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

2. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
   a. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
   b. Handling and transportation costs. Include cost of collection containers for each type of waste.
   c. Net additional cost or net savings from waste management plan.
   d. Revenue from salvaged materials.
   e. Revenue from recycled materials.
   f. Savings in hauling and tipping fees by donating materials.
   g. Savings in hauling and tipping fees that are avoided.
   h. Total cost of disposal (with no waste management).
   i. Total quantity of waste.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION:

A. General:
   1. 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:
      a. Comply with Division 01 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.

B. Training:
   1. Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site:
      a. Distribute waste management plan to everyone concerned within five (5) days of submittal return.
      b. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

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

a. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
b. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 DISPOSAL OF WASTE

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

B. Burning:
1. Do not burn waste materials.

C. Disposal:
1. Transport waste materials off Owner's property and legally dispose of them.

D. Landfill Receipts:
1. Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

3.3 PROGRESS CLEANING

A. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.

B. Keep premises broom clean during progress of the Work.

C. Keep site and adjoining streets reasonably clean. If necessary, sprinkle rubbish and debris with water to suppress dust.

D. During handling and installation, protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from soiling, damage, or deterioration until Substantial Completion.

E. Clean and maintain completed construction as frequently as necessary throughout construction period. Adjust and lubricate operable components to ensure ability to operate without damaging effects.

F. Supervise construction activities to ensure that no part of construction completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

G. Before and during application of painting materials, clear area where such work is in progress of debris, rubbish, and building materials that may cause dust. Sweep floors and vacuum as required and take all possible steps to keep area dust free.

H. Clean exposed surfaces and protect as necessary to avoid damage and deterioration.

I. Place extra materials of value remaining after completion of associated work have become Owner's property as directed by Owner or Architect.

J. Construction Waste Management And Disposal:
   1. Remove waste materials and rubbish caused by employees, Subcontractors, and contractors under separate contract with Owner and dispose of legally. Remove unsuitable or damaged materials and debris from building and from property.
      a. Provide adequate waste receptacles and dispose of materials when full.
      b. Properly store volatile waste and remove daily.
      c. Do not deposit waste into storm drains, sanitary sewers, streams, or waterways. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
   2. Do not burn waste materials or build fires on site. Do not bury debris or excess materials on Owner's property.

3.4 FINAL CLEANING

A. Immediately before Substantial Completion, thoroughly clean building and area where The Work was performed. Remove all rubbish from under and about building, landscaped areas and parking lot and leave building and Project Site ready for occupancy by Owner.

B. Comply with individual manufacturer's cleaning instructions.

C. Clean each surface or unit to condition expected in normal, commercial building cleaning and maintenance program, including but not limited to:
   1. Interior Cleaning:
      a. Clean inside glazing, exercising care not to scratch glass.
      b. Remove marks, stains, fingerprints and dirt.
      c. Clean and polish woodwork and finish hardware.
      d. Remove labels that are not permanent labels.
      e. Clean plumbing fixtures and tile work. Remove spots, soil or paint.
      f. Clean surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
      g. Clean other fixtures and equipment and remove stains, paint, dirt, and dust.
      h. Remove temporary floor protection and clean floors.
   2. Exterior Cleaning:
      a. Clean outside glazing, exercising care not to scratch glass.
      b. Remove marks, stains, and dirt from exterior surfaces.
      c. Clean and polish finish hardware.
      d. Remove temporary protection systems.
      e. Clean dirt, mud, and other foreign material from paving, sidewalks, and gutters.
      f. Clean drop inlets, through-curb drains, and other drainage structures.
      g. Remove trash, debris, and foreign material from landscaped areas.

END OF SECTION

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Closeout Procedures.

1.2 GENERAL

A. Schedule closeout procedures in the two weeks before expiration of Contract Time. Weeks will be marked by Architect's weekly before Final Closeout Review, Final Closeout Review, and expiration of Contract Time.

B. Date of Substantial Completion shall fall within week between Architect's final weekly visit and Final Closeout Review. Date of Substantial Completion shall not occur until Construction Schedule shows completion of construction work, unless agreed to by Architect and included on Certificate of Substantial Completion.

1.3 PRELIMINARY CLOSEOUT REVIEWS

A. Confirm with Architect when Substantial Completion of The Work will be achieved.
   1. Final Architect's weekly visits will serve as Preliminary Closeout Reviews to determine if Final Closeout Review will occur as scheduled and that Substantial Completion of the Work will be achieved by that date.
   2. By final weekly Architect visit, notify Owner and Architect of date when Substantial Completion of The Work will be achieved.

B. Arrange with Architect date for Final Closeout Review to confirm Substantial Completion.

1.4 CLOSEOUT REQUIREMENTS

A. Before Final Closeout Review:
   1. Deliver Closeout Submittals to Architect.
   2. Deliver tools, spare parts, extra stock, and similar items as required by the Contract Documents.
   3. Complete start-up testing of systems, and instruction of Owner's maintenance personnel as required by the Contract Documents.
   4. Discontinue or change over and remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.
   5. Complete final cleaning requirements.

1.5 FINAL CLOSEOUT REVIEW

A. Participate in Final Closeout Review.

B. When Owner and Architect have confirmed that Contractor has achieved Substantial Completion of The Work, Owner, Architect, and Contractor will execute Certificate of Substantial Completion that contains:
   1. Date of Substantial Completion.
   2. Punch List of Work not yet accepted.
   3. Amount to be withheld for completion of Punch List work.
   4. Time period for completion of Punch List work.
   5. Amount of liquidated damages set forth in Supplementary Conditions to be assessed if Contractor fails to complete Punch List work within time set forth in Certificate.

C. Final Acceptance Conference:
   1. Notify Architect in writing when work on Punch List has been completed.
   2. Arrange with Architect date and time for Final Acceptance Conference.
   3. When Owner and Architect have confirmed that Contractor has completed Punch List work, Architect will issue letter to Owner authorizing final payment.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

SECTION 01 7800

CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes But is Not Limited To:
   1. Administrative and procedural requirements for Closeout Submittals.

1.2 GENERAL

A. Workmanship bonds, final certifications, equipment check-out sheets, and similar documents.

B. Releases enabling Owner unrestricted use of The Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

C. Project photographs, damage or settlement survey, and similar record information required by Contract Documents.

1.3 OPERATIONS AND MAINTENANCE DATA

A. Operations And Maintenance Manuals that include:
   1. Copy of complete Project Manual including Addenda, Modifications as defined in General Conditions, and other interpretations issued during construction.
      a. Mark these documents to show variations in actual Work performed in comparison with text of specifications and Modifications. Show substitutions, selection of options, and similar information, particularly on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
      b. Note related record drawing information and Product Data.
   2. Operations and maintenance submittals required by Contract Documents.
   3. Certifications required by Contract Documents.
   4. Copies of warranties required by Contract Documents.
   5. Testing and Inspection Reports required by Contract Documents.

1.4 WARRANTIES

A. When written guarantees beyond one year after substantial completion are required by Contract Documents, secure such guarantees and warranties properly addressed and signed in favor of Owner. Include these documents in Operations & Maintenance Manuals specified above.

B. Delivery of guarantees and warranties will not relieve Contractor from obligations assumed under other provisions of Contract Documents.

1.5 PROJECT RECORD DOCUMENTS

A. Do not use record documents for construction purposes. Protect from deterioration and loss in secure, fire-resistive location. Provide access to record documents for Architect's reference during normal working hours.

B. Provide Bluebeam As-builts

C. Maintain clean, undamaged set of Drawings. Mark set to show actual installation where installation varies from the Work as originally shown. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
   1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
   2. Mark new information that is important to Owner, but was not shown on Drawings.
   3. Note related Change Order numbers where applicable.

1.6 SPARE PARTS

A. Provide items that are indicated in individual Sections.

1.7 EXTRA STOCK MATERIALS

A. Provide items that are indicated in individual Sections.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

END OF SECTION

DIVISION 02: EXISTING CONDITIONS

02 4000 DEMOLITION AND STRUCTURE MOVING

END OF TABLE OF CONTENTS

SECTION 02 4113

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Demolish and remove portions of existing site facilities as described in Contract Documents.

B. Related Requirements:
   1. New and replacement work specified in appropriate specification Sections.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Include on Construction Schedule specified in Section 01 3200 detailed sequence of individual site demolition operations.

1.3 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Identify abandoned utility and service lines and capping locations on record drawings.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Owner does not guarantee that existing conditions are the same as those indicated in Project Record Documents.

C. Inventory and record the condition of items being removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements are encountered, investigate and measure the nature and extent of the element. Promptly submit a written report to the owner.

E. Locate and protect utilities. Preserve active utilities traversing the site in operating condition.

F. Notify and obtain approval of utility companies before starting demolition.

3.2 PREPARATION

A. Notify corporations, companies, individuals, and local authorities owning conduits running to property.
   1. Protect and maintain conduits, drains, sewers, pipes, and wires that are to remain on the property.
   2. Arrange for removal of wires running to and on property. Remove pipes and sewers in accordance with instructions of above owners.

B. Protection of in-place conditions:
   1. Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades properties, parts of existing building to remain.
      a. Provide bracing, shoring, and underpinning as required.
      b. Repair damage caused by demolition as directed by Owner.
   2. Support affected site elements and, if safety of site element being demolished, adjacent structures, or services appears to be endangered, take preventative measures, stop Work, and immediately notify Owner.

3.3 PERFORMANCE

A. Execute work in orderly and careful manner, with due consideration for neighbors and the public.

B. Carefully remove, disassemble, or dismantle as required, and store in approved location on site, existing items to be reused in completed work. Coordinate with Owner for equipment and materials to be removed by Owner.

C. Concrete And Paving Removal:
   1. Saw cut joints between material to be removed and material to remain to full depth.
   2. Hand-excavate trench 12 inches (300 mm) wide and 16 inches (400 mm) deep along concrete or paving to be removed. Cut roots encountered with saw, axe, or pruner. Do not cut roots with excavating equipment. Remove roots under concrete and paving to be replaced down to 12 inches (300 mm) below finish grade.

3.4 CLEANING

A. Keep streets and roads reasonably clean, and sweep daily.

B. Sprinkle demolition rubbish and debris as necessary to lay dust.

C. Promptly remove demolition materials, rubbish, and debris from property.

END OF SECTION

SECTION 02 4119

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Demolition and removal of selected portions of building or structure.
   2. Salvage of existing items to be reused.

B. Reference Standards:
   1. National Fire Protection Association / American National Standards Institute:
      a. NFPA 241, 'Standard for Safeguarding Construction, Alteration, and Demolition Operations', 2009 Edition.
   2. American National Standards Institute / American Society of Safety Engineers:
      a. ANSI / ASSE A10.6-2006, 'Safety Requirements for Demolition Operations.'

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Storage of removed items or materials will not be permitted on-site.

B. Scheduling:
   1. Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, on Schedule specified in Section 01 3200.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with governing EPA notification regulations before beginning selective demolition.
   2. Comply with hauling and disposal regulations of authorities having jurisdiction.
   3. Standards: Comply with ANSI A10.6 and NFPA 241.

1.4 FIELD CONDITIONS

A. Existing Conditions:
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
   2. Prior to demolition, the Contractor shall obtain verification from the utility owner(s) that the existing utilities, including electrical, wastewater, and/or water facilities, are not operational and are ready for demolition.
   3. The Contractor shall examine the various Drawings, visit the site, determine the extent of the Work, the extent of work affected therein, and all conditions under which he is required to perform the various operations.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
      a. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

B. Evaluation And Assessment:
   1. Hazardous Materials:
      a. It is not expected that hazardous materials will be encountered in the Work. Identified hazardous materials will be removed by Owner before start of the Work.
      b. If materials suspected of containing hazardous materials are encountered, do not disturb and immediately notify Architect.
   2. Inventory and record condition of items to be removed and reinstalled.
   3. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure nature and extent of conflict. Promptly submit written report to Architect.
   4. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 PREPARATION

A. Temporary Facilities:
   1. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
   2. Maintain fire-protection facilities in service during selective demolition operations.

B. Temporary Shoring if needed:
   1. 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.
   2. Strengthen or add new supports when required during progress of selective demolition.

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

3.3 SELECTIVE DEMOLITION

A. General:
   1. Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

2. Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   a. 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.
   b. Conduct operations to minimize damage by falling debris or other causes to adjacent buildings, structures, roadways, other facilities, and persons.
   c. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
   d. 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.
   e. Maintain adequate ventilation when using cutting torches.
   f. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   g. Dispose of demolished items and materials promptly.

B. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Protect items from damage during transport and storage.
   3. 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.

C. Existing Items to Remain:
   1. Protect construction indicated to remain against damage and soiling during selective demolition.
   2. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition,
   3. Protect in place the utility service, fence, tree, or device during the prosecution of the demolition work as specified.
   4. Where indicated on the Drawings, the designated facilities shall remain intact and in service during the prosecution of the demolition work.

D. Damage:
   1. Promptly repair damage caused to adjacent facilities by demolition operations as directed by the City at no cost to the City.

3.4 TRAFFIC AND ACCESS

A. Conduct work to ensure minimum interference with on-site and off-site roads, streets, sidewalks, and occupied or used facilities.

B. Do not close or obstruct streets, sidewalks, or other occupied or used facilities without permission from the City. Provide alternate routes around closed or obstructed traffic in access ways.

C. Coordinate truck routing and timing with City.

3.5 CLEANING

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

B. Waste Management:
   1. All material, equipment, rubble, debris, and other products of the demolition shall become the property of the Contractor for his disposal off-site in accordance with all applicable laws and ordinances at the Contractor's expense. The sale of salvageable materials by the Contractor shall only be conducted off-site. The sale of removed items on the site is prohibited by the City
   2. Disposal of Demolished Materials:
      a. Remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill. Do not burn demolished materials.
         1) Do not allow demolished materials to accumulate on-site.
         2) Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
         3) Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

END OF SECTION

DIVISION 03: CONCRETE

END OF TABLE OF CONTENTS

SECTION 03 1113

STRUCTURAL CAST-IN-PLACE CONCRETE FORMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Design, construction, and safety of formwork.
   2. Furnish and install required formwork ready for placing of concrete.
   3. Strip and dispose of formwork.

B. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for:
      a. Tolerances for placing structural concrete.

1.2 REFERENCES

A. Reference Standards:
   1. American Concrete Institute:
      a. ACI 318-14, 'Building Code Requirements for Structural Concrete and Commentary'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Notify Testing Agency and Architect as directed in Section 03 3111.

1.4 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Instructions:
      a. Printed application instructions for form release agents.

PART 2 - PRODUCTS

2.1 COMPONENTS

A. Forms: Wood, metal, or plastic as arranged by Contractor:
   1. Forming material shall be compatible with specified form release agents and with finish requirements for concrete to be left exposed or to receive a smooth rubbed finish.

2.2 ACCESSORIES

A. Form Release Agents:
   1. Unexposed Surfaces Only: Contractor's option.

B. Form Release / Finish Agent:
   1. Vertical, Exposed Surfaces or Unexposed Surfaces:

a. Chemically acting type.
b. Acceptable Products.
1) Crete-Lease 727 or 20-VOC by Cresset Chemical Co, Weston, OH www.cresset.com.
2) Clean Strip (J-1 or J-3 VOC) by Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
3) E-Z Strip or DEBOND Form Coating by L & M Construction Chemicals, Omaha, NE www.lmcc.com.
4) Q-2 by Unitex, Kansas City, MO www.unitex-chemicals.com.
5) U S Spec SlicKote by U S Mix Products Co www.usspec.com.
6) Duogard or Duogard II by W R Meadows, Elgin, IL www.wrmeadows.com.
7) Equal as approved by Architect before use. See Section 01 6200.

C. Expansion / Contraction Joints:
1. 1/2 inch (13 mm) thick.
2. Manufactured commercial fiber type:
a. Meet requirements of ASTM D1751.
b. Acceptable Products:
1) Conflex by Knight-Celotex, Northfield, IL www.aknightcompany.com.
2) Sealtight by W R Meadows Inc, Hampshire, IL www.wrmeadows.com.
3) Equal as approved by Architect before installation. See Section 01 6200.
3. Recycled Vinyl:
a. Light gray color.
b. Acceptable Products:
1) Proflex by Oscoda Plastics Inc, Oscoda, MI www.oscodaplastics.com.
2) Equal as approved by Architect before Installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Forms:
1. Assemble forms so forms are sufficiently tight to prevent leakage.
2. Properly brace and tie forms.
3. Make proper form adjustments before, during, and after concreting.
4. Use new forms, or used forms that have been cleaned of loose concrete and other debris from previous concreting and repaired to proper condition. Use APA Plyform B-B Class I, or APA HDO Plyform B-B Class I, on exposed to view concrete that do not receive a smooth rubbed finish.

B. Accessories:
1. General:
a. Provide for installation of inserts, templates, fastening devices, sleeves, and other accessories to be set in concrete before placing.
b. Position anchor bolts for hold-down anchors and columns and securely tie in place before placing concrete.
2. Form Release / Finish Agents:
a. Film thickness shall be no thicker than as recommended by Manufacturer.
b. Allow no release / finish agent on reinforcing steel or footings.
3. Expansion Joints:
a. Install at joints between floor slab and foundation wall.

C. Form Removal (Slab on Grade):
1. Removal of forms can usually be accomplished in twelve (12) to twenty-four (24) hours.
2. If temperature is below 50 deg F (10 deg C) or if concrete (stairs, beams, etc) depends on forms for structural support, leave forms intact for sufficient period for concrete to reach adequate strength.

3. For exposed to view surfaces that receive a smooth rubbed finish, remove forms while concrete is still “green”.
4. Metal bars or prys should not be used. Use wood wedges, tapping gradually when necessary.

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Concrete Formwork:
      a. Inspections are not required and will be performed at discretion of Architect.

END OF SECTION

SECTION 03 1511

CONCRETE ANCHORS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Cast-in place and post-installed concrete anchors including:
      a. Adhesive anchors for concrete.
      b. Expansion anchors for concrete.
      c. Screw anchors for concrete.
      d. Concrete anchors and inserts not specified elsewhere.
   2. Installer responsible when inspection results of concrete anchors require corrective actions.

B. Related Requirements:
   1. Section 01 1200: 'Multiple Contract Summary' for Owner Furnished Testing and Inspecting Services.
   2. Section 01 4523: ‘Testing and Inspecting Services’ for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   3. Section 03 3111: ‘Cast-In-Place Structural Concrete’ for installation and inspection of cast-in-place anchors.
   4. Section 06 1100: 'Wood Framing' for installation of drilled in anchors.

1.2 REFERENCES

A. Reference Standards:
   1. American Concrete Institute:
      a. ACI 355.4-11, 'Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary'.
      b. ACI 548.12-12, 'Specification for Bonding Hardened Concrete and Steel to Hardened Concrete with an Epoxy Adhesive'.
   2. American National Standards Institute / American Welding Society (Following are specifically referenced for Structural Steel testing):
      a. ANSI/AWS D1.1/D1.1M:2015, ‘Structural Welding Code - Steel’.
   3. ASTM International:
      a. ASTM A307-14, 'Standard Specification for Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength’.
      b. ASTM A563-15, 'Standard Specification for Carbon and Alloy Steel Nuts’.
      c. ASTM A706/A706M-16, ‘Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement’.
      d. ASTM F1554-18, ‘Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength’.
      e. ASTM F3125/F3125-15a, ‘Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions'.
   4. California Building Code Council (CBC) (2022 or most recent edition adopted by AHJ):
      a. CBC Chapter 17, ‘Structural Tests and Special Inspections’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:

1. Inspection shall be performed according CBC requirements.
2. Notify Testing Agency and Architect one week before installing anchors so inspection may be scheduled.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's product literature for each item.

B. Informational Submittals:
   1. Certificates:
      a. Adhesive Anchors:
         1) Installer to provide current ACI/CRSI certification to Architect prior to installation of anchors.
   2. Test And Evaluation Reports:
      a. Provide ESR for products used indicating conformance with current applicable ESR Acceptance Criteria.
   3. Manufacturer’s Instructions:
      a. Manufacturer's published installation recommendations for each item.
   4. Qualification Statements:
      a. All concrete anchors except Adhesive Anchors:
         1) Installer to provide record of installer installation training showing dates and those trained for all installed products when required when by Architect.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Testing and Inspection Reports:
            a) Testing Agency inspection reports of all inspected anchors.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Having sufficient capacity to produce and deliver required materials without causing delay in work.
   2. Installer:
      a. Acceptable to Manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.
      b. Adhesive Anchors:
         1) Adhesive Anchors installed in horizontal to vertical overhead orientation to support sustained tension loads shall be installed by Certified Adhesive Anchor Installer (AAI) as certified through ACI/CRSI:
            a) Refer to most current version of ACI 318 for certification requirements.
            b) Proof of current certification shall be submitted to the Architect for approval prior to commencement of installation.
      c. All other Concrete Anchors:
         1) Arrange for manufacturer’s field representative to provide installation training for all products to be used, prior to commencement of work:
            a) Provide installation training when required by Architect.

B. Field Inspection:
   1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.

2. Owner will provide Inspection for post-installed concrete anchors:
   a. Owner will employ testing agency to perform inspection for post-installed concrete anchors as specified in Field Quality Control in Part 3 of this specification:
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
      2) See Section 01 1200: 'Multiple Contract Summary'.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Store materials protected from exposure to harmful weather conditions and as directed by Manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Anchors:
   1. General:
      a. Use hot-dipped galvanized or stainless steel with matching nuts and washers in exterior and moist interior applications unless indicated otherwise on Contract Drawings.
      b. Install hot-dipped or stainless steel anchor bolts to attach wood sill plates to foundation with 1/4 inch (6.4 mm) by 3 inch (76 mm) x 3 inch (76 mm) minimum adjustable plate washers and standard cut washers between wood sill plates and nuts.
      c. Nut: Conform to requirements of ASTM A563, Grade A, Hex.
      d. Conform to requirements of ASTM F3125/F3125 for chemical, physical and mechanical requirements for quenched and tempered bolts manufactured from steel and alloy steel.
   2. Threaded rod for adhesive anchors and cast-in anchors:
      a. Conform to requirements of ASTM A307, Grade A or ASTM F1554 Grade 36 unless indicated otherwise on Contract Drawings.
   3. Cast-In-Place Anchor Bolts:
      a. J-Bolts:
         1) Non-headed type threaded 2 inches (50 mm) minimum conforming to requirements of ASTM F1554, Grade A.
         2) Anchor hook to project 2 inches (50 mm) minimum including bolt diameter.
      b. Headed Bolts:
         1) Headed type threaded 2 inches (50 mm) minimum conforming to requirements of ASTM F1554, Grade A.
   4. Reinforcing Bars:
      a. Composed of deformed carbon steel meeting requirements of ASTM A615/A615M, Grade 60.
   5. Adhesive Anchors:
      a. Products shall have current ESR conforming to current ICC Acceptance Criteria AC308 for concrete.
      b. Rod diameter and embedment length as indicated on Contract Drawings.

      c. Acceptable Products:
         1) HIT-RE 500V3 with SafeSet Epoxy Adhesive by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
         2) Pure 110+ by Powers Fasteners Inc., Brewster NY www.powers.com.

3) SET-XP Epoxy by Simpson Strong-Tie Co., Pleasanton, CA www.simpsonanchors.com.
4) Equal as approved by Architect before installation. See Section 01 6200.

6. Expansion Anchors:
   a. Products shall have current ESR conforming to current ICC Acceptance Criteria AC193 for concrete.
   b. Acceptable Products:
      1) KWIK Bolt TZ Expansion Anchor by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
      2) Power-Stud +SD2 by Powers Fasteners Inc., Brewster NY www.powers.com.
      3) Strong-Bolt by Simpson Strong-Tie Co., Pleasanton, CA www.simpsonanchors.com.
      4) Equal as approved by Architect before installation. See Section 01 6200.
7. Screw Anchors:
   a. Provide anchors with length identification markings conforming to ICC Acceptance Criteria AC 193 for concrete.
   b. Acceptable Products:
      1) KWIK HUS-EZ by Hilti Fastening Systems, Tulsa, OK www.us.hilti.com.
      2) Wedge-Bolt+ by Powers Fasteners Inc., Brewster NY www.powers.com.
      3) Titen HD by Simpson Strong Tie Co, Pleasonton, CA www.simpsonanchors.com.
      4) Equals as approved by Architect through shop drawing submittal before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Embedded Items:
      a. Identify position of reinforcing steel and other embedded items before drilling holes for anchors:
         1) Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items.
         2) Take precautions as necessary to avoid damaging pre-stressing tendons, electrical and telecommunications conduit, and gas lines.
      b. Notify Engineer if reinforcing steel or other embedded items are encountered during drilling.
   2. Base Material Strength:
      a. Unless otherwise specified, do not drill holes in concrete until:
         1) Concrete has minimum age of 21 days at time of anchor installation.
         2) Concrete has achieved full design strength for load achievement.

3.2 PREPARATION

A. Surface Preparation:
   1. Clean surfaces prior to installation.
   2. Prepare surface in accordance with Manufacturer’s written recommendations.

3.3 INSTALLATION

A. Post-Installed Anchors:
   1. General:
      a. Drill holes with rotary impact hammer drills using carbide-tipped bits.
      b. Unless otherwise shown on Drawings, drill holes perpendicular to concrete surface.
      c. Perform anchor installation in accordance with Manufacturer’s published instructions.

2. Adhesive Anchors:
   a. Clean holes in accordance with Manufacturer's published instructions before installation of adhesive:
      1) Follow Manufacturer's recommendations to ensure proper mixing of adhesive components.
   b. Adhesive:
      1) Inject adhesive into holes proceeding from bottom of hole and progressing toward surface so as to avoid introduction of air pockets into adhesive.
      2) Inject sufficient adhesive into hole to ensure that annular gap is filled to surface.
      3) Remove excess adhesive from surface and threads of anchor as necessary.
   c. Shim anchors with suitable device to center anchor in hole. Do not disturb or load anchors before Manufacturer's specified cure time has elapsed.
   d. Temperature:
      1) Observe Manufacturer's recommendations with respect to installation temperatures for adhesive anchors.
      2) Base material temperatures must be maintained above minimum temperatures allowed by Manufacturer for full required epoxy cure time.
3. Expansion Anchors:
   a. Protect threads from damage during anchor installation and prior to use.
   b. Set anchors to Manufacturer's recommended torque, using a torque wrench. Following attainment of ten (10) percent of specified torque, one hundred (100) percent of specified torque shall be reached within 7 or fewer complete turns of nut. If specified torque is not achieved within required number of turns, remove and replace anchor, unless otherwise directed by Architect.
4. Screw Anchors:
   a. Protect threads from damage during anchor installation and prior to use.
   b. Set anchor flush, collared.
   c. Do not exceed Manufacturer's maximum allowed torque when seating anchor.

3.4 FIELD QUALITY CONTROL

A. Field And Inspections:
   1. Civil and structural field inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
      a. Quality Control is sole responsibility of Contractor.
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
   2. Expansion Anchors / Adhesive Anchors / Screw Anchors:
      a. Certified Inspector from Testing Agency shall verify procedures used for installation of all concrete anchors and monitor their installation for compliance with Manufacturer's requirements.
      b. Inspections:
         1) Inspections shall include required verification and inspection of anchors as referenced in CBC Table 1704.4 and in accordance with most current version of ACI 318 or ACI 318M and applicable ASTM material standards that:
            a) The correct rod/anchor is used; size and type.
            b) The correct hole size is used and prepared per Manufacturer's instructions.
            c) That climactic conditions, and concrete temperature, allow for the anchors' installation and use.
            d) Proper hole cleaning equipment, per Manufacturer's instructions, is used.
            e) Torque applied to anchors does not exceed Manufacturer's allowable limits.
            f) Torque applied to anchors is per Manufacturer's instructions.

B. Non-Conforming Work:

1. Contractor is to immediately notify Architect of incorrectly placed, misplaced or malfunctioning anchors and request instructions for corrective actions.

3.5 CLEANING

A. Waste Management:
   1. Disposal of rubbish, debris, and packaging materials.

3.6 PROTECTION

A. General:
   1. Protect installed products from damage during construction.

END OF SECTION

SECTION 03 2100

REINFORCEMENT BARS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install concrete reinforcement bars as described in Contract Documents.

B. Related Requirements:
   1. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Section 03 1113: Structural Cast-In-Place Concrete Forming'.
   3. Section 03 3111: 'Cast-In-Place Structural Concrete' for:
      a. Reinforcement installed in concrete.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute:
      a. ACI 'Detailing Manual' (2004 Edition).
   2. Concrete Reinforcing Steel Institute (CRSI):
      a. CRSI, 'Manual of Standard Practice' (2009 28th Edition).

B. Reference Standards:
   1. American Concrete Institute:
      a. ACI 117-10: 'Specifications for Tolerances for Concrete Construction and Materials and Commentary' (Reapproved 2015).
      b. ACI 318-14, 'Building Code Requirements for Structural Concrete and Commentary'.
   2. ASTM International (Following are specifically referenced for reinforcement bars testing):
      a. ASTM A615/A615M-18, 'Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Notify Testing Agency and Architect as directed in Section 03 3111.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Reinforcing placement drawings.

B. Informational Submittals:
   1. Certificates:
      a. Mill certificates for mill tests for reinforcing in accordance with ASTM A615/A615M.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:

1) Testing and Inspection Reports:
   a) Testing Agency Inspection Reports of reinforcement bars.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Comply with provisions of following codes and standards except where more stringent requirements are shown or specified:
      a. American Concrete Institute:
         1) ACI 318, ‘Building Code Requirements for Structural Concrete and Commentary'.
      b. Concrete Reinforcing Steel Institute:
         1) CRSI, 'Manual of Standard Practice'.

B. Qualifications:
   1. Throughout progress of the work of this section, provide at least one (1) person who shall be thoroughly familiar with Construction Documents and other applicable specified requirements, completely trained and experienced in necessary skills, and who shall be present at site and shall direct all work performed under this Section:
      a. In actual installation of the work of this Section, use adequate numbers of skilled workmen to ensure installation in strict accordance with approved design.
      b. In acceptance or rejection of work performed under this Section, no allowance will be made for lack of skill on part of workmen.

C. Testing And Inspection:
   1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
   2. Owner will provide Testing and Inspection for inspection of reinforcement bars:
      a. Owner will employ testing agencies to perform testing and inspection for inspection of reinforcement bars as specified in Field Quality Control in Part 3 of this specification:
         1) Owner’s employment of an independent Testing Agency does not relieve Contractor of Contractor’s obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.
         2) See Section 01 1200: ‘Multiple Contract Summary’.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver bars separated by size and tagged with manufacturer's heat or test identification number.
   2. Reinforcement bars shall be free of heavy rust scales and flakes, or other coating at time of delivery and placing.

B. Storage And Handling Requirements:
   1. Properly protect rebar on site after delivery.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Reinforcement Bars:
   1. Bars shall have grade identification marks and conform to ASTM A615/A615M:
      a. Grade 60 minimum, except dowels that are to be field bent, Grade 40 minimum.
   2. Bars shall be deformed type.
   3. Bars shall be free of heavy rust scales and flakes, or other bond-reducing coatings.

2.2 ACCESSORIES

A. Bar Supports:
   1. Concrete masonry units or bricks are not acceptable.
   2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CSRI, Class 2).
   3. Acceptable Products:
      a. Concrete 'dobies' or blocks wired to reinforcing.
      b. Manufactured chairs with 4 sq inch (25.8 sq cm) bearing surface on sub-grade, or other feature to prevent chair from being pushed into sub-grade or damaging vapor retarder under slabs on grade.
      c. Equals as approved by Architect before installation. See Section 01 6200.

2.3 FABRICATION

A. Fabricate reinforcement bars according to the Concrete Reinforcing Steel Institute (CRSI) 'Manual of Standard Practice' and details on Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Avoid cutting or puncturing vapor retarder during reinforcement placement and concrete operations.
   2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
   3. Blowtorch shall not be used to facilitate field cutting or bending or any other reinforcing work.
   4. Reinforcement shall not be bent after partially embedded in hardened concrete.

B. Placing Reinforcement:
   1. Comply with Concrete Reinforcing Steel Institute CRSI 'Manual of Standard Practice' recommended practice for 'Placing Reinforcing Bars' for details and methods of reinforcement placement and supports. and as herein specified.
   2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations:
      a. Locate and support reinforcing by chairs, runners, bolsters, bar supports, spacers, or hangers, as required as recommended by 'ACI Detailing Manual, except slab on grade work.
      b. Support bars in slabs on grade and footings with specified bar supports around perimeter and at 4-1/2 feet on center each way maximum to maintain specified concrete cover.
      c. Install bar supports at bar intersections.
   3. Bend bars cold.
   4. Dowel vertical reinforcement for formed concrete columns or walls out of footing or structure below with rebar of same size and spacing required above.
   5. Securely anchor and tie reinforcement bars and dowels before placing concrete. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

C. Splices:
   1. Non-Concrete Structural System:
      a. Avoid splices of reinforcement bars at points of maximum stress. Lap bars 60 bar diameters minimum unless dimensioned otherwise on Drawings. Run reinforcement bars continuous through cold joints.
   2. Concrete Structural System:
      a. In beams, slabs, and walls, avoid splices of reinforcement bars at points of maximum stress.

b. Lap bars as follows:
   1) Compression Splices: 45 bar diameters minimum.
   2) Tension Splices: In accordance with ACI 318 Class B requirements.
c. In columns, splices in vertical bars are permitted only at floor levels or points of lateral support and shall consist of 45 bar diameter laps.
d. Run reinforcement bars continuous through cold joints.

D. Tolerances:
1. Provide following minimum concrete cover for reinforcement as per ACI 318 or ACI 318M. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations:
   a. Concrete cast against and permanently exposed to earth:
      1) Interior Slabs on Grade: 1 inches (25 mm). clear from top of slab at 4 inches (100 mm) slabs, 2 inches (50 mm) clear at 6 inches (150 mm) slabs.
      2) Sections other than Slabs: 3 inches (75 mm).
   b. Concrete Exposed to Earth or Weather:
      1) No. 6 and Larger Bars: 2 inches (50 mm).
      2) No. 5 and Smaller Bars, W31 and D31 Wire: 1-1/2 inches (38 mm).

3.2 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
   a. Quality Control is sole responsibility of Contractor.
      1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
         a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
2. Reinforcement Bars:
   a. Testing Agency shall provide inspection for Reinforcement Bars. See Section 03 3111 for Testing and Inspection requirements.

END OF SECTION

SECTION 03 3111

CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install concrete work as described in Contract Documents including:
      a. Quality of concrete used on Project but furnished under other Sections.
      b. Concrete mix information and use of admixtures.
      c. Field Quality Control Testing and Inspection requirements for concrete.
      d. Sealants and curing compounds used with concrete.
      e. Compact aggregate base for miscellaneous cast-in-place concrete.
      f. Miscellaneous cast-in-place concrete and equipment pads.

B. Products Installed But Not Furnished Under This Section:
   1. Concrete accessories.
   2. Detectable warning panels.
   3. Inserts, bolts, boxes, templates, and fastening devices for other work, including those for bases only for Mechanical and Electrical.
   4. Light pole base anchors.
   5. Membrane Concrete Curing.
   6. Pipe bollards.

C. Related Requirements:
   1. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   2. Section 03 1113: 'Structural Cast-In-Place Concrete Forming'.
   3. Section 03 1511: 'Concrete Anchors and Inserts'.
   4. Section 03 2100: 'Reinforcement Bars'.
   5. Section 03 3517: 'Concrete Sealer Finishing' for application of concrete sealers.
   6. Section 05 1223: 'Structural Steel For Buildings' for:
      a. Furnishing of pipe for pipe bollards.
   7. Section 07 9213: 'Elastomeric Joint Sealant' for quality of sealants.
   8. Divisions 22, 23, And 26: Mechanical and electrical devices including boxes, conduits, pipes, hangers, inserts, and other work to be embedded in concrete work before placing.
   9. Furnishing of items to be embedded in concrete specified in Section involved.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. ACI 117.1R-14: 'Guide for Tolerance Compatibility in Concrete Construction'.
      b. Certifications:
         1) ACI CP-1(16), *'Technical Workbook for ACI Certification of Concrete Field Testing Technician-Grade 1*'.
         2) ACI CP-10(10), *'Craftsman Workbook for ACI Certification of Concrete Flatwork Technician/Finisher'*.
         3) ACI CP-19(16), *'Technical Workbook for ACI Certification of Concrete Strength Testing Technician'*.

B. Definitions:
1. Cold Weather, as referred to in this Section, is four (4) hours with ambient temperature below 40 deg F (4.4 deg C) in twenty-four (24) hour period.
2. Floor Flatness (F_F): Rate of change in elevation of floor over 12 inches (305 mm) section.
3. Floor Levelness (F_L): Measures difference in elevation between two points which are 10 feet (3.05 m) apart.
4. Hot Weather, as referred to in this Section, is ambient air temperature above 100 deg F (38 deg C) or ambient air temperature above 90 deg F (32 deg C) with wind velocity 8 mph (12.9 kph) or greater.

C. Reference Standards:
1. American Association of State and Highway Transportation Officials:
   a. AASHTO M 153-06 (2016), 'Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction'.
2. American Concrete Institute
   a. ACI 117-10 (R2015): 'Specifications for Tolerances for Concrete Construction and Materials and Commentary'.
   b. ACI 305.1-14, 'Specification for Hot Weather Concreting'.
   c. ACI 306.1-90 (R2002), 'Standard Specification for Cold Weather Concreting'.
   d. ACI 318-14, 'Building Code Requirements for Structural Concrete' (ACI 318) and 'Commentary on Building Code Requirements for Structural Concrete' (ACI 318R).
3. ASTM International:
   a. ASTM C31/C31M-19, 'Standard Practice for Making and Curing Concrete Test Specimens in the Field'.
   b. ASTM C33/C33M-18, 'Standard Specification for Concrete Aggregates'.
   c. ASTM C39/C39M-18, 'Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens'.
   d. ASTM C94/C94M-17a, 'Standard Specification for Ready-Mixed Concrete'.
   e. ASTM C140/C140M-18a, 'Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units'.
   f. ASTM C143/C143M-15a, 'Standard Test Method for Slump of Hydraulic-Cement Concrete'.
   g. ASTM C150/C150M-18, 'Standard Specification for Portland Cement'.
   h. ASTM C172/C172M-17, 'Standard Practice for Sampling Freshly Mixed Concrete'.
   i. ASTM C173/C173M-16, 'Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method'.
   j. ASTM C192/C192M-18, 'Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory'.
   k. ASTM C231/C231M-17a, 'Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method'.
   l. ASTM C260/C260M-10a(2016), 'Standard Specification for Air-Entraining Admixtures for Concrete'.
   m. ASTM C330/C330M-17a, 'Standard Specification for Lightweight Aggregates for Structural Concrete'.
   n. ASTM C494/C494M-17, 'Standard Specification for Chemical Admixtures for Concrete.
   o. ASTM C496/C496M-17, 'Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens'.
   p. ASTM C567/C567M-14, 'Standard Test Method for Determining Density of Structural Lightweight Concrete'.
   q. ASTM C595/C595M-18, 'Standard Specification for Blended Hydraulic Cements'.
   r. ASTM C618-19, 'Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete'.
   s. ASTM C1077-17, 'Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation'.
   t. ASTM C1157/C1157M-17, 'Standard Performance Specification for Hydraulic Cement'.
   u. ASTM D1751-18, 'Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)'.
   v. ASTM E329-18: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.

w. ASTM E1155-14, 'Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers'.

4. California Building Code (CBC) (2016 or latest approved edition):
   a. CBC Chapter 17, 'Special Inspections And Tests'.
      1) Section 1704, 'Special Inspections And Tests, Contractor Responsibility And Structural Observations'.
      2) Section 1705, 'Required Special Inspection And Tests'.
         a) Section 1705.2, 'Steel Construction'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Notify Testing Agency and Architect twenty-four (24) hours minimum before placing concrete.

1.4 SUBMITTALS

A. Action Submittals:
   1. Joint layout plan for control and expansion joints for sidewalks, curbs, and gutters for written approval before starting work on this Section.
   2. Detectable warning panels:
      a. Layout plan and joints location for written approval before starting work on this Section.
   3. Shop Drawings:
      a. Show dimensioned locations of anchor bolts for hold-down anchors and columns.
      b. Show reinforcement and all necessary bending diagrams and reinforcing steel list, and construction joint locations.
      c. Provide bar schedules and bending details.
      d. Reinforced concrete walls shall be shown in scale elevation (scale at least one quarter inch to one foot). Details shall be in accordance with ACI rules.
      e. Show all formwork for concrete surfaces which are to remain exposed in the finished work.

B. Informational Submittals:
   1. Certificates:
      a. Installers:
         1) Certification for National Ready Mixed Concrete Association (NRMCA).
         2) Certification for ACI-certified Flatwork Finishers and Technicians.
   2. Design Data:
      a. Mix Design:
         1) Furnish proposed mix design to Architect for review prior to commencement of Work.
            a) Include density (unit weight) and void content determined per ASTM C1688/C1688M for fresh mixed properties and per ASTM C140/C140M for hardened concrete properties.
            b) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use.
      b. Ready-Mix Supplier:
         1) Require mix plant to furnish delivery ticket for each batch of concrete. Keep delivery tickets at job-site for use of Owner or his representatives. Tickets shall show following:
            a) Name of ready-mix batch plant.
            b) Serial number of ticket.
            c) Date and truck number.
            d) Name of Contractor.
            e) Name and location of Project.
            f) Specific class or designation of concrete conforming to that used in Contract Documents.
            g) Amount of concrete.
            h) Amount and type of cement.
            i) Total water content allowed by mix design.
            j) Amount of water added at plant.

k) Sizes and weights of sand and aggregate.
l) Time loaded.
m) Type, name, manufacturer, and amount of admixtures used.
n) Design Data.

2) Provide certificates with supporting testing reports verifying compliance with Contract Document requirements and that materials provided are from single source for following:
a) Cement.
b) Aggregate.
c) Fly Ash.

3. Source Quality Control Submittals:
a. Concrete mix design: Submit mix designs to meet following requirements:
1) Mix Type A:
a) General purpose concrete type mix used for footings and for exterior concrete (excluding concrete paving) where not subject to freeze/thaw cycles and deicing or where higher strength is needed due to soil conditions.
b) 3000 psi (20.68 MPa) minimum at twenty-eight (28) days.
c) Water **/** Cementitious Material: 0.45 to 0.50 by weight.
2) Mix Type B:
a) Unexposed interior concrete slabs on grade.
b) 3500 psi (24.13 MPa) minimum at twenty-eight (28) days.
c) Water **/** Cementitious Material: 0.45 maximum by weight.
3) Mix Type D:
a) For exterior concrete paving, curbs, gutters, and waterways not exposed to freeze/thaw cycles and deicing salts.
b) 4000 psi (27.58 MPa) minimum at twenty-eight (28) days.
c) Water **/** Cementitious Material: 0.45 maximum by weight.
d) For concrete paving, use mix design based upon use of 1-1/2 inches (38 mm) coarse aggregate (about 15 percent).
4) Mix Type E:
a) Exterior concrete exposed to freeze/thaw cycles and deicing salts or where soils are 'corrosive'.
b) 4500 psi (31.03 MPa) minimum at twenty-eight (28) days.
c) Water **/** Cementitious Material: 0.40 maximum by weight.
d) Use twenty-five (25) percent Class F fly ash as part of cementitious material.
e) Mix Type F should be used for all exterior concrete exposed to freeze/thaw cycles and deicing salts, unless dictated otherwise by site conditions.
f) For concrete paving, use mix design based upon use of 1-1/2 inches (38 mm) coarse aggregate (about 15 percent).
5) Mix Type F - Self-Consolidating Concrete (SCC):
a) Rarely used optional mix type.
b) Self-consolidating concrete may be used for all architectural concrete, heavily reinforced concrete, concrete for structural repairs, and other members as described in contract documents.
c) 4000 psi (27.58 MPa) minimum at twenty-eight (28) days.
d) All self-consolidating concrete shall contain high-range water-reducing admixture and viscosity-modifying admixture where required.
e) Minimum flow of 20 inches (508 mm) – 30 inches (762 mm) or as required by successful test placement.
f) Workability, pump ability, finish ability, and setting time of mix design shall be verified with successful test placement onsite.
g) Viscosity Modifying Admixture (VMA) shall be used to optimize viscosity of Self-Consolidating Concrete (SCC) at dosage rates per manufacturer's recommendation.
6) Air Entrainment: Six (6) percent, plus or minus 1-1**/**2 percent for exterior concrete and foundation walls exposed to freeze/thaw cycles.
7) Do not add water any time during mixing cycle above amount required to meet specified water / cement ratio. No reduction in amount of cementitious material is allowed.
b. Slump:

1) 4 inch (100 mm) slump maximum before addition of high range water reducer.
2) 8 inch (200 mm) slump maximum with use of high range water reducer.
3) Slump not required for Mix Type G.

c. Admixtures:
1) Mix design shall show proposed admixture, amount, usage instructions, and justification for proposed use. Do not use any admixture without Architect's written approval.
2) Fly ash: Amount of specified Class F (or Class C where Class F is not available) fly ash not to exceed twenty-five (25) percent of weight of cementations materials may used.
3) Chemical:
a) Specified accelerator or retarder may be used if necessary, to meet environmental conditions.
b) Special additives to promote rapid drying concrete, or moisture vapor reduction (MVRA), may be used in interior concrete slabs on grade and elevated concrete decks that will receive flooring if necessary, to meet construction schedules.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Pour Reports:
a) Provide report that records following information:
b) Date and time of start of pour, Date and time of end of pour, and Date and time of end of finishing procedures.
c) Temperature at start of pour, Temperature at end of Pour, and Maximum temperature during performance of finishing procedures.
d) Wind speed at start of pour, Wind speed at end of pour, and Maximum wind speed during performance of finishing procedures.
e) Humidity at start of pour, Humidity at end of pour, and High and low humidity during performance of finishing procedures.
f) Cloud cover at start of pour, Cloud cover at end of pour, and High and low cloud cover during performance of finishing procedures.
g) Screeding method and equipment used.
h) Saw cut method and equipment used.
2) Testing and Inspection Reports:
a) Testing Agency Testing and Inspecting Reports of concrete.
3) Warranty. Submit rapid concrete drying or MVRA manufacturer warranties for concrete moisture vapor emission induced flooring failure and adhesion; ensure both have been completed in project’s name and registered with manufacturer.
a) Provide warranty to cover cost of flooring failures due to moisture migration from slabs for life of concrete. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
b) Provide stand-alone adhesion warranty matching duration of flooring adhesive or primer manufacturer's material defect warranty.

1.5 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to following:
1. Installers and Installation Supervisor:
a. ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
2. Ready-Mix Supplier:
a. Comply with ASTM C94/C94M requirements and be certified according to NRMCA's 'Certification of Ready Mixed Concrete Production Facilities'.
3. Testing Agencies:
a. Independent agency qualified according to ASTM C1077 and ASTM E329.
1) Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technicians, Grade I according to ACI CP-1 or equivalent certification program.

2) Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be ACI-certified Concrete Laboratory Testing Technician - Grade II.

B. Testing And Inspection:
1. Owner is responsible for Quality Assurance. Quality assurance performed by Owner will be used to validate Quality Control performed by Contractor.
2. Owner will provide Testing and Inspection on concrete:
a. Owner will employ testing agencies to perform testing and inspection on concrete as specified in Field Quality Control in Part 3 of this specification:
1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform the Work in strict accordance with requirements of Contract Documents and perform contractor testing and inspection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Expansion Joint Filler Material:
a. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage And Handling Requirements:
1. Expansion Joint Filler Material:
a. Store materials in a clean, dry area in accordance with manufacturer's instructions.
b. Protect materials during handling and application to prevent damage.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Manufacturer Contact List:
a. Aridus Admixture by US Concrete, Euless, TX www.us-concrete.com/aridus/.
b. BASF (Construction Chemicals Division), Cleveland, OH www.master-builders-solutions.basf.us/en-us.
c. Bonsal American, Charlotte, NC www.bonsal.com.
d. Concure Systems Admixture by Concure Systems, Phoenix, AZ www.ConcureSystems.com.
e. Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
f. Euclid Chemical Company, Cleveland, OH www.euclidchemical.com.
g. Fritz-Pak Concrete Admixtures, Dallas, TX www.fritzpak.com.
h. GCP Applied Technologies, Cambridge, MA www.gcpat.com/construction/en-us.
i. ISE Logik Industries, Gulfport, MS www.iselogik.com.
j. Kryton International Inc,. Vancouver, British Columbia, Canada www.kryton.com.
k. L & M Construction Chemicals, Omaha, NE www.lmcc.com.
l. Larsen Weldcrete by Larsen Products Corp, Rockville, MD www.larsenproducts.com.
m. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com and Sika Canada, Pointe Claire, QC www.sika.ca.
n. Unitex, Kansas City, MO www.unitex-chemicals.com.
o. U S Mix Products Co, Denver, CO www.usspec.com.
p. W R Meadows, Hampshire, IL www.wrmeadows.com.

B. Performance:
1. Design Criteria: Conform to requirements of ASTM C94/C94M unless specified otherwise:
2. Capacities:

a. For testing purposes, following concrete strengths are required:
   1) At 7 days: 70 percent minimum of 28 day strengths.
   2) At 28 days: 100 percent minimum of 28 day strengths.

C. Materials:
   1. Hydraulic Cement: Meet requirements of ASTM C150/C150M, Type <**Insert Type**>.
      a. Meet requirements of ASTM C595/C595M, Type <**Insert Type**>.
      b. Meet requirements of ASTM C1157/C1157M, Type <**Insert Type**>.
   2. Aggregates:
      a. General:
         1) Submit a letter on quarry's letterhead that certifies all aggregate for concrete complies with the requirements of this section. Material certificates which are submitted shall be signed by both the materials producer and the contractor, certifying that materials comply with or exceed requirements specified herein to the Architect, Civil and Structural Engineering Consultant and the Independent Testing Laboratory for review and approval.
         2) Aggregates for all concrete shall come from a quarry that is DOT approved and meets or exceeds durability Class I aggregate. The quarry shall submit a letter to Engineer that certifies that all aggregate complies with DOT requirements for durability. Aggregate not meeting DOT durability requirements shall not be used.
      b. Coarse:
         1) Meet requirements of ASTM C33/C33M or nonconforming aggregate that by test or actual service produces concrete of required strength and conforms to local governing codes.
         2) Aggregate shall be uniformly graded by weight.
      c. Fine:
         1) Meet requirements of ASTM C33/C33M.
         2) Aggregate shall be uniformly graded by weight.
   3. Water: Clear, apparently clean, and potable.
   4. Admixtures And Miscellaneous:
      a. Fly Ash:
         1) Meet requirements of ASTM C618, Class F (or Class C where Class F is not available) and with loss on ignition (LOI) of three (3) percent maximum.
      b. Chemical:
         1) No admixture shall contain calcium chloride nor shall calcium chloride be used as an admixture. All chemical admixtures used shall be from same manufacturer and compatible with each other.
         2) Air Entraining Admixture:
            a) Meet requirements of ASTM C260/C260M.
         3) Water Reducing Admixture:
            a) Meet requirements of ASTM C494/C494M, Type A and containing not more than 0.05 percent chloride ions.
            b) Type Two Acceptable Products:
               (1) Equal as approved by Architect before use. See Section 01 6200.
         4) Water Reducing, Retarding Admixture:
            a) Meet requirements of ASTM C494/C494M, Type D and contain not more than 0.05 percent chloride ions.
            b) Acceptable Products:
               (1) Equal as approved by Architect before use. See Section 01 6200.
         5) High Range Water Reducing Admixture (Superplasticizer):
            a) Meet requirements of ASTM C494/C494M, Type F or G and containing not more than 0.05 percent chloride ions.
            b) Acceptable Products:
               (1) Equal as approved by Architect before use. See Section 01 6200.
         6) Non-Chloride, Non-Corrosive Accelerating Admixture:
            a) Meet requirements of ASTM C494/C494M, Type C or E and containing not more than 0.05 percent chloride ions.
            b) Acceptable Products:
               (1) Equal as approved by Architect before use. See Section 01 6200.

7) Corrosion Inhibiting Admixture:
   a) Liquid admixture to inhibit corrosion of steel reinforcement in concrete by introducing proper amount of anodic inhibitor. Admixture shall contain thirty (30) percent calcium nitrite solution and shall be used where called for in specifications or on drawings.
   b) Acceptable Products:
      (1) Eucon CIA by Euclid.
      (2) DCI or DCI-S by GCP Applied Technologies.
      (3) Equal as approved by Architect before use. See Section 01 6200.
8) Alkali-Silica Reactivity Inhibiting Admixture:
   a) Specially formulated lithium nitrate admixture for prevention of alkali-silica reactivity (ASR) in concrete. Admixture must have test data indicating conformance to ASTM C1293.
   b) Acceptable Products:
      (1) Eucon Integral ARC by Euclid.
      (2) RASIR by W R Grace.
      (3) Equal as approved by Architect before use. See Section 01 6200.
9) Viscosity Modifying Admixture (VMA):
   a) Liquid admixture used to optimize viscosity of Self-Consolidating Concrete (SCC). Subject to compliance with requirements, provide following at dosage rates per manufacturer's recommendation.
   b) Acceptable Products:
      (1) Equal as approved by Architect before use. See Section 01 6200.
10) Shrinkage Reducing Admixture (SRA):
   a) Liquid admixture specifically designed to reduce drying shrinkage and potential for cracking.
   b) Acceptable Products:
      (1) Equal as approved by Architect before use. See Section 01 6200.
11) Rapid Drying Admixture in Interior Concrete Slabs on Grade:
   a) Admixture specifically designed to promote rapid drying of concrete.
   b) Acceptable Products:
      (1) Equal as approved by Architect before use. See Section 01 6200.
12) Moisture Vapor Reduction Admixture (MVRA):
   a) Liquid, inorganic, ASTM C494/C494M Type S Admixture free of volatile organic compounds (VOCs); specifically formulated to close capillary systems formed during concrete placement and to reduce moisture vapor emission and transmission with no adverse effect on concrete properties or finish flooring.
   b) Acceptable Products:
      (1) MVRA 900 by ISE Logik Industries: www.iselogik.com.
      (2) Concure Systems Admixture by Concure Systems, Phoenix, AZ www.ConcureSystems.com.
      (3) Equal as approved by Architect before use. See Section 01 6200.
13) Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties:
   a) Functioning by growth of crystals in capillary pores.
   b) Permeability of Cured Concrete: No measurable leakage when tested in accordance with COE CRD-C 48 at 200 feet of head; provide test reports.
   c) Acceptable Products:
      (1) CWPA 800 by ISE Logik Industries: www.iselogik.com.
      (2) Krystol Internal Membrane (KIM) by Kryton: www.kryton.com.
      (3) Equal as approved by Architect before use. See Section 01 6200.

2.2 ACCESSORIES

A. Formwork:
   1. Meet requirements specified in Section 03 1113:

B. Bonding Agents:

1. Acceptable Products:
   a. Acrylic Additive by Bonsal American.
   b. Day Chem Ad Bond (J-40) by Dayton Superior.
   c. Flex-Con by Euclid Chemical Co.
   d. Larsen Weldcrete by Larsen Products Corp.
   e. Everbond by L & M Construction Chemicals.
   f. MasterEmaco A 660 (formally Acryl 60) by BASF.
   g. U S Spec Multicoat by U S Mix Products.
   h. Intralok by W R Meadows.
   i. Equal as approved by Architect before use. See Section 01 6200.

C. Expansion Joint Filler:
   1. Expansion Joint Filler Material:
      a. Design Criteria:
         1) Resilient, flexible, non-extruding, expansion-contraction joint filler meeting requirements of ASTM D1751.
         2) 1/2 inch (12.7 mm) thick.
         3) Resilience:
            a) When compressed to half of original thickness, recover to minimum of seventy (70) percent of original thickness.
      b. Acceptable Products:
         1) Fiber Expansion Joint by W R Meadows, Hampshire, IL www.wrmeadows.com.
         2) Equal as approved by Architect before installation. See Section 01 6200.

D. Finishing Material (Exposed Vertical Faces of Foundation):
   1. Finishing Material available in multiple concrete shades to closely match concrete surface.
   2. Acceptable Products:
      a. Mixture of 1 part cement (using same cement as used in concrete foundations), 1 part sand with 95 percent passing #50 sieve.
      b. RapidSet WunderFixx by CTS Cement Manufacturing Corporation, Cypress, CA www.rapidset.com.
      c. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Concrete Forms:
      a. Verify dimensions and spot elevations for locations of forms for concrete footings, stem walls, building slabs, curbs, gutters, walkways, and drainage systems are correct before concrete is placed.
         1) Notify Architect of incorrect dimensions or spot elevations in writing.
         2) Do not place concrete until corrections are made and verified.
   2. Detectable Warning Panels:
      a. Examine substrate and verify substrate is suitable for installation of detectable warning panels:
         1) Notify Architect of unsuitable conditions in writing.
         2) Do not install detectable warning panels over unsuitable conditions.
         3) Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Concrete Mixing:
   1. General:
      a. All concrete shall be machine mixed.

b. Water gauge shall be provided to deliver exact predetermined amount of water for each batch.
c. Reliable system must be employed to insure that no less than predetermined amount of cement goes into each batch.
d. Re-tempering partly set concrete will not be permitted.

2. Transit Mix:
   a. Transit mix concrete may be used provided it conforms to Specifications and tests herein described and ASTM C94/C94M.
   b. Central plant producing concrete and equipment transporting it are suitable for production and transportation of controlled concrete and plant is currently approved by local state DOT.
   c. Maximum elapsed time between time of introduction of water and placing shall be one (1) hour.
   d. Minimum time of mixing shall be one (1) minute per cubic yard after all material, including water, has been placed in drum, and drum shall be reversed for an additional two (2) minutes.
   e. Mixing water shall be added only in presence of Inspecting Engineer or inspector employed by Testing Agency.
   f. Trucks shall not be overloaded in excess of rated capacity as recommended by manufacturer.
3. Cold Weather Concreting Procedures:
   a. General Requirements:
      1) Materials and equipment required for heating and protection of concrete shall be approved and available at Project site before beginning cold weather concreting.
      2) Forms, reinforcement, metallic embedments, and fillers shall be free from snow, ice, and frost. Surfaces that will be in contact with newly placed concrete, including sub-grade materials, shall be 35 deg F (2 deg C) minimum at time of concrete placement.
      3) Thaw sub-grade 6 inches (150 mm) deep minimum before beginning concrete placement. If necessary, re-compact thawed material.
      4) Use no frozen materials or materials containing ice.
      5) See ACI 306.1 'Standard Specification for Cold Weather Concreting' for additional requirements.
4. Hot Weather Concreting Procedures:
   a. General:
      1) Maximum concrete temperature allowed is 90 deg F (32 deg C) in hot weather.
      2) Cool aggregate and subgrades by sprinkling.
      3) Avoid cement over 140 deg F (60 deg C).
      4) Use cold mixing water or ice.
      5) Use fog spray or evaporation retardant to lessen rapid evaporation from concrete surface.
      6) See ACI 305.1 'Specification for Hot Weather Concreting' for additional requirements.

B. Surface Preparation:
1. Earthwork Preparation:
   a. Aggregate base and subgrade:
      1) Prepare aggregate base as specified in Section 31 1123.
      2) Prepare natural soil subgrade as specified in Section 31 2213.
      3) Prepare fill subgrade as specified in Section 31 2323.
2. Concrete Slab Thickness:
   a. Increase thickness of concrete beneath detectable warning panels one inch (25 mm).
3. Inserts, bolts, boxes, templates, pipes, conduits, and other accessories required by Divisions 22, 23, and 26 shall be installed and inspected before placing concrete.
4. Install inserts, bolts, boxes, templates, pipes, conduits, and other accessories furnished under other Sections to be installed as part of work of this Section:
   a. Tie anchor bolts for hold-down anchors and columns securely to reinforcing steel.

C. Removal:
1. Remove water and debris from space to be placed:

3.3 INSTALLATION

A. Placing Concrete:
1. General:
   a. Place as soon after mixing as possible.
   b. Deposit as nearly as possible in final position.
   c. No concrete shall be deposited in water.
   d. Placing of concrete shall be continuous until panel or section is complete.
   e. Compact concrete in forms by vibrating and other means where required.
      1) Thoroughly consolidate concrete around reinforcing bars (Consolidation not required in concrete around reinforcing bars with Mix Type G).
      2) Use and type of vibrators shall conform to ACI 309.
   f. Form vertical surfaces full depth. Do not allow concrete to flow out from under forms in any degree into landscaped areas.
   g. Consolidate concrete thoroughly.
   h. Do not embed aluminum in concrete.
   i. Do not use contaminated, deteriorated, or re-tempered concrete.
   j. Avoid accumulation of hardened concrete.
   k. Dusting with cement not permitted.
2. Footings:
   a. Level top of finish footing and leave rough.
   b. Where joints are required, bulkhead, key horizontally, and dowel with two No. 5 reinforcing bars, 48 inches (1 200 mm) long.
3. Foundation Walls: Leave steel projecting where required for floor tie.
4. Exterior Slabs:
   a. For continuous placing and where shown on Drawings, saw cut one inch (25 mm) deep control joints before shrinkage occurs (2 inches at 6 inch slabs) (50 mm at 150 mm slabs).
5. Miscellaneous Concrete Elements:
   a. Detectable Warning Panels:
      1) Follow Manufacturer's recommendations on following:
         a) Temperature requirements.
         b) Expansion and control joint requirements.
         c) Installation of panels.
         d) Curing of panels.
   b. Equipment Bases: Coordinate with appropriate Sections for locations and dimensions.
   c. Light Pole Bases, Mow Strips, and Aprons:
      1) Install bond breaker consisting of three (3) layers of 30 lb (13.6 kg) roofing felt between pole base and adjoining sidewalk, mow strip and building foundations, and aprons and building foundations.

   d. Mow Strips and Aprons:
      1) Aggregate base not necessary under mow strips and aprons.
      2) Form and cast mow strips in place.
      3) Set top of mow strip above finish grade as follows:
         a) Sodded Areas: 2 inches (50 mm) below.
         b) Seeded Areas: One inch (25 mm) below.
         c) Ground Cover Areas: 2 inches (50 mm) below.
         d) Trees and Shrub Areas (not individual trees): 4 inches (100 mm) below.
      4) Compact topsoil underneath mow strips and aprons to density of undisturbed earth.
   e. Pipe Bollards:
      1) Install plumb and fill with concrete.
   f. Sidewalks And Landings:
      1) Slope with cross slope of 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) in direction of intended drainage.
      2) Slope away from building 1/8 to 1/4 inch per ft (3 to 6 mm per 300 mm) (one to two percent) minimum.
      3) Concrete walks shall be screeded to bring surface to grades and lines as indicated. Surface shall be floated with wood float with no coarse aggregate showing and then given broom finish before concrete sets.

6. Joints:
   a. Control Joints (Contraction Joints):
      1) Form control joints with early-entry, dry-cut saws as soon as final trowel operations are complete, and joints can be cut without raveling.
      2) Control joints in Concrete Paving are specified in Section 32 1313.
      3) Depth of control joints shall be approximately one quarter of concrete slab thickness, but not less than one inch (25 mm).
      4) Control joints to be hand tooled in sidewalks, curbs and gutters, mow strips, and aprons.
      5) Table One:

Concrete Control Joint On-Center Spacing (+/-)		
Sidewalks	4 feet to 6 feet	1.2 meters to 1.8 meters
Curbs and Gutters	10 feet	3.0 meters
Mow Strips	3 feet to 5 feet	0.90 meters to 1.50 meters
Flat Drainage Structures	10 feet	3 meters
Retaining Walls w/guardrails	Align with posts	
Retaining Walls w/chain link fencing	Align with posts	

   b. Expansion Joints:
      1) Expansion joints in Concrete Paving are specified in Section 32 1313.
      2) Install so top of expansion joint material is 1/4 inch (6 mm) below finished surface of concrete.
      3) No expansion joint required between curbs and sidewalks parallel to curb.
      4) Provide expansion joints at ends of exterior site concrete elements that are perpendicular to and terminate at curbs, building foundations or other concrete elements (i.e. sidewalks, mow strips, aprons).
      5) Provide expansion joints between sidewalks that are parallel, and adjacent, to storage building or main building.
      6) Provide expansion joints around perimeter of concrete slab on grade at mechanical enclosure, around perimeter of slab on grade at dumpster enclosure and at top and bottom of exterior stairs.

      7) Table Two:

Concrete Expansion Joint (Isolation) On-Center Spacing (+/-)		
Sidewalks, Curbs and Gutters	40 feet to 100 feet	12 meters to 30 meters
Mow Strips and Aprons	20 feet to 40 feet	6 meters to 12 meters
Flat Drainage Structures	50 feet	15 meters
Retaining Walls w/guardrails	36 feet	11 meters
Retaining Walls w/chain link fencing	50 feet	15 meters

      8) Seal expansion joints as specified in Section 07 9213 for following areas:
         a) Between entryway slabs and building foundations.
         b) Between sidewalks and building foundations.
         c) Within curbs and gutters.
         d) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
      9) Expansion joints are not required to be sealed for following areas:
         a) Within aprons and where apron abuts sidewalks.
         b) Within mow strips and where mow strip abuts building foundation and sidewalks.
         c) Within sidewalks.

7. Bonding Fresh And Hardened Concrete:
   a. Re-tighten forms.
   b. Roughen surfaces.
   c. Clean off foreign matter and laitance.
   d. Wet but do not saturate.
   e. Slush with neat cement grout or apply bonding agent.
   f. Proceed with placing new concrete.
8. Anchor Bolts:
   a. Place anchor bolts not tied to reinforcing steel immediately following leveling of concrete. Reconsolidate concrete around bolt immediately after placing bolt.
   b. Do not disturb bolts during finishing process.

B. Finishing:
1. Interior Concrete Flatwork:
   a. Screed Concrete.
   b. Float Finish:
      1) Float as soon after screeding as possible.
      2) Consolidate surface with power-driven floats with exception of areas inaccessible to power-driven floats, which may be hand-floated.
      3) Re-straighten, cutting down high spots and filling low spots.
      4) Repeat float passes and re-straightening until surface has uniform, smooth, granular texture.
   c. Rough:
      1) Top of building slab to receive setting bed for ceramic or paver tile.
   d. Trowel Finish:
      1) Steel trowel slab after concrete has set enough to avoid bringing water and fines to surface.
      2) Perform troweling with power-driven trowels with exception of areas inaccessible to power-driven trowels, which may be hand-troweled.
      3) Continue troweling passes and re-straightening with 10 foot (3 meter) highway straightedge until surface is free of trowel marks and uniform in texture and appearance.
      4) Apply burnished, burned-out trowel finish.
2. Exterior Concrete Flatwork:
   a. Curb, Gutter, Sidewalks, Mow Strips, Flat Drainage Structures, And Miscellaneous:
      1) After completion of final floating, performed immediately after screeding and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
         a) Provide fine hair finish where grades are less than 6 percent 1-1/4 inch (32 mm).
         b) Provide rough hair finish where grades exceed 6 percent 1-1/4 inch (32 mm).
         c) Broom finish, by drawing broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide fine line texture acceptable to Architect. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
         d) On inclined slab surfaces, provide coarse, non-slip finish by scoring surface with stiff-bristled broom, perpendicular to line of traffic. At curb and gutter, apply broom finish longitudinal to curb and gutter flowline.
         e) Do not remove forms for twenty-four (24) hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.
         f) Round edges exposed to public view to 1/2 inch (13 mm) radius, including edges formed by expansion joints.
         g) Remove edger marks.
   b. Concrete Paving Finish is specified in Section 32 1313.
3. Vertical Surfaces (Exposed To View Vertical Surfaces, , Exposed Foundation Walls, Concrete Piers, and etc.):
   a. General:

1) Finishing Material to fill and smooth interior and exterior concrete surface defects such as spalls, gouges, cracks, dents, chips, bug holes, stone pockets, honeycombs, voids and other defective areas.
2) Chamfer lines shall be finished.

b. Surface Preparation:
1) Formwork shall be stripped from concrete while concrete is still 'green'.
2) Concrete surface to be finished immediately after formwork has been removed.
a) Immediately after removing forms, remove joints, marks, bellies, projections, loose materials and other irregularities, and cut back metal ties from surfaces to be exposed.
b) Repair defective areas and voids or stone pockets with Finishing Material and smooth to even surface matching surrounding undamaged area.

c. Smooth Rubbed Finish:
1) Thoroughly wet with water, apply Finishing Material in thin layer, rub in circular motion to smooth uniform finish.
2) Entire surface shall be protected from rapid drying for not less than three (3) days.
3) Surfaces shall be cleaned of drip marks and discolorations.
4) Concrete surface shall be left with clean, neat, uniform finish, free from form markings and shall be uniform in color and texture.

4. Light Pole Bases:
a. Exposed portion to have smooth rubbed finish as specified in Vertical Surfaces in previous paragraph.

C. Curing:
1. Membrane Concrete Curing:
a. Follow Manufacturer's written instructions for preparation, application rates, placement, and cleanup:
1) Apply as soon as troweling on interior concrete is complete.
2) Apply as soon as brooming or finishing of exterior concrete is complete.
3) Spraying application is required.
4) Do not dilute or thin product.
5) Do not apply when temperature of concrete is less than 40 deg F (4.4 deg C).
6) Apply uniformly without puddles or ponding.
7) Do not apply before bleed water has dissipated.
8) Do not apply over standing water.

D. Tolerances:
1. General:
a. Tolerances shall conform to requirements of ACI 117 or CSA A23.1/A23.2, except where specified differently:
1) Floor test surfaces shall be measured and reported within seventy two (72) hours after completion of slab concrete finishing operations and before removal of any supporting shores to eliminate any curling effect F-numbers.

b. Maximum Variation Tolerances:
1) Table Three:

Maximum Variation Tolerances		
Thickness, standard	plus 3/8 inch, minus 1/4 inch	plus 9.5 mm, minus 3 mm
Thickness, footings	minus 0 inch	minus 0 mm
Plan, 0 - 20 feet	1/2 inch	12.7 mm
Plan, 40 feet or greater	3/4 inch	19 mm
Plan, footings	plus 1/2 inch	plus 12.7 mm
Eccentricity, footings	2 inch maximum standard, 1/2 inch at masonry	50 mm maximum standard, 12.7 mm at masonry
Openings, size	minus 1/4 inch, plus one inch	minus 6 mm, plus 25.4 mm
Openings, location	plus / minus 1/2 inch at center	plus / minus 12.7 mm at center
Plumb	1/2 inch maximum	12.7 mm maximum

2. Local Flatness / Levelness of Interior Slabs:
   a. Carpet and Tile Areas:
      1) Specified Overall Value of F_F25 / F_L20 and Minimum Local Value of F_F15 / F_L13 when tested in accordance with ASTM E1155.
      2) Specified Overall Value of F_F30 / F_L20 and Minimum Local Value of F_F18 / F_L13 when tested in accordance with ASTM E1155 in ceramic, resilient or vinyl tiled areas.
      3) Used on building slabs to be covered by carpet and tile as shown on Contract Drawings. Verify and coordinate with Finish Schedule.
      4) Remedy For Out-of-Tolerance Building Slabs:
         a) Sections of building slabs which do not meet specified tolerances but are within ten (10) percent of specified tolerances, may be corrected by grinding or filling, at Owner's option.
         b) Remove and replace sections of slabs measuring outside specified correctable tolerances.
         c) Carpet areas: If floor leveling compounds or concrete patching compounds are required to bring floor into specified tolerances, they will be provided by Owner in conjunction with carpet installation and back-charged to Contractor.

3.4 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
   1. Civil and structural field tests, laboratory testing, and inspections are provided by Owner's independent Testing Agency as specified in Section 01 4523 'Testing And Inspection Services':
      a. Quality Control is sole responsibility of Contractor:
         1) Owner's employment of an independent Testing Agency does not relieve Contractor of Contractor's obligation to perform testing and inspection as part of his Quality Control:
            a) Testing and inspections, if performed by Contractor, will be responsibility of Contractor to be performed by an independent entity.
   2. Reinforcement Bars and Bolts:
      a. Testing Agency shall provide inspections will include following:
         1) Bolts:
            a) Inspection of bolts to be installed in concrete prior to and during placement of concrete.
            b) Periodic inspection of anchors installed in hardened concrete.
         2) Reinforcement Bars:
            a) Periodic inspection of reinforcement bars and placement prior to concrete placement to verify grade, size, cover, spacing, and position of reinforcing.
            b) Inspect that all reinforcement bars are be positively identified as to heat number and mill analysis.
            c) Confirm surface of reinforcing bars is free of form release oil or other deleterious substances.
   3. Concrete:
      a. Testing Agency shall provide testing and inspection for concrete as per ASTM C1077.
      b. Testing and inspections, if performed, will include following:
         1) Periodic inspection verifying use of required design mix.
         2) Inspection of reinforcing bars and anchor bolts before placement of concrete for proper installation.
         3) Inspection at time fresh concrete is sampled to fabricate specimens for strength tests, perform slump and air content tests, and determine temperature of concrete.
         4) Inspection of concrete placement for proper application techniques.
            a) Steel tools are not to be used on exterior concrete.
         5) Periodic inspection for maintenance of specified curing temperature and techniques:
            a) Steel tools are not to be used on exterior concrete. Bull floating and finish floating is to be performed with magnesium or wood floats.
         6) Periodic inspect of formwork for shape, location and dimensions of concrete member being formed:

a) Certified Inspector shall inspect forms for general location, configuration, camber, shoring, sealing of form joints, correct forming material, concrete accessories, and form tie locations.

7) Periodic inspection of concrete finishing operations for proper finishing techniques.
8) Periodic inspection for placement of specified curing compounds.

c. Testing Agency will sample and test during placement of concrete as directed by Architect and may include following:
1) Sampling Fresh Concrete: ASTM C172/C172M, except modified for slump to comply with ASTM C94/C94M:
a) Slump: ASTM C143/C143M, test each time set of compressive specimens are made.
b) Air Content: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete: ASTM C231/C231M, pressure method for normal weight concrete each time set of compression test specimens are made.
c) Concrete Temperature: Test each time set of compressive specimens are made.
d) Unit Weight: ASTM C567/C567M, test each time set of compressive specimens are made.
2) Concrete floor flatness and floor levelness of interior slabs as per ASTM E1155.
3) Concrete moisture and alkalinity testing. See Section 09 0503 Flooring Substrate Preparation.

d. Compression Test Specimen: ASTM C31/C31M, one (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

e. Compressive Strength Tests: ASTM C39/C39M:
1) Obtain one (1) composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd (4 cu m), but less than 50 cu. yd (38 cu m), plus one (1) set for each additional 50 cu. yd (38 cu m) or fraction thereof.
2) One (1) specimen tested at seven (7) days, two (2) specimens tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.
3) If strength of field-cured cylinders is less than eighty-five (85) percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing in-place concrete.
4) Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi (3.45 MPa).

f. Samples:
1) Fresh Concrete: ASTM C172/C172M except modified for slump to comply with ASTM C94/C94M.
a) Slump: ASTM C143/C43M, test each time set of compressive specimens are made.
b) Air Content: ASTM C173/C173M, volumetric method for lightweight or normal weight concrete: ASTM C231/C231M, pressure method for normal weight.
c) Concrete Temperature: Test each time set of compressive specimens are made.
d) Unit Weight: ASTM C567/C567M, test each time set of compressive specimens are made.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.

3.5 CLEANING

A. General:
1. Curing:
a. Clean tools, equipment as directed by Manufacturer's instructions.
2. Detectable Warning Panels:

a. Clean panel(s) in accordance with Manufacturer's cleaning instruction.

3.6 PROTECTION

A. Concrete:
   1. Protect concrete that has not received its initial set from precipitation to avoid excess water in mix and unsatisfactory surface finish.
   2. Do not allow materials resulting from construction activities, which will affect concrete or application of finish floor systems adversely, to come in contact with interior concrete slabs.
   3. Protect interior concrete floors from stains, paint, mortar and other construction activities.

B. Curing:
   1. Restrict foot or vehicle traffic as curing membrane dries as recommended be Manufacturer.

C. Detectable Warning Panels:
   1. Protect installed panels from damage and until completion of project.
   2. Protect installed panels from traffic until desired concrete strength is achieved.

END OF SECTION

SECTION 03 3517

CONCRETE SEALER FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install Concrete Sealer on concrete surfaces as described in Contract Documents including:

B. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for concrete mix information and use admixtures.
   2. Section 32 1313: 'Concrete Paving' for requirements for concrete sealers on concrete placed after about September 1.
   3. Section 32 1723: 'Pavement Markings' for concrete pavement parking stripes.

1.2 REFERENCES

A. Definitions:
   1. Concrete Sealers: As used in this specification, are sealers applied to concrete surfaces to protect from surface damage, corrosion, and staining. Sealers either block pores in concrete to reduce absorption of water and salts or form impermeable layer which prevents such materials from passing. Concrete sealer, when selected and applied properly, will prevent intrusion of water and deicers, minimizing freeze/thaw damage.

B. Reference Standards:
   1. American Association of State and Highway Transportation Officials:
      a. AASHTO T 259-02(2012), 'Standard Method of Test for Resistance of Concrete to Chloride Ion'.
      b. AASHTO T 260-97(2011), 'Standard Method of Test for Sampling and Testing for Chloride Ion in Concrete and Concrete Raw Materials'.
   2. ASTM International:
      a. ASTM C672/C672M-12 'Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals'.
   3. German Institute for Standardization (DIN Standards):
      a. DIN EN 1504-2,' Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete (2005).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Concrete Pavement:
      a. Install Concrete Sealer before paint stripes are placed on concrete pavement.
      b. Apply to prepared surfaces no sooner than about thirty (30) days after concrete placement.
      c. Do not use concrete sealers to replace Membrane Concrete Curing.

1.4 SUBMITTALS

A. Action Submittals:

1. Product Data:
    a. Concrete Sealer:
        1) Manufacturer's product literature or cut-sheets for specified products.
        2) Manufacturer's LEED product literature for specified products.

B. Informational Submittals:
1. Manufacturer Instructions:
    a. Concrete Sealer: Written preparation and application instructions.
2. Source Quality Control Submittals:
    a. Provide protection plan of surrounding areas and non-work surfaces if requested by Architect/Owner's Representative.
3. Qualification Statements:
    a. Applicator: Provide qualification documentation.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Comply with applicable VOC standards and other local requirements.

B. Qualifications:
1. Applicator:
    a. Applicator shall be acceptable to Manufacturer as applicator of its product.
    b. Minimum five (5) satisfactorily completed installations of comparable quality, scope, similar size, and complexity in past two (2) years before bidding. Include contact information of person with oversight of each project.
    c. Provide qualification documentation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
1. Follow Manufacturer’s written instructions for handling and storage of product:
    a. Store in unopened containers in clean, dry area between 35 deg F (2 deg C) and 110 deg F (43 deg C) or as directed by Manufacturer's instruction.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
1. Concrete Sealer:
    a. Follow printed Manufacturer's instruction for environmental hazards:
    b. Follow printed Manufacturer's instruction for ambient conditions for application of product including:
        1) Minimum and maximum application temperatures.
        2) Application precautions when rain is expected.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Concrete Sealer:
1. Description:

a. Concrete sealer that protects new and existing exterior concrete.

2. Design Criteria:
   a. General:
      1) Penetrating water repellent silane or linseed oil/mineral spirit concrete sealers are to be used.
      2) Siloxanes are not to be used to replace silane or linseed oil/mineral spirits sealers.
   b. Linseed Oil/Mineral Spirits Sealers:
      1) Protects concrete from freeze/thaw cycles and deicing salts.
      2) Resists penetration of water and deicing salts.
   c. Silane Based Sealers:
      1) Protects concrete from freeze/thaw cycles and deicing salts.
      2) Resists penetration of water and deicing salts.
      3) 100 percent silane active ingredient content.
      4) Penetrating sealer.
      5) Water repellant.
      6) Clear (colorless, non-yellowing). Surface appearance after application: unchanged.
3. Limitations:
   a. VOC:
      1) If Low VOC product are required or desired, use only those products listed as 'Low VOC' in acceptable products below.
4. Acceptable Products. See Section 01 6200. Applicator Option:
   a. Linseed Oil/Mineral Spirits Sealers:
      1) Anti Spall J33 Concrete Sealer by Dayton Superior Corporation, Miamisburg, OH www.daytonsuperior.com.
         a) Low VOC.
      2) Equal product meeting design criteria requirements as approved by Architect/Owner's Representative before BID. See Section 01 6200.
   b. Silane Based Sealers:
      1) MasterProtect H 1000 by BASF, Cleveland, OH www.master-builders-solutions.basf.us.
         a) Low VOC.
      2) Weather Worker J29A by Dayton Superior Corporation, Miamisburg. OH www.daytonsuperior.com.
      3) Baracade Silane 100 by Euclid, Cleveland, OH www.euclidchemical.com.
         a) Low VOC.
      4) Sikagard 705L by Sika Corporation, Lyndhurst, NJ www.usa.sika.com.
         a) Low VOC.
      5) TK-590-100 by TK Products, Minnetonka, MN www.tkproducts.com.
      6) Equal product meeting design criteria requirements as approved by Architect/Owner's Representative before BID. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Verify concrete has properly cured.

3.2 PREPARATION

A. Surface Preparation:
   1. Concrete Sealer:
      a. Take necessary precautions to protect adjoining property.
      b. Do not contaminate any body of water by direct application, cleaning of equipment or disposal of wastes.
   2. Cleaning:

a. Clean concrete surface of membrane curing and all dirt, mud spots, silt spots, loose material, vegetation, oil spots, and other objectionable and foreign material.
b. Remove debris, sand, dirt, and dust from concrete surface.
c. Power brooms, power blowers, air compressors, water flushing equipment, and blowers are acceptable equipment for cleaning concrete surface.

3.3 APPLICATION

A. Concrete Sealer:
1. General:
a. Apply concrete sealer after surface preparation has been completed as per Manufacturer's recommendations.
b. Follow Manufacturer's ambient conditions for minimum and maximum application temperatures and application precautions when rain is expected.
c. Stir material thoroughly before and during application if required by Manufacturer.
d. Do not apply sealer if standing water is visible on concrete surface to be treated.
e. Apply even distribution of sealer.
f. Do NOT over apply. All product should penetrate substrate with no surface build-up. Any excess or puddles of material must be removed.
2. Apply Concrete Sealer:
a. Linseed Oil/Mineral Spirits Sealers:
1) For maximum protection, apply onto concrete surface before it is exposed to deicing salts.
2) Do not apply in temperatures below 40 deg F (4.4 deg C).
3) Apply first coat at 1 gallon (3.785 liters) per 350 sq ft (32.5 sq m).
4) When first coat is dry to touch, apply second coat at 1 gallon (3.785 liters) per 600 sq ft (55.7 sq m).
5) When second coat is totally dry, surface is ready for traffic.
6) Texture and absorption of surface will influence final coverage rates.
7) This application will turn concrete to dark amber color.
b. Silane Based Sealers:
1) Apply at rate of about 1 gallon (3.785 liters) per 300 sq ft (27.8 sq meters) or as per Manufacturer's recommendations depending upon absorbency of concrete surface.
3. Allow Concrete Sealer to dry as per Manufacturer's recommendations.

3.4 CLEANING

A. General:
1. Clean tools, equipment and spills as directed by Manufacturer's instructions.
2. Clean drips and over spray while still wet.

B. Waste Management:
1. Sterilant/Concrete Sealers:
a. Follow Manufacturer's recommendations for approved disposal of product and containers.
1) Do not reuse empty containers.

END OF SECTION

SECTION 03 4800

PRECAST CONCRETE SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install precast concrete elements.

B. Products Furnished But Not Installed Under This Section:
   1. Detectable warning panels.

C. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for installation of detectable warning panels.
   2. Section 07 9213: 'Elastomeric Joint Sealants'.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A615/A615M-18, 'Standard Specification for Deformed and Plain Steel Bars for Concrete Reinforcement'.
      b. ASTM A1064/A1064M-18a, 'Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete'.
      c. ASTM C33/C33M-18, 'Standard Specification for Concrete Aggregates'.
      d. ASTM C150/C150M-18, 'Standard Specification for Portland Cement'.
      e. ASTM C260/C260M-10a(2016), 'Standard Specification for Air-Entraining Admixtures for Concrete'.
   2. ASTM International (following are referenced specifically for detectable warning panels):
      a. ASTM C39/C39M-18, 'Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens'.
      b. ASTM C140-18a, 'Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units'.
      c. ASTM C293/C293M-16, 'Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)'.
      d. ASTM C418-12, 'Standard Test Method for Abrasion Resistance of Concrete by Sandblasting'.
      e. ASTM C947-03(2016), 'Standard Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)'.
      f. ASTM C1262/C1262M-18, 'Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units'.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer product literature for each type of product indicated.
   2. Shop Drawings:
      a. Precast concrete elements:
         1) Detail fabrication and installation of architectural precast concrete units.

2) Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit.
3) Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.
a) Indicate separate face and backup mixture locations and thicknesses.
4) Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
5) Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
6) Include plans and elevations showing unit location and sequence of erection for special conditions.
7) Indicate location of each architectural precast concrete unit by same identification mark placed on panel.
8) Indicate relationship of architectural precast concrete units to adjacent materials.
9) Indicate locations and details of stone facings, anchors, and joint widths.

b. Detectable warning panels:
1) Detail fabrication details and installation of detectable warning panels.
2) Indicate locations on site, plans, dimensions, shapes, and cross sections of each unit.
3) Indicate joints locations and placement.

3. Samples:
a. Detectable warning panels.
1) Provide 4 inch (100 mm) by 4 inch (100 mm) minimum sample of detectable warning panel representing actual finish, color, texture, and patterns.

B. Informational Submittals:
1. Certificates:
a. Precast concrete elements:
1) Material Certificates: For the following items, signed by manufacturers:
a) Admixtures.
b) Bearing pads.
c) Cementitious materials.
d) Reinforcing materials.

2. Design Submittals:
a. Precast concrete elements:
1) Design Modifications:
a) If design modifications are proposed to meet performance requirements and field conditions, submit design calculations and Shop Drawings.
b) Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.

3. Test And Evaluation Reports:
a. Material Test Reports:
1) Detectable warning panels:
a) Test reports from qualified independent testing laboratory indicating that material proposed for use meets physical properties indicated herein.

4. Manufacturer’s Instructions:
a. Detectable warning panels:
1) Cleaning and maintenance instructions.
2) Preparation and installation instructions.
3) Storage and handling requirements.

5. Source Quality Control Submittals.
a. Precast concrete units:
1) Control test reports.
2) Precast Concrete mix design: Submit compressive strength and water-absorption tests for each precast concrete mix design.

6. Field Quality Control Submittals:
a. Precast concrete units:
1) Provide special inspection reports.

7. Qualification Statements:
a. Precast concrete units:
1) Installer and Fabricator:

a) Letter certifying level of training and experience of Installer and Fabricator.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data:
1) Detectable Warning Panels: Maintenance instructions.
b. Warranty Documentation:
1) Detectable Warning Panels: Final, executed copy of Warranty.
c. Record Documentation:
1) Manufacturers documentation:
a) Detectable Warning Panels: Manufacturer's literature or cut sheet.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Americans with Disabilities Act – 28 CFR Part 35 Title II and 28 CFR 36 Title II:
a. Comply with requirements of detectable warning surfaces.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Check, carefully unload, and deliver material to site in such manner as to avoid soiling and damaging.
2. Detectable warning panels:
a. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
1. Store material on planks clear of ground and protect from damage.
2. Detectable warning panels:
a. Store pallets on supported flat surface. Do not double stack pallets.

1.6 WARRANTY

A. Manufacturer Warranty:
1. Detectable Warning Panels:
a. Provide Manufacturer Five (5) Year limited Warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Materials:
1. Design Criteria:
a. Precast Concrete:
1) Air Entrainment: Wet cast mixture maintains 5 to 7 percent air entrainment where surfaces are exposed to freeze-thaw. Admixture conforms to ASTM C260.
2) Aggregates: ASTM C33/C33M.
3) Cement: ASTM C150/C150M, Type II.
4) Compressive Strength: 4500 psi (31.03 MPa) concrete minimum.
5) Water: Potable water free from impurities.
b. Reinforcing:
1) Bars: ASTM A615/A615M, Grade 60.
2) Reinforcing Mesh: ASTM A1064/A1064M.

c. Concrete Elements:
   1) Color:
      a) Add Natural Grey color to mix.
      b) Integral Color: Concentrated dry powder iron oxide pigments designed to meet samples and mock-up.

2.2 ACCESSORIES

A. Sealant: As specified in Section 07 9213: 'Elastomeric Joint Sealants'.

B. Detectable Warnings Panels:
   1. ADA compliant.
   2. Cementitious high strength reinforced concrete panel.
   3. Meet requirements of following:
      a. ASTM C39/C39M or ASTM C140 for compressive strength requirements.
      b. ASTM C140 for water absorption requirements.
      c. ASTM C293 or ASTM C947 for flexural strength requirements.
      d. ASTM C418 or C779 for abrasion resistance requirements.
      e. ASTM C1262/C1262M for freeze thaw requirements.
   4. Dome spacing: standard spacing approved by code.
   5. Colors: Select color from Manufacturer's available colors and local ADJ requirements.
   6. Approved Products. See Section 01 6200.
      a. TekWay Dome Tiles by StrongGo Industries, Tucson, AZ www.stronggo.com.
      b. CASTinTACT by Masons Supply Co., Portland OR www.masco.net/castintactweb.

2.3 FABRICATION

A. General:
   1. Chamfered edges.
   2. Smooth finish free from pits and rock pockets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Detectable warning panels:
   1. Follow Manufacturers installation instructions.

END OF SECTION

SECTION 03 6213

NON-METALLIC NON-SHRINK GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install structural grout as described in Contract Documents.
      a. For grout base for machine bases.
      b. For securing anchor bolts and hardware in concrete.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute:
      a. ACI 305R-10, ‘Guide to Hot Weather Concreting’.
      b. ACI 306R-10, 'Guide to Cold Weather Concreting’.
      c. ACI 351.1R-12, ‘Grouting Between Foundations and Bases for Support of Equipment and Machinery’.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C1107/C1107M-17, 'Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).'
   2. United States Army Corps of Engineers (USACE):
      a. CRD C-621-93, ‘Handbook for Concrete and Cement Standard Specification for Packaged, Dry, Hydraulic-Cement Grout (Nonshrink’.

1.3 SUBMITTALS

A. Action Submittals
   1. Product Data:
      a. Manufacturer's data sheets on each product to be used, including:
         1) Preparation instructions and recommendations.
         2) Storage and handling requirements and recommendations.
         3) Manufacturer's printed installation instructions for each product.

1.4 DELIVERY, STORAGE AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact clearly identifying product name and manufacturer until time of use.

B. Storage And Handling Requirements:
   1. Follow Manufacturer’s recommendations including but not limited to following:
      a. Store in clean, dry location.
      b. Keep containers sealed until ready for use.
      c. Store materials at room temperature before use.
   2. Protect materials during handling and placement to prevent damage or contamination.
      a. Protect materials from freezing or overheating.
   3. Shelf Life: One (1) year minimum in original, unopened containers.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
   1. General:
      a. Do not place grout over frozen concrete.
   2. Maintain environmental conditions and protect Work during and after installation to comply with referenced standards and Manufacturer's printed recommendations:
      a. Do not install products under environmental conditions outside Manufacturer's recommendations.
   3. Follow ACI requirements for cold and hot weather concreting or Manufacturer's written instructions, whichever is more stringent:
      a. Cold Weather Limitations:
         1) Follow requirements of ACI 306R for cold weather concreting.
      b. Hot Weather Limitations:
         1) Follow requirements of ACI 305R for hot weather concreting.
      c. ACI 305R-10, 'Guide to Hot Weather Concreting'.
      d. ACI 306R-10, 'Guide to Cold Weather Concreting'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Design Criteria:
   1. Description:
      a. Commercial non-shrink, non-metallic grout.
   2. Meet following requirements:
      a. ASTM C1107/C1107M, Type B or Type C.
      b. Corps and Engineers CRD C-621.
      c. Compressive strength of 6000 psi (41 MPa) minimum.

B. Acceptable Products:
   1. Masterflow 928 by BASF Systems, Shakopee www.buildingsystems.basf.com.
   2. ProSpec F77 by Bonsal American, Inc., Charlotte, NC www.bonsal.com.
   3. Advantage 1107 Grout by Dayton Superior Corporation, Oregon, IL www.daytonsuperiorchemical.com.
   4. NS Grout by Euclid Chemical Company, Cleveland, OH www.euclidchemical.com.
   5. Five Star Grout by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
   6. Duragrout by L&M Construction Chemicals Inc., Omaha, NE www.lmcc.com.
   7. Planigrout 712 by MAPEI Corporation, Deerfield Beach, FL www.mapei.US
   8. SikaGrout 212 by Sika Corporation, Lyndhurst, NJ www.usa.sika.com
   9. MP Grout by US Mix Products Company, Denver, CO www.usspec.com.
   10. Sealtight CG-86 Grout by W R Meadows, Hampshire, IL www.meadows.com.
   11. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Examine substrate and verify substrate is suitable for installation.
   2. Notify Architect of unsuitable conditions in writing.
      a. Do not install board over unsuitable conditions.
      b. Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Surface Preparation:
   1. Prepare concrete surfaces in accordance with Manufacturer's written instructions:
   2. Remove all loose materials.
   3. Clean surface of any substance that could interfere with bond on material including dirt, paint, tar, asphalt, wax, oil, grease, latex compounds, form release agents, laitance, loose toppings, foreign substances and any other residues.
   4. Saturate area to be grouted with water in accordance with Manufacturer's written instructions.

3.3 APPLICATION

A. General:
   1. Follow Manufacturer's recommended thickness.

B. Mixing:
   1. Mix grout in accordance with Manufacturer's written instructions.
   2. Add mix water in amount in accordance with Manufacturer's written instructions to provide required placing consistency.
   3. Do not add water in amount that will cause bleeding or segregation of mixed grout.
   4. Do not add any sand, cement, admixtures, or fluidifiers to grout.

C. Placement:
   1. Place grout in accordance with Manufacturer's written instruction including but not limited to the following:
      a. Proper curing is required.
      b. Use cold weather or hot weather grouting procedures in accordance with Manufacturer's written instructions, as temperature dictates:
         1) Do not use at temperatures that may cause premature freezing.
         2) Do not allow to freeze until 4000 psi (27.6 MPa) is attained.
      c. Employ cold weather or hot weather grouting practices as temperatures dictates.
   2. Completely eliminate air pockets and provide full contact between grout and item being grouted. Do not exceed Manufacturer's recommended thickness.

D. Curing:
   1. Cure grout in accordance with Manufacturer's written instructions or ACI curing practices.
   2. Wet cure grout until forms are removed.
   3. Seal grout surfaces after forms are removed as recommended by Manufacturer.

E. Keep grout surfaces wet after curing compound has dried for as long as recommended by Manufacture.

3.4 FIELD QUALITY CONTROL

A. Field Inspections:
   1. Verify product has been installed as per Contract Documents and Manufacturer's written instructions.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with Contract Document requirements at no additional cost to the Owner.

3.5 CLEANING

A. Use clean water.

B. Clean tools and equipment with water before material hardens.

3.6 PROTECTION

A. Follow Manufacturer's recommendation for protection when applying material.

B. Protect placed grout from freezing until minimum strength of 4000 psi (27.58 MPa) is reached.

C. Protect placed grout from damage during construction.

END OF SECTION

DIVISION 05: METALS

END OF TABLE OF CONTENTS

SECTION 05 0503

SHOP-APPLIED METAL COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of factory or shop-applied priming applied to steel supplied to Project without finish coat.
   2. Quality of and procedures for field touch-up and repair of factory-applied priming and galvanizing.

B. Related Requirements:
   1. Section 05 4010: 'Cold-Formed Load-Bearing Metal Framing' for repair to galvanized coatings.
   2. Sections under 09 9000 heading: Finish painting.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A780/A780M-09(2015), ‘Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings'.
      b. ASTM B695-04(2016), 'Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel'.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Product data and samples, if requested by Architect.

PART 2 - PRODUCTS

2.1 FINISHES

A. Factory And Shop-Applied Primer:
   1. Compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.
   2. Primer on unexposed, unfinished surfaces may be fabricator's standard shop coat.

B. Repairs To Primed Surface:

C. Unless otherwise specified, use primer which matches characteristics of original primer and is compatible with and of equal or better quality than finish paint system to be applied by Sections under 09 9000 heading.

D. Material For Repairs Of Galvanized Surfaces:
   1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
      a. Zinc-Rich Paints:
         1) Zinc-Dust Content: Dried film shall contain 94 percent minimum of zinc-dust by weight.
         2) Acceptable Manufacturers:
            a) Galvax by Alvin Products Inc, Everett, MA www.alvinproducts.com.
            b) ZRC Galvilite by ZRC Worldwide, Marshfield, MA www.zrcworldwide.com.
            c) Equal as approved by Architect before bidding. See Section 01 6200.

2. Structural, Load-Bearing Items And Items Exposed To Weather:
    a. Zinc-Based Solders, Powder, Or Rod:
        1) Zinc-Cadmium solder with liquidus temperature range from 518 to 527 deg F (270 to 275 deg C), or
        2) Zinc-Tin-Lead alloy with liquidus temperature range from 446 to 500 deg F (230 to 260 deg C).
    b. Sprayed Zinc: Wire, ribbon, or powdered zinc suitable for process.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation:
1. General:
    a. Clean, grind, or otherwise prepare welds in steel that is to be coated within limits acceptable to welder responsible for structural integrity.
    b. Surfaces to be coated shall be clean, dry and free of oil, grease, and corrosion products.
2. Preparation Of Primed, Ungalvanized Surfaces:
    a. Clean welds and grind serious abrasions.
3. Preparation Of Galvanized Surfaces:
    a. Follow requirements of ASTM A780/A780M and following:
    b. For Repair Using Zinc-Rich Paints:
        1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP10 (1 to 2 mil anchor pattern), as minimum.
        2) Where circumstances do not allow blast cleaning, power disk sand to bright metal finish.
        3) Extend surface preparation into undamaged galvanized area.
        4) Remove flux residue and weld spatter from welded areas.
    c. For Repair Using Zinc-Based Alloys:
        1) Clean surface to be reconditioned using wire brush, light grinding action, or mild blasting.
        2) Extend surface preparation into surrounding, undamaged galvanized areas.
        3) Remove flux residue and weld spatter from welded areas.
        4) Preheat cleaned area to at least 600 deg F (316 deg C).
            a) Do not overheat surface beyond 750 deg F (400 deg C) or allow surrounding galvanized coatings to be burned.
            b) Wire brush surface during preheating.
    d. For Repair Using Sprayed Zinc (Metallizing):
        1) Blast clean surfaces to near-white metal, in accordance with SSPC-SP5 as minimum.
        2) Extend surface preparation into undamaged galvanized area.
        3) Remove flux residue and weld spatter from welded areas.

3.2 REPAIR / RESTORATION

A. Repairs To Primed, Ungalvanized Surfaces:
1. Thoroughly clean metal and give one (1) prime coat of specified material, well-worked into metal joints and open spaces. Match existing primed finish as required.
    a. Do not apply primer at temperatures below 45 deg F (7 deg C).
    b. Protect un-primed machine-finished surfaces against corrosion by priming.

B. Repairs To Galvanized Surfaces:
1. Non-Structural, Non-Load-Bearing Items Not Exposed To Weather:
    a. Repair Using Zinc-Rich Paints: Spray- or brush-apply zinc-rich paint to prepared area. Apply paint in single application employing multiple spray passes to achieve dry film thickness of 2 mils.

2. Structural, Load-Bearing Items And Items Exposed To Weather:
   a. Repair Using Zinc-Based Alloys:
      1) Rub cleaned, pre-heated areas with repair stick to deposit evenly distributed layer of zinc alloy. If powdered zinc alloys are used, sprinkle powder on surface and spread out with spatula or similar tool.
      2) Remove flux residue by rinsing with water or wiping with damp cloth.
   b. Repair Using Sprayed Zinc (Metallizing): Apply 2 mil minimum coating by means of metal-spraying pistols fed with either zinc wire or zinc powder in accordance with requirements of ASTM B695, Type I.
3. All Items:
   a. Apply repair materials immediately after surface preparation is complete.
   b. Take thickness measurements, with either magnetic or electromagnetic gauge, to ensure applied coating is as specified or agreed to.

END OF SECTION

SECTION 05 0523

METAL FASTENING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of structural metal-to-metal, wood-to-metal, and wood-to-wood bolts used on Project.
   2. Requirements and standards for site welded metal-to-metal connections.

B. Related Requirements:
   1. Section 03 1511: 'Concrete Anchors And Inserts' for cast-in-place and drilled-in anchor bolts.
   2. Furnishing and installing of structural bolts specified under Section concerned.
   3. Performance of welding specified under Section concerned.

1.2 REFERENCES

A. Reference Standards:
   1. American National Standards Institute / American Welding Society:
      a. ANSI/AWS D1.1/D1.1M:2015, ‘Structural Welding Code - Steel’.
      b. ANSI/AWS D1.3/D1.3M:2018, ‘Structural Welding Code - Sheet Steel’.
   2. ASTM International:
      a. ASTM A307-14, ‘Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength'.

1.3 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but not limited to the following:
   1. Welders shall be certified 30 days minimum before beginning work on Project. If there is doubt as to proficiency of welder, Architect may require welder to take another test, at no expense to Owner. Certification shall be by Pittsburgh Laboratories or other authority approved by Architect.

B. Certifications:
   1. Maintain welder's certifications on job-site.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Materials:
   1. Bolts And Threaded Fasteners:
      a. Bolts: Conform to requirements of ASTM A307, Grade A.

2.2 ACCESSORIES

A. Arc-Welding Electrodes: Type E70XX AWS Iron and Steel Arc-welding electrodes and meeting current AISC Specifications.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Welding shall meet requirements of ANSI / AWS D1.1 and D1.3.

B. Minimum weld sizes, unless detailed otherwise.
   1. Weld pipe columns to base plates and top plates with 1/4 inch (6 mm) fillet weld all around.
   2. Weld glu-lam connection side plates to base plates with 1/4 inch (6 mm) fillet weld all along outside edges.
   3. Weld stiffeners to pipe columns with 1/4 inch (6 mm) fillet weld all around.

END OF SECTION

SECTION 05 5871

METAL BRACKETS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Metal Brackets:
      a. Metal brackets necessary to support Counter.

B. Related Requirements:
   1. Metal Brackets:
      a. Section 05 0503: 'Shop-Applied Metal Coatings' for quality of priming.
      b. Section 05 0523: 'Metal Fastening' for quality of welding.
      c. Section 06 2001: ‘Common Finish Carpentry Requirements’ for installation of metal brackets.
      d. Section 09 9124: ‘Interior Painted Metal’ for finish painting.

1.2 REFERENCES

A. Reference Standards (Metal Brackets):
   1. ASTM International:
      a. ASTM A36/A36M-14, ‘Standard Specification for Carbon Structural Steel'.

PART 2 - PRODUCTS

2.1 FABRICATED UNITS

A. Materials:
   1. Metal Brackets:
      a. Steel: Meet requirements of ASTM A36/A36M.
      b. Fabrication:
         1) Fabricate as detailed.
         2) Grind exposed welds smooth and polish to match non-welded metal finish.
         3) After fabrication and drilling of mounting holes, shop prime.

PART 3 - EXECUTION: Not Used

END OF SECTION

DIVISION 06: WOOD, PLASTICS, AND COMPOSITES

END OF TABLE OF CONTENTS

SECTION 06 0573

PRESERVATIVE WOOD TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of wood preservative treatment where specified.

B. Related Requirements:
   1. Section 06 1100:
      a. Characteristics of wood to be pressure-treated.
      b. Furnishing and installing of pressure-treated wood.

1.2 REFERENCES

A. Definitions:
   1. Preservative-Treated Wood: Wood exposed to high levels of moisture or heat susceptible to decay by fungus and other organisms, and to insect attack. The damage caused by decay or insects can jeopardize the performance of the wood members so as to reduce the performance below that required. Preservative treatment requires pressure-treatment process to achieve depth of penetration of preservative into wood to verify that the wood will be resistant to decay and insects over time.
   2. Treated Wood: Wood impregnated under pressure with compounds that reduce its susceptibility to flame spread or to deterioration caused by fungi, insects, or marine bores.

B. Reference Standards:
   1. American Wood Protection Association:
      a. AWPA N1-06, 'All Millwork Products - Preservative Treatment by Nonpressure Process'.
      b. AWPA P5-10. 'Standard For Waterborne Preservatives'.
      c. AWPA P22-10. 'Standard For Ammoniacal Copper Zinc Arsenate (ACZA)'.
      d. AWPA P51-10, ‘Standard for Zinc Borate (ZB)’.
      e. AWPA T1-12, ‘Use Category System: Processing and Treatment Standard For Treated Wood’.
      f. AWPA U1-12, ‘Use Category System: User Specification For Treated Wood’.
   2. California Building Code (CBC) (2022 or most recent edition adopted by AHJ):
      a. Chapter 23, 'Wood':
         1) Section 2303, 'Minimum Standards and Quality':
            a) 2301, ‘General’:
               (1) 2303.1.9, 'Preservative-Treated Wood’.
         2) Section 2304, 'General Construction Requirements':
            a) 2304.12, ‘Protection Against Decay and Termites’:
               (1) 2304.12.1, 'Wood Used Above Ground’.
               (2) 2304.12.3, 'Wood In Contact With The Ground Or Fresh Water'.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Certificate: Certificate of pressure treatment showing compliance with specification requirements and including information required under CBC Section 2303.1.8.1, ‘Identification’.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Arch Wood Protection Inc, Atlanta, GA www.wolmanizedwood.com.
      b. Hoover Treated Wood Products, Thomson, GA www.frtw.com.
      c. Osmose Inc, Griffin, GA www.osmose.com.
      d. U S Borax Inc, Valencia, CA www.borax.com/wood.
      e. Viance LLC, Charlotte, NC www.treatedwood.com.
      f. Equal as approved by Architect.

B. Performance:
   1. Framing lumber grade and species shall be as specified in Section 06 1100 for particular use.
   2. Interior Wood In Contact With Concrete or Masonry:
      a. Preservatives:
         1) Disodium octoborate tetrahydrate (DOT / SBX) meeting requirements of AWPA U1 and with retention of 0.25 lbs per cu ft (4 kg per cu meter).
         2) Zinc borate meeting requirements of AWPA U1 and with retention of 0.17 lbs per cu ft (2.7 kg per cu meter).
         3) CCA-C (47.5 percent chromium trioxide, 18.5 percent copper oxide and 34 percent arsenic pentoxide) by Koppers Performance Chemicals, Griffin, Georgia, http://www.koppersperformancechemicals.com/ (0.25 lb/cu ft minimum retention).
         4) DURA-GUARD by Hoover Treated Wood Products, Thomson, GA www.frtw.com (.40 lb/cu ft minimum retention).
      b. Lumber: Treat in accordance with AWPA U1.
      c. Millwork: Treat in accordance with AWPA N1 and dry after treatment.
   3. Exterior Wood Continuously Exposed To Weather:
      a. Preservatives: Waterborne preservatives meeting requirements of AWPA U1 with retention levels as required by AWPA U1 for specific application.
      b. Lumber: Treat in accordance with AWPA U1.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 06 1011

WOOD FASTENINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of wood fastening methods and materials used for Rough Carpentry unless specified otherwise.

B. Related Requirements:
   1. Section 03 1511: 'Concrete Anchors and Inserts' for Quality of Anchors and Inserts.
   2. Section 05 0523: 'Metal Fastenings' for Quality of bolts used for Rough Carpentry.
   3. Furnishing and installing of other fasteners are specified in individual Sections where installed.

1.2 REFERENCES

A. Reference Standards;
   1. ASTM International:
      a. ASTM A153/A153M-16a, ‘Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware’.
      b. ASTM D3498-18, ‘Standard Specification for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems’.
      c. ASTM F1667-18a, ‘Standard Specification for Driven Fasteners: Nails, Spikes, and Staples’.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature on framing anchors and powder actuated fasteners.
   2. Shop Drawings:
      a. Submit diameter and lengths of fasteners proposed for use on Project. If length or diameter of proposed fasteners differ from specified fasteners, also include technical and engineering data for proposed fasteners including, but not limited to:
         1) Adjusted fastener spacing where using proposed fasteners and,
         2) Adjusted number of fasteners necessary to provide connection capacity equivalent to specified fasteners.
      b. Submit on powder-actuated fasteners other than those specified in Contract Documents showing design criteria equivalents at each application.
      c. Show type, quantity, and installation location of framing anchors. Where necessary, reference Drawing details, etc, for installation locations.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Description:
   1. Nail Terminology:

a. When following nail terms are used in relation to this Project, following lengths and diameters will be understood. Refer to nails of other dimensions by actual length and diameter, not by one of listed terms:

Nail Term	Length	Diameter	Length	Diameter
8d Box	2-1/2 inches	0.113 inch	63.5 mm	2.827 mm
8d Common	2-1/2 inches	0.131 inch	63.5 mm	3.389 mm
10d Box	3 inches	0.128 inch	76.2 mm	3.251 mm
10d Common	3 inches	0.148 inch	76.2 mm	3.759 mm
16d Box	3-1/2 inches	0.135 inch	88.9 mm	3.411 mm
16d Sinker	3-1/4 inches	0.148 inch	82.6 mm	3.759 mm
16d Common	3-1/2 inches	0.162 inch	88.9 mm	4.115 mm

B. Materials:
1. Fasteners:
   a. General:
      1) Fasteners for preservative treated and fire-retardant-treated wood shall be of hot dipped zinc-coated galvanized steel, stainless steel, silicon bronzed, or copper. Coating weights for zinc-coated fasteners shall be in accordance with ASTM A153/A153M.
   b. Nails:
      1) Meet requirements of ASTM F1667.
      2) Unless noted otherwise, nails listed on Drawings or in Specifications shall be common nail diameter, except 16d nails, which shall be box diameter.
   c. Wood Screws:
      1) SDS Screws:
         a) Acceptable Products.
            (1) SDS Screws by Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
            (2) Equal as approved by Architect.
      2) All Other: Standard type and make for job requirements.
   d. Powder-Actuated Fasteners:
      1) Quality Standard: Hilti X-DNI 62P8.
      2) Manufacturers:
         a) Hilti, Tulsa, OK www.us.hilti.com.
         b) Redhead Division of ITW, Wood Dale, IL www.itw-redhead.com
         c) Equals as approved by Architect through shop drawing submittal before installation.
2. Adhesives:
   a. Construction Mastics:
      1) Meet requirements of 'APA-The Engineered Wood Association' Specification AFG-01 or ASTM D3498.
      2) Use phenol-resorcinol type for use on pressure treated wood products.
3. Framing Anchors:
   a. Framing anchors and associated fasteners in contact with preservative hot dipped zinc-coated galvanized steel or stainless steel. Do not use stainless steel items with galvanized items.
   b. Acceptable Products:
      1) KC Metals Inc, San Jose, CA www.kcmetals.com.
      2) Simpson Strong Tie Co, Dublin, CA www.strongtie.com.
      3) United Steel Products Co Inc (USP), Montgomery, MN www.uspconnectors.com.
      4) Equals as approved by Architect through shop drawing submittal before installation.

PART 3 - EXECUTION

3.1 ERECTION

A. Secure one Manufacturer approved fastener in each hole of framing anchor that bears on framing member unless approved otherwise in writing by Architect.

B. Provide washers with bolt heads and with nuts bearing on wood.

END OF SECTION

SECTION 06 1100

WOOD FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install wood framing and blocking as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:
   1. Miscellaneous structural steel elements.
   2. Roof related blocking, wood nailers, and curbs.

C. Related Requirements:
   1. Section 05 1223: 'Structural Steel For Buildings' for furnishing of miscellaneous structural steel.
   2. Section 06 0573: 'Preservative Wood Treatment' for quality of preservative wood treatment.
   3. Sections under 06 4000 Heading: 'Architectural Woodwork' for wall blocking requirements.
   4. Sections in Division 07: Roofing membranes for related blocking, wood nailers, and curbs.
   5. Section 08 4113: 'Aluminum-Framed Entrances And Storefronts':

1.2 REFERENCES

A. Association Publications:
   1. American Lumber Standard Committee (ALSC) (Maintains NIST standard):
      a. Voluntary Product Standard:
         1) PS 20-15, 'American Softwood Lumber Standard'.
   2. National Institute of Standards and Technology (NIST), U. S. Department of Commerce:
      a. Voluntary Product Standard DOC PS 20-15, 'American Softwood Lumber Standard'.

B. Reference Standards:
   1. Truss Plate Institute / Structural Building Components Association:
      a. TPI / SBCA. ‘Building Component Safety Information BCSI 2013, ‘Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses'.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Test And Evaluation Reports:
      a. Technical and engineering data on nails to be set by nailing guns for Architect's approval of types proposed to be used as equivalents to specified hand set nails and adjusted number and spacing of pneumatically-driven nails to provide equivalent connection capacity.
   2. Manufacturer Instructions:
      a. Copies of pamphlets specified in REFERENCE Article. After Architect's examination, keep pamphlets on Project site with approved shop drawings. Pamphlets may be obtained from Truss Plate Institute, Wood Truss Council of America, or from Truss Fabricator.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Suppliers:
      a. Licensed by American Institute of Timber Construction, or American Wood Systems.
      b. Approved Supplier(s):
         1) Approval subject to agreement process approval.
         2) Submit documentation to Architect or Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Protect lumber and sheathing and keep under cover in transit and at job site.
   2. Do not deliver material unduly long before it is required.

B. Storage And Handling Requirements:
   1. Store lumber and sheathing on level racks and keep free of ground to avoid warping.
   2. Stack to insure proper ventilation and drainage.
   3. Handle and store wood trusses in accordance with ANSI / WTCA Booklet BSCI except trusses may be unloaded by dumping if trusses are shipped horizontally, are rolled off low profile roller bed trailer, and no part of any truss is required to drop more than 18 inches (450 mm).

PART 2 - PRODUCTS

2.1 SUPPLIERS

2.2 MATERIALS

A. Dimension Lumber:
   1. Design Criteria:
      a. Meet requirements of PS 20 and National Grading Rules for softwood dimension lumber.
      b. Bear grade stamp of WWPA, SPIB, or other association recognized by American Lumber Standards Committee identifying species of lumber by grade mark or by Certificate of Inspection.
      c. Lumber 2 inches (50 mm) or less in nominal thickness shall not exceed 19 percent in moisture content at time of fabrication and installation and be stamped 'S-DRY', 'K-D', or 'MC15'.
      d. Preservative Treated Plates / Sills:
         1) 2x4 (38 mm by 64 mm): Standard and better Douglas Fir, Southern Pine, or HemFir, or StrandGuard by iLevel by Weyerhaeuser Boise, ID www.ilevel.com. (LSL 1.3 E)
         2) 2x6 (38 mm by 140 mm) And Wider: No. 2 or or MSR 1650f - 1.5e Douglas Fir, Southern Pine, HemFir, or StrandGuard by iLevel by Weyerhaeuser, Boise, ID www.ilevel.com. (LSL 1.3 E).

B. Posts, Beams, And Timbers 5 Inches by 5 Inches (125 mm by 125 mm) And Larger:
   1. Design Criteria:
      a. No. 1 or better Douglas Fir or Southern Pine.

C. Lumber Ledgers:
   1. Design Criteria:
      a. No. 2 Douglas Fir-Larch, or Southern Pine.

D. See Contract Drawings for additional requirements.

2.3 ACCESSORIES

A. Blocking:
   1. Sound lumber without splits, warps, wane, loose knots, or knots larger than 1/2 inch (13 mm).

B. Furring Strips:
   1. Utility or better.

C. Sill Sealer:
   1. Closed-cell polyethylene foam, 1/4 inch (6 mm) thick by width of plate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Use preservative treated wood for wood members in contact with concrete or masonry, including wall, sill, and ledger plates, door and window subframes and bucks, etc.

B. Interface With Other Work:
   1. Coordinate with other Sections for location of blocking required for installation of equipment and building specialties. Do not allow installation of gypsum board until required blocking is in place.
   2. Where manufactured items are to be installed in framing, provide rough openings of dimensions within tolerances required by manufacturers of such items. Confirm dimensions where not shown on Contract Drawings.

C. Tolerances:
   1. Walls:
      a. 1/4 inch (6 mm) in 20 feet (6 meters), non-cumulative in length of wall.
      b. 1/8 inch (3 mm) in 10 feet (3 meters) with 1/4 inch (6 mm) maximum in height of wall.
      c. Distances between parallel walls shall be 1/4 inch (6 mm) maximum along length and height of wall.

D. Walls:
   1. Posts And Columns:
      a. Unless shown otherwise, nail members of multiple member columns together with 16d at 6 inches (150 mm) on center from each side.

E. Roof And Ceiling Framing:
   1. Place with crown side up at 16 inches (400 mm) on center unless noted otherwise.
   2. Install structural blocking and bridging as necessary and as described in Contract Documents.
   3. Special Requirements:
      a. Roof And Ceiling Joists: Lap joists 4 inches (100 mm) minimum and secure with code approved framing anchors.

F. Accessory / Equipment Mounting And Gypsum Board Back Blocking (nailers) for Wood Framing):
   1. Furnish and install blocking in wood framing required for hardware, specialties, equipment, accessories, and mechanical and electrical items, etc.
   2. Furnish and install back blocking in wood framing required for joints in gypsum wallboard.
      a. Install back blocking between I-joist framing members with equivalent of Simpson Z2 clips attached with four 10d x 1-1/2 inches (38 mm) nails at each end, two into ‘I’ joist and two into blocking.
      b. Attach back blocking at trusses, stick framing, or walls with two 10d nails in each end of each piece of blocking.

G. Furring Strips:
   1. On Wood or Steel: Nail or screw as required to secure firmly.
      a. Ceiling:
         1) Attach furring strips to the underside of structural elements with #8 wood screws, of length to penetrate wood framing 1 inch (25 mm) minimum.
   2. On Concrete or Masonry:
      a. Back up furring strips on walls in contact with earth with 15 lb (6.8 kg) felt strip.
      b. Nail at 12 inches (300 mm) on center maximum.

END OF SECTION

SECTION 06 2001

COMMON FINISH CARPENTRY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants required for items installed under this Section, as described in Contract Documents.

B. Products Installed But Not Furnished Under This Section:
   1. Selected Building Specialties.
   2. Miscellaneous as specified elsewhere.

C. Related Requirements:
   1. Section 07 9213: 'Elastomeric Joint Sealants' for quality of sealants, submittal and installation requirements.
   2. Sections in Division 10: Furnishing of Specialties.

1.2 REFERENCES

A. Association Publications:
   1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA www.awinet.org.
      a. Architectural Woodwork Standards (AWS), 1st Edition, 2009'.

B. Definitions:
   1. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade:
      a. Economy Grade: The lowest acceptable grade in both material and workmanship requirements, and is for work where price outweighs quality considerations.
      b. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.
      c. Premium Grade: The highest Grade available in both material and workmanship where the highest level of quality, materials, workmanship, and installation is required.

C. Reference Standards:
   1. ASTM International:
      a. ASTM C578-11b, 'Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Blum Inc, Stanley, NC www.blum.com.
      b. Bommer Industries, Landrum, SC www.bommer.com.
      c. Dow Chemical, Midland, MI www.dow.com.
      d. Hafele America Co., Archdale, NC hafele.com.

e. Ives, Indianapolis, IN www.iveshardware.com.
f. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com
g. SOSS Door Hardware (Division of Universal Industrial Products Company) Pioneer OH www.soss.com.
h. Stanley, New Britain, CT www.stanleyhardware.com
i. TWP Inc., Berkley, CA www.twpinc.com.

B. Glue: Waterproof and of best quality.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Verify walls, ceilings, floors, and openings are plumb, straight, in-line, and square before installing Architectural Woodwork.
2. Report conditions that are not in compliance to Architect before starting installation.

3.2 PREPARATION

A. Surface Preparation:
1. Install Architectural Woodwork after wall and ceiling painting is completed in areas where Architectural Woodwork is to be installed.

B. Items Installed But Not Furnished Under This Section: Install in accordance with requirements specified in Section furnishing item.

3.3 INSTALLATION

A. Special Techniques:
1. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for installation of architectural woodwork.

B. General Architectural Woodwork Installation:
1. Fabricate work in accordance with measurements taken on Project site.
2. Scribe, miter, and join accurately and neatly to conform to details.
3. Exposed surfaces shall be machine sanded, ready for finishing.
4. Allow for free movement of panels.
5. Countersink nails. Countersink screws and plug those exposed to view.

END OF SECTION

SECTION 06 2024

DOOR, FRAME, AND FINISH HARDWARE INSTALLATION

PART 1 - GENERAL

1.1 SUMMARY

A. Products Installed But Not Furnished Under This Section:
   1. Flush wood doors.
   2. Door frames.
   3. Finish hardware.

B. Related Requirements:
   1. Sections under 08 1000 heading: Furnishing of metal frames.
   2. Sections under 08 7000 heading: Furnishing of finish hardware.

1.2 REFERENCES

A. Association Publications:
   1. Door and Hardware Institute (DHI) 14150 Newbrook Drive, Suite 200 Chantilly, VA www.dhi.org, *Installation Guide for Doors & Hardware' by Door & Hardware Institute*.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
   1. Metal Frames:
      a. Protect metal frames from damage before and during installation.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames:
   1. Site Tolerances:
      a. Squareness: 1/16 inch (1.6 mm) from top edge to opposite top edge.
      b. Plumbness: 1/16 inch (1.6 mm) from top of jamb to bottom of jamb.
      c. Alignment: 1/16 inch (1.6 mm) from plane of left side face of jamb to right side face of jamb.
      d. Twist: 1/16 inch (1.6 mm) across throat of jamb plane measured across each face to plane of opposite jamb throat.
      e. Finished Clearance Between Door And Frame:
         1) 1/16 inch (1.6 mm) at head and hinge jamb plus 1/16 inch (1.6 mm) maximum
         2) 1/8 inch (3 mm) at strike jamb plus or minus 1/16 inch (1.6 mm) maximum.
         3) 1/2 inch (12.7 mm) to top of finished floor surface or 1/4 inch (6 mm) to top of threshold, plus or minus 1/16 inch (1.6 mm) maximum.

B. Doors:
   1. When Project is completed, doors shall not bind, stick, or be mounted so as to cause future hardware difficulties.
   2. Do not impair utility or structural strength of door in fitting of door, applying hardware, or cutting and altering door louvers, panels, or other special details.

C. Hardware:
   1. General:
      a. Install using set of Manufacturer's installation, adjustment, and maintenance instructions submitted with hardware under Section 08 7101. Follow as closely as possible.
      b. Mount closers on jamb stop side of door in parallel arm configuration where it is physically possible to do so and not damage or hinder operation of door or closer.
   2. Hardware for Wood Doors:
      a. If doors are not factory-machined, use hardware templates furnished by Hardware Manufacturer when mounting hardware.
      b. Set hinges flush with edge surface. Be sure that hinges are set in a straight line to prevent distortion.
      c. Mount door latches high in strike plate opening so when door later settles, latch will not bind.

3.2 FIELD QUALITY CONTROL

A. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to the Owner.
   2. Door frames:
      a. Door frames damaged by use of crowbar or other prying devices to set door frames shall be repaired or replaced at no additional cost to Owner.

END OF SECTION

SECTION 06 2710

SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install adjustable shelving not part of casework, including mounting hardware, as described in Contract Documents.

B. Related Requirements:
   1. Section 06 4001: 'Common Architectural Woodwork Requirements'.

1.2 REFERENCES

A. Association Publications:
   1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA www.awinet.org.
      a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Shelves:
   1. Design Criteria:
      a. Conform to applicable requirements of Sections 06 4001.
      b. Fabricate the work of this section to AWS 'Custom Grade'.
      c. Species as acceptable for AWS 'Custom Grade'.
   2. Material:
      a. Panel Product:
         1) Glues (adhesives) used in manufacture and fabrication of panel products shall be Type I or II.
         2) Moisture content shall be same as specified for lumber.
         3) Cores:
            a) All Other: Industrial grade particle board with minimum density of 45 lbs per cu ft (721 kg per cu meter).
         4) Facings:
            a) All facings shall be Melamine or Kortron.
         5) Thickness:
            a) 30 Inch (750 mm) Span And Less: 3/4 inch (19 mm) thick.
            b) Spans Over 30 Inches (750 mm) To 42 Inches (1 050 mm): One inch (25 mm) thick.
            c) Spans Over 42 inches (1 050 mm): One inch (25 mm) thick and provide equal center supports.
      b. Edgings:
         1) Use 3/4 inch (19 mm) Kortron or Melamine faced Panel Product with hot glued 3 mm thick PVC with eased edges. Apply banding on all four edges of adjustable shelving and on exposed edges of fixed shelving, with one-inch return onto unexposed edges. Edge banding color to match Panel Product.

B. Shelf Supports In Storage Room: 1x4 solid stock Pine, C or better, S4S.

2.2 ACCESSORIES

A. Manufacturer:
   1. Manufacturer Contact Information:
      a. Knape & Vogt, Grand Rapids, MI www.knapeandvogt.com

B. Shelf Brackets And Standards In Main Building:
   1. Brackets:
      a. Size according to shelf width, end of bracket to be within 2 inches (50 mm) of front edge of shelf.
      b. Approved Product. See Section 01 6200.
         1) 187WH extra heavy duty brackets by Knape & Vogt.
   2. Standards:
      a. Approved Product. See Section 01 6200.
         1) 87WH extra heavy duty standard by Knape & Vogt.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Attach metal standards by screws into framing members or special blocking. Utilize all available pre-drilled screw holes in standards.

B. Attach wood shelf supports with 16d finish nails through sheathing into framing members or special blocking, two nails minimum into each framing member. Attach shelves to supports with 1-1/2 inch (38 mm) long minimum flathead screws with heads countersunk to be flush or slightly below shelf surface, one screw at each shelf corner minimum.

END OF SECTION

SECTION 06 4001

COMMON ARCHITECTURAL WOODWORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. General standards for materials and fabrication of Architectural Woodwork and for hardware associated with Architectural Woodwork.

B. Related Requirements:
   1. Section 06 1100: 'Wood Framing' for furring and blocking.
   2. Section 06 2001: 'Common Finish Carpentry Requirements' for Installation.
   3. Section 06 4005: 'Plastic Laminate'.

1.2 REFERENCES

A. Association Publications:
   1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA www.awinet.org.
      a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.

B. Definitions:
   1. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade:
      a. Custom Grade: Typically specified for and adequately covers most high-quality architectural woodwork, providing a well-defined degree of control over a project's quality of materials, workmanship, or installation.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature for specialty items and hardware not manufactured by Architectural Woodwork fabricator.
   2. Shop Drawings:
      a. Approved Fabricator:
         1) Fabricator Submittal:
            a) Provide 1/4 inch (or larger) scale building layout and/or description of required room walls required for field dimension for Field Quality Control Submittal. Provide submittal before rough framing is completed.
            b) Provide shop drawings for cabinet and casework that are included for project showing details, casework locations and layout and required dimensions based on Field Quality Control Submittals for compliance to Contract Drawings for approval to Project Architect.

1.4 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
   1. Fabricator:
      a. Fabricator Firm specializing in performing work of this section.

1) Firm experience in supplying products indicated for this Project.
2) Firm with sufficient production capacity to produce required units.
3) Firm will comply with specifications and Contract Documents for this Project.
4) Minimum five (5) years experience in Woodwork installations.
5) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and installation procedures required for this project before bidding.

b. Upon request by Architect or Owner, submit documentation.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Delivery And Acceptance Requirements:
1. Assemble architectural woodwork at Architectural Woodwork Fabricator's plant and deliver ready for erection insofar as possible.
2. Protect architectural woodwork from moisture and damage while in transit to job site.
3. Report damaged materials received within two (2) days from delivery at project site.

B. Storage And Handling Requirements:
1. Unload and store in place where it will be protected from moisture and damage and convenient to use.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Design Criteria:
1. General:
a. AWS Custom Grade is minimum acceptable standard, except where explicitly specified otherwise, for materials, construction, and installation of architectural woodwork.
2. Materials:
a. Lumber:
1) Grade:
a) No defects in boards smaller than 600 sq in (3 871 sq cm).
b) One defect per additional 150 sq inches (968 sq cm) in larger boards.
c) Select pieces for uniformity of grain and color on exposed faces and edges.
d) No mineral grains accepted.
2) Allowable Defects:
a) Tight knots not exceeding 1/8 inch (3 mm) in diameter. No loose knots permitted.
b) Patches (dutchmen) not apparent after finishing when viewed beyond 18 inches (450 mm).
c) Checks or splits not exceeding 1/32 inch by 3 inches (1 mm by 75 mm) and not visible after finishing when viewed beyond 18 inches (450 mm).
d) Stains, pitch pockets, streaks, worm holes, and other defects not mentioned are not permitted.
e) Normal grain variations, such as cats eye, bird's eye, burl, curl, and cross grain are not considered defects.
3) Use maximum lengths possible, but not required to exceed 10 feet (3 meters) without joints. No joints shall occur closer than 72 inches (1 800 mm) in straight runs exceeding 18 feet (3 600 mm). Runs between 18 feet (3 600 mm) and 10 feet (3 meters) may have no more than one joint. No joints shall occur within 72 inches (1 800 mm) of outside corners nor within 18 inches (450 mm) of inside corners.
4) Moisture content shall be six (6) percent maximum at fabrication. No opening of joints due to shrinkage is acceptable.

B. Fabrication:
   1. Follow Architectural Woodwork Standards (AWS) for fabrication of Architectural Woodwork.
   2. Tolerances:
      a. No planer marks (KCPI) allowed. Sand wood members and surfaces with 100 grit or finer.
      b. Maximum Gap: None allowed.
      c. Flushness Variation: 0.015 inch (0.4 mm) maximum.
      d. Sanding Cross Scratches: 1/4 inch (6 mm) maximum.
      e. Plug screw holes. Screw locations not to be visible beyond 18 inches (450 mm).
   3. Fabricate work in accordance with measurements taken on job site.
   4. 'Ease' sharp corners and edges of exposed members to promote finishing and protect users from slivers. Radius of 'easing' shall be uniform throughout Project and between 1/32 and 1/16 of an inch (0.8 and 1.6 of a millimeter).
   5. Fabricate so veneer grain is vertical.
   6. Joints:
      a. Use lumber pieces with similar grain pattern when joining end to end.
      b. Compatibility of grain and color from lumber to panel products is required.
   7. Install hardware in accordance with Manufacturer's directions. Leave operating hardware operating smoothly and quietly.
   8. Remove or repair damaged surface of or defects in exposed finished surfaces of architectural woodwork to match adjacent similar undamaged surface.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 06 4005

PLASTIC LAMINATE

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Wall-hung counters.
   2. Countertops for custom casework.
   3. Cabinet Facing

B. Related Requirements:
   1. Section 06 2001: 'Common Finish Carpentry Requirements':
      a. Installation of wall-hung counters.
      b. Installation of countertops for custom casework.
   2. Section 06 4001: 'Common Architectural Woodwork Requirements':
   3. Section 06 4116: Plastic Laminate Faced Architectural Cabinets
   4. Sections Under 22 4200 Heading: Plumbing Fixtures.

1.2 REFERENCES

A. Association Publications:
   1. Architectural Woodwork Institute / Architectural Woodwork Manufacturers Association of Canada / Woodwork Institute, 46179 Westlake Drive, Suite 120, Potomac Falls, VA www.awinet.org.
      a. Architectural Woodwork Standards (AWS), 2nd Edition, 2014.

B. Definitions:
   1. Flame Spread: The propagation of flame over a surface.
      a. Flame Spread Index: The numerical value assigned to a material tested in accordance with ASTM E84 or UL 723.
   2. Grade: Unless otherwise noted, this term means Grade rules for Economy, Custom, and/or Premium Grade.
      a. Premium Grade: Highest Grade available in both material and workmanship where highest level of quality, materials, workmanship, and installation is required.
   3. High-Pressure Decorative Laminate (HPDL): Laminated thermosetting decorative sheets intended for decorative purposes. Also known as Plastic Laminate.
   4. Smoke-Developed Index: The numerical value assigned to a material tested in accordance with ASTM E84 or UL 723.

C. Reference Standards:
   1. ASTM International:
      a. ASTM E84-18, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
      b. ASTM E162-15a, 'Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source'.
   2. Kitchen Cabinet Manufacturers Association:
      a. ASTM/KCMA A161.1-2012, 'Performance And Construction Standards For Kitchen And Vanity Cabinets'.
   3. National Electrical Manufacturer's Association / American National Standards Institute:
      a. ANSI/NEMA LD-3-2005, 'High Pressure Decorative Laminates'.
   4. Underwriters Laboratories, Inc.:
      a. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (10th Edition).

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Color selections.
      b. Manufacturer's technical data sheet.

B. Informational Submittals:
   1. Certificates:
      a. Provide Manufacturer's certification of compliance to ANSI/NEMA LD 3.
   2. Test And Evaluation Reports:
      a. Test reports: Certified test reports showing compliance with specified performance characteristics and physical properties for Quality Assurance if requested by Owner or Architect.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer's literature for plastic laminate.
            b) Color selections.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Fire-Test-Response Characteristics: Provide plastic laminate with surface burning characteristics as determined by testing identical products by qualified testing agency.
      a. Surface-Burning Characteristics:
         1) Plastic Laminate shall have Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
            a) Class A (Flame spread index 0-25; Smoke-developed index 0-450).
            b) Flash point: None.

1.5 WARRANTY

A. Manufacturer Extended Warranty:
   1. Approved Fabricator’s written guarantee that all Goods and Services will be free from defects in materials and workmanship for a period of five (5) years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Formica, Cincinnati, OH www.formica.com
      b. Nevamar, Odenton, MD www.nevamar.com.
      c. Pionite Decorative Surfaces, Auburn, ME www.pionite.com.
      d. WilsonArt, Temple, TX www.wilsonart.com
      e. Equal as approved by Architect before bidding. See Section 01 6200.

B. Plastic Laminates:
   1. Design Criteria:.
      a. Vertical Applications: GP 28.

b. Balancing Material: BK 20.
c. AWS Quality Grade: Premium.

2. Assemblies:
   a. Cabinet face shall meet requirements of KCMA A161.1.
   b. Adhesives for other than post-formed types shall be spray grade, high heat resistant, neoprene contact adhesive.
3. Color: Nevamar – Valencia Teak Polished Velvet WT0003PV

PART 3 - EXECUTION: Not Used

END OF SECTION

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SECTION 06 4116

PLASTIC LAMINATE FACED ARCHITECTURAL CABINETS

PART 1 GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section
   1. Custom casework

B. Related Sections
   1. Section 062001 - Installation
   2. Section 06 4005 - Plastic Laminate
   3. Section 12 3661 - Quart Countertop
   43. Plumbing Fixtures.

1.2 SUBMITTALS

A. Shop Drawings
   1. Fabricator to submit complete details of construction and elevations of all cabinets and countertops.

1.3 QUALITY ASSURANCE

A. Construction Details, Fastening, Tolerances and Workmanship
   1. Architectural Woodwork Institute (AWI) Premium Grade Standards, with exceptions indicated.

1.4 DESCRIPTION

A. General
   1. Furnish all labor, materials, tools, equipment, and services for all architectural cabinetwork as indicated, in accordance with provisions of the contract documents.
   2. Although such work is not specifically indicted, furnish and install all supplementary or miscellaneous appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

B. Work Included
   1. All plastic laminate cabinets and hardware.

C. Definitions
   1. Exposed surfaces: All surfaces visible when drawers and doors are closed.
      a. Exposed ends.
      b. VCounter tops, vertical surfaces and their exposed edges.
      c. Face frames.
      d. Toe strip.
   2. Concealed surfaces: Surfaces not visible after installation.
      a. Web frames.
      b. Dust panels.
   3. Semi-exposed surfaces: All other surfaces not exposed or concealed.

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PART 2 PRODUCTS

2.1 GENERAL

A. Cabinetwork
1. Custom, shop or factory-build casework, complete with all hardware, accessories, countertops and bases, in sizes and configurations indicated.
2. Style: Flush overlay, with square corner doors and drawer fronts overlapping case front with minimum reveal.

2.2 MATERIALS

A. Acceptable Manufacturers
1. Plastic Laminate
   a. Base: Formica Corp.; Ralph Wilson Plastics Co. (WilsonArt); Pionite
2. Plastic Overlay Panel Products
   a. Base: Simpson Timber Co.; Sel-Ply Div./Medford Corp.
3. Cabinet Hardware
   a. Base: National Lock Co.; Knape & Vogt; Grant; Epco; Webber Knapp; Stylemark; Ives; and Stanley

B. Plastic Laminate
1. NEMA LD3-1975 High Pressure Laminate, Smooth Finish
2. Countertops and their edges: Grade GP50, 0.050 inch (1.3 mm) thick.
3. All other exposed surfaces: Grade GP28, 0.028 inch (9.7 mm) thick.
4. Provide backer sheet on each plastic laminated item.
   a. Semi-exposed backer sheet: Grade C120, 0.020 inch (1.5 mm) thick; color to match plastic overlay.
   b. Concealed backer sheet: Grade BK20, 020 inch (0.5 mm) thick.
5. Color: Nevamar – Valencia Teak Polished Velvet WT0003PV

Color shall be as indicated on Sheet F-101 on Finishes Plan.

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C. Particle Board
1. ANSI A208.1, Mat Formed, 45 PCF density
2. Type 1-M-3 for general use.

D. Fiber Board
1. ANSI A208.2, Medium Density Wood Fiber Board, 48 PCF Density, Minimum

E. Hardboard
1. CS251, Tempered, Smooth on Both Sides

F. Plywood
1. PSI-74, Softwood Plywood, AA Grade

G. Countertop Core

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1. Veneer Core, Spruce Faced Plywood or Particle Board

2.4 FABRICATION

A. Case Body - All Joints Glued
   1. Top and bottom (and fixed horizontals): Lock-jointed, dadoed or rabbeted into ends/dividers and screwed or doweled at approximately 2.5 inches (60 mm) on center.
   2. Back: Dadoed or rabbeted into top, sides and bottom.
   3. Fixed small compartment dividers: Dadoed.

B. Fasteners
   1. Use no blocking or fasteners in exposed or semi-exposed locations.

2.5 CASE CONFIGURATION

A. Flush all sides, top and bottom of doors and drawer fronts, and between door and drawer fronts in the same unit.

B. Double door units: No vertical rail of divider between doors. A vertical dividing panel will be located behind the doors in order to secure the locks.

C. Toe space: Four inch high by approximately three inches deep. Provide on front of each base unit (INS side).

PART 3 EXECUTION - Not Used

END OF SECTION

SECTION 06 6413

PLASTIC PANELING (FRP)

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install plastic sanitary wall paneling at mop sink as described in Contract Documents.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. Glasteel, Moscow, TN www.glasteel.com.
      b. Kemlite, Channahon, IL www.cranecomposites.com.
      c. Marlite FRP Products, Dover, OH www.marlitefrp.com.
      d. Nudo Products Inc, Springfield, IL www.nudo.com.

B. Materials:
   1. FRP Sanitary Wall Panels:
      a. 0.090 inch thick, white, with embossed surface.
      b. Color Quality Standard: No. 659 White by Glasteel.
      c. Quality Standard: Glasliner by Glasteel.

2.2 ACCESSORIES

A. Use Panel Manufacturer’s standard vinyl moldings at joints, edges, and corners.

PART 3 - EXECUTION: Not Used

END OF SECTION

DIVISION 07: THERMAL AND MOISTURE PROTECTION

END OF TABLE OF CONTENTS

SECTION 07 2116

BLANKET INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install insulation.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM C665-12, 'Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing'.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Insulation shall be manufactured to be in compliance with California Building Code (CBC) or other applicable building codes.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Insulation:
      a. Acceptable Manufacturers:
         1) Certainteed Corp, Valley Forge, PA www.certainteed.com.
         2) Guardian Fiberglass, Greer, SC www.guardianbp.com.
         3) Johns Manville, Denver, CO www.jm.com.
         4) Knauf Fiber Glass, Shelbyville, IN www.knaufusa.com.
         5) Owens-Corning Fiberglass Corporation, Toledo, OH www.owens-corning.com.
      b. Equal as approved by Architect before bidding.

B. Materials:
   1. Thermal And Acoustic Insulation:
      a. Order insulation by 'R' value rather than 'U' value, rating, or thickness, either 16 or 24 inches (400 or 600 mm) wide according to framing spacing.
      b. Unfaced Insulation: Meet requirements of ASTM C665, Type I.
         1) Support at trussed rafters:
            a) Provide support at trussed rafters where insulation is not enclosed by structure or drywall.
            b) Provide stings/wires which run perpendicular to framing and attach at each trussed rafter and to framing at 32 inches (800 mm) O.C. minimum and where batt ends adjoin each other.

            or

c) Quality Standard: Simpson Strong Tie IS Insulation Supports with 14 gauge (1.89 mm) carbon steel, spring wire and mitered tips for 16 inch (400 mm) O.C. and 24 inch (610 mm) O.C. spacing.

c. 'R' Value Required:
   1) Acoustically Insulated Ceilings:
      a) Enclosed Spaces: Fill framed cavity with batt of appropriate thickness.
      b) Unenclosed Spaces: R-19.
      c) Unenclosed Spaces above Ceilings: R-30.
   2) Thermally Insulated Ceilings / Roof:
      a) R-38 Standard: All Other. (R-49 in Climate Zones 6, 7, and 8).

d. 'R' Factor Required:
   1) Wood Wall Stud Framing:

R11	3-1/2 inches deep	89 mm deep
R19	5-1/2 inches deep	140 mm deep

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Leave no gaps in insulation envelope.

B. In Framing:
   1. Install insulation behind wiring, around duct and vent line penetrations, and in similar places.
   2. Fit ends of batts snug against top and bottom plates.
   3. Fit batts snug against stud framing at each side.
   4. Where insulation is not enclosed by structure or drywall, support in place with wire or other suitable material.

C. Attic Baffles:
   1. Install in accordance with manufacturer's instructions.
   2. instructions.
   3. Install baffles between trusses or rafters and underside of roof sheathing.
   4. Install baffles to prevent insulation from blocking ventilation airflow from soffit

END OF SECTION

SECTION 07 8400

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install firestopping not involving penetrations.
   2. Quality of firestopping materials and systems used for penetrations on Project, including submittal requirements.

B. Related Requirements:
   1. Furnishing and installing of penetration firestopping specified under Section installing work penetrating structure.

1.2 REFERENCES

A. Reference Standards:
   1. American Society For Testing And Materials:
      a. ASTM E84-18b, ‘Standard Test Method for Surface Burning Characteristics of Building Materials'.
      b. ASTM E119-18c, ‘Standard Test Methods for Fire Tests of Building Construction and Materials’.
      c. ASTM E814-13a(2017), ‘Standard Test Method for Fire Tests of Penetration Firestop Systems'.
      d. ASTM E1996-17, ‘Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes’.
   2. California Building Code (CBC) (2016 or latest approved edition):
      a. Chapter 7, 'Fire And Smoke Protection Features':
         1) Section 703, "Fire-Resistance Ratings And Fire Tests':
   3. Underwriters Laboratories:
      a. UL 'Fire Resistance Directory', current edition, contains listing of approved Penetration Firestop Systems:
         1) Through-penetration firestop devices.
         2) Fire resistance ratings.
         3) Through-penetrations firestop systems.
         4) Fill, void, or cavity material.
      b. UL 263, 'Fire Tests of Building Construction and Materials' (14th Edition).
      c. UL 723: ‘Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (11th edition - 2018).
      d. UL 1479, 'Standard for Safety for Fire Tests of Through-Penetration Firestops' (4th Edition).
      e. UL 2079, 'Tests for Fire Resistance of Building Joint Systems' (5th Edition).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate construction of openings and penetrating items to ensure that firestopping assemblies are installed in compliance with specific requirements.
   2. Coordinate sizes of sleeves, openings, core drilled holes, or cut openings to accommodate through-penetration firestop systems.

B. Sequencing:
   1. Perform work of this section in proper sequence to prevent damage to firestop system and to ensure installation will occur prior to enclosing or concealing work. Firestopping shall precede finishing of gypsum board.
      a. Do not conceal firestopping installations until inspection agency or authorities having jurisdiction, as required, have examined each installation.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Show each type of Penetration Firestop System to be used on Project with design approval reference number.
      b. Identify locations where each type of Penetration Firestop System is to be installed.

B. Informational Submittals:
   1. Qualification Statement:
      a. Manufacturer/Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Conform to applicable building codes for fire resistance ratings.
   2. Comply with installation requirements and protocol outlined in Firestop Contractors International Association 'FICIA 'Manual of Practice' handbook.
   3. Each Penetration Firestop System shall be UL/ULC listed for that type of penetration occurring on Project.
   4. Ratings shall be in accordance with ASTM E814, UL 1479, or IBC Section 703, "Fire-Resistance Ratings And Fire Tests' as acceptable to local code authority.
      a. Provide Firestop Systems with F Ratings not less than Fire-Resistance Rating of Constructions penetrated.
      b. Provide Firestop Systems with T and F Ratings, as determined per ASTM E814.
      c. Provide Joint Sealants with Fire-Resistance Ratings as determined per ASTM E119.
      d. Provide Products with Flame-Spread values of less than 25 and smoke developed values of less than 450, as determined per ASTM E84.
      e. Surface burning characteristics (per ASTM E84): 25 or less. Tested in accordance with UL 1479 or ASTM E814.

B. Qualifications:
   1. Manufacturer Qualifications:
      a. Company that specializes in manufacturing the type of products specified, with minimum of five (5) years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver firestopping materials to Project Site in original, new unopened containers or packages bearing manufacturer’s printed labels.

B. Storage And Handling Requirements:
   1. Store and handle firestopping materials in compliance with manufacturers written instructions.
   2. Protect materials from freezing or overheating and to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes.
   3. Store materials off floor at temperatures between 40 deg F (4.4 deg C) and 90 deg F (32.2 deg C)

1.7 FIELD CONDITIONS

A. Ambient Conditions:
   1. Temperature: Do not install firestopping materials when ambient or substrate temperatures are outside limits permitted by manufacturer of firestopping materials.
   2. Humidity and Moisture: Do not install the Work of this Section under conditions that are detrimental to the application, curing, and performance of the materials.
   3. Ventilation: Provide sufficient ventilation wherever firestopping materials are installed in enclosed spaces. Follow manufacturer's recommendations.

1.8 WARRANTY

A. Manufacturer Warranty:
   1. Firestop materials shall be free from cracking, checking, dusting, flaking, spalling, separation, and blistering for period of 10 years from Date of Substantial Completion. Reinstall or repair such defect or failures at no cost to Owner.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Members of International Firestop Council www.firestop.org and member in good standing.
      b. Equal as approved by Architect before installation. See Section 01 6200.

B. Materials:
   1. General:
      a. Sealant, packing material, or collar system required by Firestop Manufacturer for Firestop Penetration System to comply with listed design.
      b. Primers, sleeves, forms, insulation, packing, stuffing, and accessories: Type required for tested assembly design.
   2. Firestopping Assembly Requirements:
      a. Head-of-Wall Firestopping at Joints Between Non-Rated Floor and Fire-Rated Wall: Use any system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
      b. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
      c. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   3. Firestopping System:
      a. Any material meeting requirements.
   4. Firestop Tracks (Metal Stud Framing):
      a. Metal Stud Manufacturer's top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly by factory applied cured intumescent fire stop material affixed to steel profile; in thickness, not less than indicated for studs and in width to accommodate depth of studs.
         1) Acceptable Products:
            a) BlazeFrame Deflection Track by ClarkDietrich Buiding Systems.
            b) Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
   3. Verify ducts, piping, equipment, and other similar items that would interfere with application of firestopping shall be in place.
   4. Do not commence Work until unsatisfactory conditions have been corrected.
      a. Commencement of installation constitutes acceptance of conditions and responsibility for satisfactory performance.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
   2. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work. Remove tape as soon as it is possible to do so without disturbing firestopping seal with substrates.

B. Surface Preparation:
   1. Clean out openings, control, and expansion joints immediately before installation of through-penetration firestopping. Comply with recommendations of firestopping manufacturer and the following requirements:
      a. Remove foreign materials from surfaces of openings and joint substrates, and from penetrating items that could interfere with adhesion of firestopping.
      b. Clean opening and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
      c. Remove laitance and form release agents from concrete.
      d. Do not apply firestopping materials to surfaces which have been previously painted or treated with sealer, curing compound, water repellent, or other similar coating, unless application has been accepted by manufacturer of firestopping products.
      e. Install damming materials, as recommended by sealant manufacturer, to hold sealant in place.
   2. Priming:
      a. Prime substrates where recommended by firestopping manufacturer using manufacturer's recommended products and methods.
      b. Confine primers to areas of bond. Do not allow spillage and migration onto exposed surfaces.
      c. Apply prime coat in compliance with manufacturer’s instructions.

3.3 INSTALLATION

A. General:
   1. Install firestopping in accordance with Manufacturer’s instructions for installation of firestopping products.
   2. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
   3. Do not cover installed firestopping until inspected by authority having jurisdiction.

3.4 PROTECTION

A. Protect surfaces adjacent to through-penetration firestops with suitable covering to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or that would be caused by cleaning methods used to remove smears from firestopping materials.

B. Protect firestopping during and after curing period from contact with contaminating substances, or damage resulting from adjacent Work.

3.5 CLEANING

A. Clean off excess fill materials and sealants adjacent to penetrations by methods and cleaning materials recommended by manufacturers of firestopping products and of products in which penetrations occur.

END OF SECTION

SECTION 07 9213

ELASTOMERIC JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install sealants not specified to be furnished and installed under other Sections.
   2. Quality of sealants to be used on Project not specified elsewhere, including submittal, material, and installation requirements.

B. Related Requirements:
   1. Furnishing and installing of sealants is specified in Sections specifying work to receive new sealants.

1.2 REFERENCES

A. Definitions:
   1. Sealant Types and Classifications:
      a. ASTM Specifications:
         1) Type:
            a) Type S: Single-component sealant.
            b) Type M: Multi-component sealant.
         2) Grade:
            a) Grade P: Pourable or self-leveling sealant used for horizontal traffic joints.
            b) Grade NS: Non-sag or gunnable sealant used for vertical and non-traffic joints.
         3) Classes: Represent movement capability in percent of joint width.
            a) Class 100/50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand of at least 100 percent increase and decrease of at least 50 percent of joint width as measured at time of application.
            b) Class 50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 50 percent of joint width as measured at time of application.
            c) Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
            d) Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
         4) Use:
            a) T (Traffic): Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
            b) NT (Non-Traffic): Sealant designed for use in joints in non-traffic areas.
            c) I (Immersion): Sealant that meets bond requirements when tested by immersion (Immersion rated sealant applications require primer).
            d) M (Mortar): Sealant that meets bond requirements when tested on mortar specimens.
            e) G (Glass): Sealant that meets bond requirements when tested on glass specimens.
            f) A (Aluminum): Sealant that meets bond requirements when tested on aluminum specimens.
            g) O (Other): Sealant that meets bond requirements when tested on substrates other than standard substrates, being glass, aluminum, mortar.
   2. Silicone: Any member of family of polymeric products whose molecular backbone is made up of alternating silicon and oxygen atoms and which has pendant hydrocarbon groups attached to

silicon atoms. Used primarily as a sealant. Offers excellent resistance to water and large variations in temperature (minus 100 deg F to + 600 deg F) (minus 73.3 deg C to + 316 deg C).

B. Reference Standards:
   1. ASTM International:
      a. ASTM C920-14a, 'Standard Specification for Elastomeric Joint Sealants'.
      b. ASTM C1193-16, 'Standard Guide for Use of Joint Sealants'.
      c. ASTM C1330-18, 'Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants'.
      d. ASTM C1481-12(2017) 'Standard Guide for Use of Joint Sealants with Exterior Insulation & Finish Systems (EIFS)'.
      e. ASTM D5893/D5893M-16, 'Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Scheduling:
   1. Schedule work so waterproofing, water repellents and preservative finishes are installed after sealants, unless sealant manufacturer approves otherwise in writing.
   2. Ensure sealants are cured before covering with other materials.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
      b. Manufacturer's literature for each Product.
      c. Schedule showing joints requiring sealants. Show also backing and primer to be used.

B. Informational Submittals:
   1. Certificates:
      a. Manufacturer's Certificate:
         1) Certify products are suitable for intended use and products meet or exceed specified requirements.
         2) Certificate from Manufacturer indicating date of manufacture.
   2. Manufacturers' Instructions:
      a. Manufacturer's installation recommendations for each Product.
      b. Manufacturer's installation for completing sealant intersections when different materials are joined.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum ten (10) years documented experience.
   2. Applicator Qualifications:
      a. Company specializing in performing work of this section.
      b. Provide if requested, reference of projects with minimum three (3) years documented experience, minimum three (3) successfully completed projects of similar scope and complexity and approved by manufacturer.
      c. Designate one (1) individual as project foreman who shall be on site at all times during installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Deliver and keep in original containers until ready for use.
   2. Inspect for damage or deteriorated materials.

B. Storage and Handling Requirements:
   1. Handle, store, and apply materials in compliance with applicable regulations and material safety data sheets (MSDS).
   2. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
   3. Store in a cool dry location, but never under 40 deg F (4 deg C) or subjected to sustained temperatures exceeding 90 deg F (32 deg C) or as per Manufacturer's written recommendations.
   4. Do not use sealants that have exceeded shelf life of product.

1.7 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not install sealant during inclement weather or when such conditions are expected. Allow wet surfaces to dry.
   2. Follow Manufacturer’s temperature recommendations for installing sealants.

1.8 WARRANTY

A. Manufacturer Warranty:
   1. Signed warranties against adhesive and cohesive failure of sealant and against infiltration of water and air through sealed joint for period of three (3) years from date of Substantial Completion.
      a. Manufacturer's standard warranty covering sealant materials.
      b. Applicator’s standard warranty covering workmanship.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Dow Corning Corp., Midland, MI www.dowcorning.com.
      b. Franklin International, Inc. Columbus, OH www.titebond.com.
      c. GE Sealants & Adhesives (see Momentive Performance Materials Inc.).
      d. Laticrete International Inc., Bethany, CT www.laticrete.com.
      e. Momentive Performance Materials Inc. (formally GE Sealants & Adhesives), Huntersville, NC www.ge.com/silicones.
      f. Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
      g. Sika Corporation, Lyndhurst, NJ www.sikaconstruction.com
      h. Tremco, Beachwood, OH www.tremcosealants.com

B. Materials:
   1. Design Criteria:
      a. Compliance: Meet or exceed requirements of these standards:
         1) ASTM C920: Elastomeric joint sealant performance standard.
         2) ASTM D5893/D5893M: Silicone Joint Sealant for Concrete Pavements.
      b. Comply with Manufacturer’s ambient condition requirements.
      c. Sealants must meet Manufacturer's shelf-life requirements.
      d. Sealants must adhere to and be compatible with specified substrates.
      e. Sealants shall be stable when exposed to UV, joint movements, and environment prevailing at project location.

f. Primers (Concrete, stone, masonry, and other nonporous surfaces typically do not require a primer. Aluminum and other nonporous surfaces except glass require use of a primer. Installer Option to use Adhesion Test to determine if primer is required or use primer called out in related sections):
   1) Adhesion Test:
      a) Apply silicone sealant to small area and perform adhesion test to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with Manufacturer's instructions. See 'Field Quality Control' in Part 3 of this specification for Adhesive Test.
   2) If Primer required, shall not stain and shall be compatible with substrates.
   3) Allow primer to dry before applying sealant.

2. Sealants At Exterior Building Elements:
   a. Description:
      1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
         a) Aluminum entrance perimeters and thresholds.
         b) Columns.
         c) Connections.
         d) Door frames.
         e) Joints and cracks around windows.
         f) Louvers.
         g) Wall penetrations.
         h) Other joints necessary to seal off building from outside air and moisture.
   b. Design Criteria:
      1) Meet following standards for Sealant:
         a) ASTM C920: Type S, Grade NS, Class 50 Use NT, M, G, A.
      2) Limitations:
         a) Do not use below-grade applications.
         b) Do not use on surfaces that are continuously immersed or in contact with water.
         c) Do not use on wet, damp, frozen or contaminated surfaces.
         d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.
      3) Color:
         a) Architect to select from Manufacturer's standard colors.
         b) Match building elements instead of window (do not use white that shows dirt easily).
   c. Approved Products. See Section 01 6200.
      1) Dow Corning:
         a) Primer: 1200 Prime Coat.
         b) Sealant: 791 Silicone Weatherproofing Sealant.
      2) Momentive Performance Materials (formerly, GE Sealants & Adhesives):
         a) Primer: SS4044 Primer.
         b) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.
      3) Tremco:
         a) Primer:
            (1) Metal surface: No. 20 primer.
            (2) Porous surfaces: No. 23 primer.
         b) Sealant: Spectrum 1 Silicone Sealant.

3. Sealants At Exterior Sheet Metal And Miscellaneous:
   a. Description:
      1) Weathersealing expansion, contraction, perimeter, and other movement joints which may include all or part of the following for project:
         a) Flashings.
         b) Roof vents and flues.
   b. Design Criteria:
      1) Meet following standards for Sealant:
         a) ASTM C920: Type S Grade NS, Class 25 (min) Use NT, M, G, A and O.
      2) Limitations:
         a) Do not use below-grade applications.

b) Do not use on surfaces that are continuously immersed or in contact with water.
c) Do not use on wet, damp, frozen or contaminated surfaces.
d) Do not use on building materials that bleed oils, plasticizers or solvents, green or partially vulcanized rubber gaskets or tapes.

c. Approved Products. See Section 01 6200.
1) Dow Corning: 790 Silicone Building Sealant.
2) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2350 Silicone Elastomeric Sealant.
3) Tremco: Tremsil 600 Silicone Sealant.

4. Sealants At Expansion Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Sidewalks):
a. Expansion Joints:
1) Design Criteria:
a) Meet following standards for Sealant:
(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
2) Sealant required at expansion for following areas:
a) Between entryway slabs and building foundations.
b) Between sidewalks and building foundations.
c) Miscellaneous vertical applications.
3) Sealant NOT required at expansion joints for following areas:
a) Within aprons and where aprons abut building foundations and sidewalks.
b) Within mowstrips and where mowstrips abut building foundations and sidewalks.
c) Within sidewalks.
4) Approved Products. See Section 01 6200.
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 790 Silicone Building Sealant.
b) Sika:
(1) Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

b. Penetrations thru Concrete Walls:
1) Design Criteria:
a) Meet following standards for Sealant:
(1) ASTM C920: Type S, Grade NS, Class 100/50 Use T, NT, M, G, A, and O.
2) Approved Products. See Section 01 6200.
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 790 Silicone Building Sealant.
b) Sika:
(1) Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 NS Non-Sag Silicone Sealant.

5. Sealants At Control Joints in Exterior Concrete (Aprons, Entryway Slabs, Mowstrips, Sidewalks):
a. Control Joints:
1) Design Criteria:
a) Meet following standards for Sealant:
(1) ASTM C920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
2) Sealant is NOT required at control joints, unless needed to protect moisture sensitive soils or by Contract Drawings, in following areas:
a) Within aprons.
b) Within mowstrips.
c) Within sidewalks.
d) Within entryway slabs.
3) Approved Products. See Section 01 6200.
a) Dow Corning:
(1) Primer: 1200 Prime Coat.
(2) Sealant: 890-SL Silicone Building Sealant.
b) Sika:
(1) Primer: Primer: Sikasil Primer-2100.
(2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.

6. Sealants At Exterior Concrete Waterways – Flat Drainage Structures (Waterways:
    a. Expansion Joints and Control Joints:
        1) Description:
            a) One component (part) self-leveling silicon material that cures to ultra-low modulus silicone rubber upon exposure to atmospheric moisture.
            b) Cured silicone rubber remains flexible over entire temperature range expected in pavement applications.
        2) Design Criteria:
            a) Sealant is required at following areas:
                (2) Within flat drainage structures and at joints between flat drainage structures and other concrete elements.
            b) Meet following standards for Sealant: Self-leveling: ASTM D-5893; ASTM C920, Type S, Grade P, Class 100/50; Use T, M, G, A, O.
        3) Approved Products. See Section 01 6200.
            a) Dow Corning:
                (1) Primer: 1200 Prime Coat.
                (2) Sealant: 890-SL Silicone Building Sealant.
            b) Sika:
                (1) Primer: Primer: Sikasil Primer-2100.
                (2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.
7. Sealants At Curbs And Gutters:
    a. Expansion Joints and Control Joints:
        1) Description:
            a) Effective for sealing transverse contraction and expansion joints, longitudinal, center line and shoulder joints in Portland cement concrete.
            b) One component (part) non-sag silicone material that cures to low modulus, silicone rubber upon exposure to atmospheric moisture. May be applied over wide temperature range.
        2) Design Criteria:
            a) Expansion joint sealant is required in following areas:
                (1) Within curbs and gutters at approved layout locations.
            b) Meet following standards for Sealant: Non-sag: ASTM C920: Type S, Grade NS, Class 100/50, Use T, NT.
        3) Approved Products. See Section 01 6200.
            a) Dow Corning:
                (1) Primer: 1200 Prime Coat.
                (2) Sealant: 888 Silicone Joint Sealant.
            b) Sika:
                (1) Primer: Primer: Sikasil Primer-2100.
                (2) Sikasil-728 NS Non-Sag Silicone Sealant.
8. Sealants At Concrete Paving:
    a. Expansion Joints and Control Joints (as required in Section 32 1313):
        1) Description:
            a) One component (part) self-leveling silicon material that cures to ultra-low modulus silicone rubber upon exposure to atmospheric moisture.
            b) Cured silicone rubber remains flexible over entire temperature range expected in pavement applications.
        2) Design Criteria:
            a) Sealant is required at approved layout locations.
            b) Meet following standards for Sealant: Self-leveling: ASTM C-920, Type S, Grade P, Class 100/50; Use T.
        3) Approved Products. See Section 01 6200.
            a) Dow Corning:
                (1) Primer: 1200 Prime Coat.
                (2) Sealant: 890-SL Silicone Building Sealant.
            b) Sika:
                (1) Primer: Primer: Sikasil Primer-2100.
                (2) Sealant: Sikasil-728 SL Self-leveling Silicone Sealant.
9. General Interior Sealants:

a. General:
   1) Inside jambs and heads of exterior door frames.
   2) Both sides of interior door frames.
   3) Inside perimeters of windows.
   4) Miscellaneous gaps between substrates.
b. Design Criteria:
   1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
   2) 100 percent silicone sealant.
c. Non-Paintable Sealant (Installer Option A):
   1) Approved Product. See Section 01 6200.
      a) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
      b) Laticrete: Latasil Silicone Sealant.
      c) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS2800 SilGlaze II Silicone Sealant.
      d) Sherwin Williams: White Lightning Silicone Ultra Low Odor Window and Door Sealant.
      e) Tremco: Tremsil 200 Silicone Sealant.
      f) Franklin International: Titebond 2601 (White) 2611 (Clear) 100% Silicone Sealant.
d. Paintable Sealant (Installer Option B):
   1) Approved Product. See Section 01 6200.
      a) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS7000 Paintable Silicone Sealant.

10. Sealants For Interior Joints:
    a. General:
       1) Countertops and backsplash to wall.
       2) Sinks and lavatories to countertops.
       3) Joints between plumbing fixtures and other substrates.
    b. Description:
       1) One-part acetoxy cure silicone sealant with fungicides to resist mold and mildew.
    c. Design Criteria:
       1) Meet ASTM C920, Type S, Grade NS, NT, and Class 25 test requirements.
       2) 100 percent silicone sealant.
    d. Color: As selected by Architect from Manufacturer's standard colors.
    e. Approved Products. See Section 01 6200.
       1) Dow Corning: Tub, Tile, And Ceramic Silicone Sealant.
       2) Laticrete: Latasil Tile and Stone Silicone Sealant.
       3) Momentive Performance Materials (formerly, GE Sealants & Adhesives): GE SCS1700 Sanitary Silicone Sealant.
       4) Tremco: Tremsil 200 Silicone Sealant.

2.2 ACCESSORIES

A. Bond Breaker Tape:
   1. Pressure sensitive tape as by Sealant Manufacturer to suit application.
   2. Provide tape to prevent adhesion to joint fillers or joint surfaces at back of joint and allow sealant movement.

B. Joint Backing:
   1. Comply with ASTM C1330.
   2. Flexible closed cell, non-gassing polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
   3. Oversized 25 to 50 percent larger than joint width.

C. Joint Cleaner:
   1. Non-corrosive and non-staining type as recommended by Sealant Manufacturer, compatible with joint forming materials.

D. Masking Tape:
   1. Non-staining, non-absorbent tape product compatible with joint sealants and adjacent joint surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Examine substrate surfaces and joint openings are ready to receive Work.
      a. Verify each sealant is compatible for use with joint substrates.
      b. Verify joint surfaces are clean and dry.
      c. Ensure concrete surfaces are fully cured.
   2. Sealants provided shall meet Manufacturer's shelf-life requirements.
   3. Notify Architect of unsuitable conditions in writing.
      a. Do not proceed until unsatisfactory conditions are corrected.
   4. Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Surface Preparation:
   1. Surfaces shall be clean, dry, free of dust, oil, grease, dew, frost or incompatible sealers, paints or coatings that may interfere with adhesion. Prepare substrates in accordance with Manufacturer’s instructions:
      a. Porous surfaces: Clean by mechanical methods to expose sound surface free of contamination and laitance followed by blasting with oil-free compressed air.
      b. Nonporous surfaces: Use two-cloth solvent wipe in accordance with ASTM C1193. Allow solvent to evaporate prior to sealant application.
      c. High-pressure water cleaning: Exercise care that water does not enter through failed joints.
      d. Primers:
         1) Primers enhance adhesion ability.
         2) Use of primers is not a substitution for poor joint preparation.
         3) Primers should be used always in horizontal application where there is ponding water.
   2. Field test joints in inconspicuous location.
      a. Verify joint preparation and primer required to obtain optimum adhesion of sealants to joint substrate.
      b. When test indicates sealant adhesion failure, modify joint preparation primer, or both and retest until joint passes sealant adhesion test.
   3. Masking: Apply masking tape as required to protect adjacent surfaces and to ensure straight bead line and facilitate cleaning.

B. Joints:
   1. Prepare joints in accordance with ASTM C1193.
      a. Clean joint surfaces of contaminates capable of affecting sealant bond to joint surface using Manufacturer’s recommended instructions for joint preparation methods.
      b. Remove dirt, dust, oils, wax, paints, and contamination capable of affecting primer and sealant bond.
      c. Clean concrete joint surfaces to remove curing agents and form release agents.

C. Protection:
   1. Protect elements surrounding the Work of this section from damage or disfiguration.

3.3 APPLICATION

A. General:
   1. Apply silicone sealant in accordance with Manufacturer’s instructions.

2. Do not use damaged or deteriorated materials.
3. Install primer and sealants in accordance with ASTM C1193 and Manufacturer's instructions.
4. Apply primer where required for sealant adhesion.
5. Install sealants immediately after joint preparation.
6. Do not use silicone sealant as per the following:
    a. Apply caulking/sealant at temperatures below 40 deg F (4 deg C).
    b. Below-grade applications.
    c. Brass and copper surfaces.
    d. Materials bleeding oils, plasticizers, and solvents.
    e. Structural glazing and adhesive.
    f. Surfaces to be immersed in water for prolonged time.

B. Joint Backing:
1. Install joint backing to maintain sealant joint ratios recommended by Manufacturer.
2. Install without gaps, twisting, stretching, or puncturing backing material. Use gage to ensure uniform depth to achieve correct profile, coverage, and performance.
3. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch (9.5 mm) deep.

C. Bond Breaker:
1. Install bond breaker where joint backing is not used or where backing is not feasible.
    a. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

D. Sealant:
1. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint. Apply sealants in vertical joints from bottom to top.
2. Fill joint opening to full and proper configuration.
3. Apply in continuous operation.
4. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface. Tool joints in opposite direction from application direction, i.e., in vertical joints, from the top down. Do not 'wet tool' sealants.
5. Depth of sealant bite shall be 1/4 inch (6 mm) minimum and 1/2 inch (12.7 mm) maximum, but never more than one half or less than one fourth joint width.

E. Caulk gaps between painted or coated substrates and unfinished or pre-finished substrates. Caulk gaps larger than 3/16 inch (5 mm) between painted or coated substrates.

3.4 TOLERANCES

A. Provide joint tolerances in accordance with Manufacturer's printed instructions.

3.5 FIELD QUALITY CONTROL

A. Adhesion Test (Installer Option to use adhesion test to determine if primer is required).
1. Perform adhesion tests in accordance with Manufacturer's instructions and ASTM C1193, Method A, Field-Applied Sealant joint Hand-Pull Tab:
    a. Perform five (5) tests for first 1,000 linear feet (300 meters) of applied silicone sealant and one (1) test for each 1,000 linear feet (300 meters) seal thereafter or perform one (1) test per floor per building elevation minimum.
    b. For sealants applied between dissimilar materials, test both sides of joints.
2. Sealants failing adhesion test shall be removed, substrates cleaned, sealants re-installed, and re-testing performed.
3. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

3.6 CLEANING

A. Remove masking tape and excess sealant.

B. Clean adjacent materials, which have been soiled, immediately (before setting) as recommended by Manufacturer.

C. Waste Management: Dispose of products in accordance with manufacturer's recommendation.

END OF SECTION

SECTION 07 9219

ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of sealants to be used at perimeters of and penetrations through acoustically insulated walls and associated ceilings.

B. Related Requirements:
   1. Section 09 2900: Furnishing and installing of acoustical sealants.

1.2 REFERENCES

A. Definitions:
   1. Sealant. Sealants are generally used in applications where elastic properties are needed while adhesives are generally used in applications where bonding strength and rigidity are needed. With technology advancements both sealants and adhesives can be used interchangeably depending on the applications performance requirements.
   2. Sealant Types and Classes:
      a. Federal Specifications:
         1) Type I: Self-leveling, pour grade.
         2) Type II: Non-sag, gun grade.
         3) Type NS: Non-sag, gun grade.
         4) Class A: +25 percent, -25 percent expansion – contraction.
      b. ASTM Specifications:
         1) Type S: Single-component sealant.
         2) Type M: Multi-component sealant.
         3) Grade P: Pourable or self-leveling sealant for joints on horizontal surfaces.
         4) Grade NS: Non-sag or gunnable sealant for joints in vertical surfaces.
         5) Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
         6) Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
         7) T: Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
         8) NT: Sealant designed for use in joints in non-traffic areas.
         9) M: Sealant will remain adhered to mortar.
         10) G: Sealant will remain adhered to glass.
         11) A: Sealant will remain adhered to aluminum.
         12) O: Sealant will remain adhered to substrates other than glass, aluminum, mortar.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C834-17, ‘Standard Specification for Latex Sealants’.
      b. ASTM C919-18, 'Standard Practice for Use of Sealants in Acoustical Applications'.
      c. ASTM C1193-16, ‘Standard Guide for Use of Joint Sealants'.
      d. ASTM E84-18b, ‘Standard Test Method for Surface Burning Characteristics of Building Materials’.
      e. ASTM E90-09(2016), ‘Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements’.
   2. Underwriters Laboratories, Inc.:

a. UL 723: ‘Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (11th edition - 2018)’

1.3 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Manufacturer's literature for each Product.

B. Informational Submittals:
1. Certificates:
a. Manufacturer’s Certificate:
1) Certify products are suitable for intended use and products meet or exceed specified requirements.
2) Certificate from Manufacturer indicating date of manufacture.
2. Manufacturers’ Instructions:
a. Manufacturer's installation recommendations for each Product.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Surface-Burning Characteristics:
a. Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
1) Class A (Flame spread index 0-25; Smoke-developed index 0-450).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Deliver and keep in original containers until ready for use.
2. Inspect for damage or deteriorated materials.

B. Storage And Handling Requirements:
1. Handle to prevent inclusion of foreign matter, damage by water, or breakage.
2. Store in cool, dry location, and at temperatures never under 40 deg F (4 deg C) nor exceeding 80 deg F (26.7 C).

1.6 FIELD CONDITIONS

A. Ambient Conditions:
1. Do not apply caulking at temperatures below 40 deg F (4 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Sealants:
1. Design Criteria:
a. Meet requirements of ASTM C834.
b. Meet Class A flame spread rating.
2. Approved Products. See Section 01 6200.
a. OSI Pro-Series SC-175 Draft & Acoustical Sound Sealant by OSI Sealants Inc, Mentor, OH www.osisealants.com.
b. QuietZone Acoustic Caulk by Owens Corning, Toledo, OH www.owenscorning.com.
c. Acoustical Sealant by Tremco, Beachwood, OH www.tremcosealants.com
d. Acoustical Sound Sealant by Titebond.

e. Acoustical Sealant by U S Gypsum, Chicago, IL www.usg.com.

2.2 ACCESSORIES

A. Bond Breaker: Pressure sensitive tape recommended by Sealant Manufacturer to suit application.

B. Joint Backing:
1. Flexible closed cell polyurethane or polyolefin rod or bond breaker tape as recommended by Sealant Manufacturer for joints being sealed.
2. Oversized 25 to 50 percent larger than joint width.

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by Sealant Manufacturer, compatible with joint forming materials.

D. Masking Tape: Pressure sensitive tape recommended by Sealant Manufacturer to suit application.

E. Primer: Non-staining type, type, recommended by Sealant Manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Examine substrate surfaces and joint openings are ready to receive Work.
2. Sealants provided shall meet Manufacturer's shelf-life requirements.
3. Notify Architect of unsuitable conditions in writing.
a. Do not proceed until unsatisfactory conditions are corrected.
4. Commencement of Work by installer is considered acceptance of substrate.

3.2 PREPARATION

A. Surface Preparation:
1. Prepare joints in accordance with ASTM C1193 and Manufacturer's instructions.
2. Clean joint surfaces to remove dirt, dust, oils, wax, paints, and other contamination capable of affecting primer and sealant bond.
3. Protect elements surrounding the Work of this section from damage or disfiguration. Apply masking tape to adjacent surfaces when required to prevent damage to finishes from sealant installation.

B. Surface Preparation:
1. Clean joint surfaces of residual sealant and other contaminates capable of affecting sealant bond to joint surface.
2. Surfaces shall be clean, dry, and free of dust, oil, grease, dew, or frost.

3.3 INSTALLATION

A. General:
1. Do not use damaged or deteriorated materials.
2. Install primer and sealants in accordance with ASTM C1193 and Manufacturer’s instructions where required for sealant adhesion.
3. Install sealants immediately after joint preparation.
4. Do not apply caulking/sealant at temperatures below 40 deg F (4 deg C).

B. Joint Backing:

1. Rod for open joints shall be at least 1-1/2 times width of open joint and of thickness to give solid backing. Backing shall fill up joint so depth of sealant bite is no more than 3/8 inch (9.5 mm) deep.
2. Apply bond-breaker tape in shallow joints as recommended by Sealant Manufacturer.

C. Install at perimeter joints and mechanical and electrical penetrations in sound insulated rooms. Apply sealant with hand-caulking gun with nozzle of proper size to fit joints. Use sufficient pressure to insure full contact to both sides of joint to full depth of joint.

D. Tool joints immediately after application of sealant if required to achieve full bedding to substrate or to achieve smooth sealant surface.

E. Depth of sealant bite shall be 1/4 inch (6 mm) minimum and 1/2 inch (12.7 mm) maximum, but never more than one half or less than one fourth joint width.

3.4 FIELD QUALITY CONTROL

A. Inspection:
1. Examine sealant joints to verify compliance with Contract Document requirements.

B. Non-Conforming Work. Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Sealant material found to be contaminated or damaged or inadequate preparation of substrate results in deficiencies in joint sealant adhesion is considered defective or not complying with Contract Document requirements.
2. Correct any work found defective or not-complying with Contract Document requirements at no additional cost to Owner.

3.5 CLEANING

A. General:
1. Remove sealant from adjacent surfaces in accordance with Sealant Manufacturer and Substrate Manufacturer recommendations as work progresses.
2. Remove masking tape and any other foreign material.
3. Clean adjacent materials that have been soiled immediately (before setting) as recommended by Manufacturer.

B. Waste Management: Dispose of products in accordance with Sealant Manufacturer's recommendation.

END OF SECTION

DIVISION 08: OPENINGS

END OF TABLE OF CONTENTS

SECTION 08 0601

HARDWARE GROUP AND KEYING SCHEDULES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install door hardware and keying as described in Contract Documents.

1.2 REFERENCES

A. Definitions:
   1. Builders Hardware Manufacturer's Association (BHMA) Hardware Functions:
      a. F75 Passage Latch: Latch bolt operated by lever from either side at all times.
      b. F76 Privacy Lock: Latch bolt operated by lever from either side. Outside lever locked by push button inside and unlocked by emergency key from outside or rotating lever from inside.
      c. F81 Office Door Lock: Dead locking latch bolt operated by lever from either side, except when outside lever is locked by turn button in inside lever. When outside lever is locked, latch bolt is operated by key in outside lever or by rotating inside lever. Turn button must be manually rotated to unlock outside lever.
      d. F84 Classroom Deadlock: Dead locking latch bolt operated by lever from either side, except when outside lever is locked, latch bolt is operated by key in outside lever or by rotating inside lever.
      e. F86 Utility Space Door Lock: Dead locking latch bolt operated by key in outside lever or by rotating inside lever. Outside lever is always fixed.
      f. F91 Store Door Lock: Deadlocking latch operated by either lever. Key in either lever locks / unlocks both levers.
      g. F109 Entrance Lock: Turn/push button locking: Pushing and turning button disengages outside lever, requiring using of key until button is manually unlocked. Push-button locking: Pushing button disengages outside lever until unlocked by key or by turning inside lever. Disengages outside spindle from latch when locked.
      h. E2142 Deadbolt: Dead bolt operated by key from either side. Bolt automatically dead locks when fully thrown.
      i. E2152 Deadbolt: Dead bolt operated by key from outside and turn unit from inside. Bolt automatically dead locks when fully thrown.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

PART 2 - HARDWARE GROUPS

2.1 STOREFRONT ENTRY DOORS

A. Single Doors:
   1. **Group ST1**: .
      a. 1 set: Pivots.
      b. 1 set: Weatherstrip.

SECTION 08 1213

HOLLOW METAL FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Hollow metal frames.

B. Related Requirements:
   1. Section 06 2024: 'Door, Frame, And Finish Hardware Installation' for installation.
   2. Section 08 4113: 'Aluminum-Framed Entrances And Storefronts' for aluminum entry frames.

1.2 REFERENCES

A. Reference Standards:
   1. American Architectural Manufacturers Association / Window & Door Manufacturers Association / CSA Group:
      a. AAMA/WDMA/CSA 101/I.S.2/A440-17, 'North American Fenestration Standard/Specification for windows, doors, and skylights'.
   2. ASTM International:
      a. ASTM A568/A568M-17a, 'Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
      b. ASTM A653/A653M-17, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
   3. Steel Door Institute:
      a. SDI A250.8-2017, 'Specifications for Standard Steel Doors and Frames'.
      b. SDI A250.11-2012, 'Recommended Erection Instructions for Steel Frames'.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Copy of SDI A250.11.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. Any current member of Steel Door Institute.

B. Frames:
   1. Cold rolled furniture steel:
      a. Interior Frames: 16 ga. (1.6 mm).
      b. Exterior Frames: 14 ga. (1.9 mm).
   2. Provide labeled frame to match fire rating of door.
   3. Finish:
      a. Use one of following systems:
         1) Prime surfaces with rust inhibiting primer.
         2) Galvanize.

4. Anchors: 16 US ga (1.6 mm) minimum meeting UL or other code acceptable requirements for door rating involved.

C. Fabrication:
   1. General Requirements:
      a. Frames shall be welded units. Provide temporary spreader on each welded frame.
      b. Provide Manufacturer's gauge label for each item.
      c. Make breaks, arrises, and angles uniform, straight, and true. Accurately fit corners.
   2. Frame width dimension:
      a. Fabricate frame 1/8 inch (3 mm) wider than finished wall thickness as described in Contract Documents.
   3. Provide mortar guards at strikes and hinges.
   4. Anchors:
      a. Provide three jamb anchors minimum for each jamb. On hinge side, install one anchor at each hinge location. On strike side, install one anchor at strike level and anchors at same level as top and bottom hinges. Tack weld anchors on frames intended for installation in framed walls.
      b. Frames installed before walls are constructed shall be provided with extended base anchors in addition to other specified anchors.
      c. Anchor types and configurations shall meet wall conditions.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 1313

HOLLOW METAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Hollow metal doors.

B. Related Requirements:
   1. Section 06 2024: 'Door, Frame, And Finish Hardware Installation' for door installation.

1.2 REFERENCES

A. Association Publications:
   1. National Association of Architectural Metal Manufacturers (NAAMM):
      a. HMMA 810-09, ‘Hollow Metal Doors’.
      b. HMMA 860-13, ‘Guide Specifications For Hollow Metal Door and Frames’.
   2. Steel Door Institute:
      a. SDI-108, ‘Recommended Selection and Usage Guide for Standard Steel Doors.

B. Reference Standards:
   1. American Architectural Manufacturers Association / Window & Door Manufacturers Association / CSA Group:
      a. AAMA/WDMA/CSA 101/I.S.2/A440-17, ‘North American Fenestration Standard/Specification for windows, doors, and skylights'.
   2. ASTM International:
      a. ASTM A568/A568M-17a, ‘Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
      b. ASTM A653/A653M-17, ‘Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
      c. ASTM C1036-16, ‘Standard Specification for Flat Glass'.
      d. ASTM C1048-18, 'Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass'.
   3. Steel Door Institute:
      a. SDI A250.8-2017, ‘Specifications for Standard Steel Doors and Frames.
      b. UL 10B, ‘Fire Tests of Door Assemblies’ (Ten Edition).

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. Any current member of Steel Door Institute.

B. Doors:
   1. Meet one of following requirements:
      a. Meet requirements of Steel Door Institute ANSI / SDI A250.8.
      b. Commercial grade steel meeting requirements of ASTM A568/A568M, Class 1:

1) Grade I for interior doors, Grade II for exterior doors.
2) Model 1 Full Flush or Model 2 Seamless designs at Manufacturer's option.
3) Type F as required.
4) Finish:
   a) Interior doors primed or galvanized as per ASTM A653/A653M.
   b) Exterior doors galvanized and primed as per ASTM A653/A653M.

C. Fabrication:
   1. General:
      a. Mortise and reinforce doors for hinges and locks.
      b. Reinforce doors for closers and other surface applied hardware.
      c. Drill and tap on job.
      d. Seams along vertical edges of door need not be filled.
      e. Do not extend hinge cut out full width of door unless fill strip is inserted, weld filled, and ground smooth so no seam appears on back face plate.

2.2 SOURCE QUALITY CONTROL

A. Tests:
   1. Verification of Performance:
      a. Label each door as conforming to above required standards.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 1429

FLUSH WOOD DOORS: Factory-Finished, Clear

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Factory-finished flush wood doors.

B. Related Requirements:
   1. Section 06 2024: Installation.

1.2 REFERENCES

A. Reference Standards
   1. American National Standards Institute / Composite Panel Association:
      a. ANSI A208.1-1999, ‘Particleboard.’
   2. American National Standards Institute / Hardwood Plywood & Veneer Association:
      a. ANSI / HPVA HP-1-2004 01-Jan-2004 ‘American National Standard for Hardwood and Decorative Plywood.'
   3. Architectural Woodwork Institute:
      a. AWI Standards, 'Architectural Woodwork Quality Standards, 8th Edition,Version-2, 2005.'
   4. ASTM International:
      a. ASTM C1036-06, ‘Standard Specification for Flat Glass.’
      b. ASTM C1048-04, ‘Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.’

1.3 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Schedule showing type of door at each location. Included shall be size, veneer, core type, fire rating, hardware prep, openings, blocking, etc.
      b. Indicate factory finish color and type.

B. Closeout Submittals:
   1. Operations And Maintenance Data: Include following in Operations And Maintenance Manuals:
      a. Manufacturer's product literature on doors and factory finish.
      b. Maintenance and repair instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver in clean truck and, in wet weather, under cover.
   2. Deliver to building site only after plaster, cement, and taping compound are completed and dry and after interior painting operations have been completed.
   3. Individually wrap in polyethylene bags for shipment and storage. Leave shipping bag on door after installation until immediately before substantial completion inspection.

B. Storage And Handling Requirements:
   1. Store doors in a space having controlled temperature and humidity range between 25 and 55 percent. Store flat on level surface in dry, well ventilated space. Cover to keep clean but allow air circulation. Do not subject doors to direct sunlight, abnormal heat, dryness, or humidity.
   2. Handle with clean gloves and do not drag doors across one another or across other surfaces.

1.5 WARRANTY

A. Manufacturer's standard full door warranty for lifetime of original installation.
   1. Warranty shall include finishing, hanging, and installing hardware if manufacturing defect was discovered after door was finished and installed.
   2. Warranty to include defects in materials including following:
      a. Delaminating in any degree.
      b. Warp or twist of 1/4 inch or more in door panel at time of one-year warranty inspection.
      c. Telegraphing of core assembly: Variation of 1/100 inch or more in 3 inch span.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Approved Manufacturers.
      a. Oshkosh Architectural Door Co., Oshkosh, WI.
      b. Marshfield Door Systems Inc, Marshfield, WI.
      c. VT Industries, Holstein, IA.
      d. Haley, Buena Park, CA

B. Wood Doors:
   1. Type: AWI PC-5ME or FD-5ME.
   2. Grade: AWI Premium, except face veneer.
   3. Fully Type I Construction: Adhere all glue lines with Type I adhesive, including veneer lay-up.
   4. Face Veneer:
      a. Paint grade birch
   5. Core:
      a. Fully bonded to stiles and rails and sanded as a unit before applying veneers.
      b. Non-Rated:
         1) 32 lb density meeting requirements of ANSI A208.1 Mat Formed Wood Particle Board, Grade 1-L-1 minimum.
         2) Stiles:
            a) 1-3/8 inches deep minimum before fitting.
            b) Stile face to be hardwood matching face veneer material, thickness manufacturer's standard.
         3) Rails:
            a) 1-1/8 inches.
            b) Manufacturer's option.
   6. Particleboard core shall contain recycled content.
   7. Composite wood material (particleboard core, stave core) shall contain no added urea formaldehyde.

C. Fabrication:
   1. Doors shall be factory-machined. Coordinate with Section 08 1212 and Sections under 08 7000.
   2. Provide doors requiring lites with factory- or shop-installed lites and stops to match fire rating of door.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance:
   1. Doors shall have following information permanently affixed on top of door:
      a. Manufacturer:
      b. Door designation or model.
      c. Veneer species.
      d. Factory finish.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 4113

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install aluminum storefront entry and window systems, including hardware, glazing, and caulking, as described in Contract Documents.

B. Related Requirements:
   1. Section 01 1100: 'Summary Of Work' for cores for High Security Cylinders are excluded from Contract and provided by Owner. This specification establishes quality of materials and installation of those items for information of Contractor, Architect, and Owner's Representatives.
   2. Section 06 1100: 'Wood Framing':
   3. Section 07 9213: ‘Elastomeric Joint Sealant’ for quality of sealants.
   4. Section 08 8100: 'Glass Glazing' for quality of glass glazing.

1.2 REFERENCES

A. Association Publications:
   1. American Architectural Manufacturers Association (AAMA):
      a. AAMA 501-15, ‘Methods of Test for Exterior Walls’.
      b. AAMA 609 & 610-15, ‘Cleaning and Maintenance Guide for Architecturally Finished Aluminum’ (combined documents).
      c. AAMA SFM 1-14, ‘Aluminum Store Front and Entrance Manual’.
      d. AAMA 2605-17a, ‘Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels’.

B. Definitions:
   1. Glass Surface:
      a. Insulated glass unit:
         1) Surface 1: Exterior surface of outer lite.
         2) Surface 2: Interspace-facing surface of outer lite.
         3) Surface 3: Interspace-facing surface of inner lite.
         4) Surface 4: Interior surface of inner lite.
      b. Monolithic glass:
         1) Surface 1: Exterior surface.
         2) Surface 2: Interior surface.

C. Reference Standards:
   1. American National Standards Institute / Builders Hardware Manufacturers Association:
      a. ANSI/BHMA A156.19-2013, ‘Power Assist & Low Energy Operated Doors'.
   2. ASTM International:
      a. ASTM B221-14, ‘Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes'.
      b. ASTM B456-17, 'Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium’.
      c. ASTM B633-15, ‘Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel’.
      d. ASTM C920-18, ‘Standard Specification for Elastomeric Joint Sealants’.
      e. ASTM C1184-18, 'Standard Specification for Structural Silicone Sealants'.

f. ASTM E283-04(2012), ‘Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen’.
g. ASTM E330/E330M-14, ‘Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference’.
h. ASTM E331-00(2016), ‘Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference’.

3. International Building Code (IBC) (2018 or most recent edition adopted by AHJ):
   a. Chapter 10, 'Means of Egress'.
   b. Chapter 16, 'Structural Design'.
      1) Section 1609 'Wind Loads'.
4. International Code Council / American National Standards Institute:
   a. ICC / ANSI A117.1-2009, ‘Accessible and Usable Buildings and Facilities'.
5. National Fenestration Rating Council (NFNC):
   a. NFRC 100-2017, 'Procedure for Determining Fenestration Product U-factors’.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature.
         1) Storefront entry system.
         2) Low-energy door operator.
      b. Color and finish.
   2. Shop Drawings:
      a. Clearly mark components to identify their location in Project.
      b. Show exact dimensions of factory-fabricated frames and required tolerances for rough openings.
      c. Show locations, sizes, etc, of hardware reinforcing.

B. Informational Submittals:
   1. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance, adjustment, and repair instructions.
      b. Warranty Documentation:
         1) Final, executed copy of Warranty.
            a) Storefront warranty.
            b) Storefront closers.
            c) Low-energy door operator.
      c. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer's literature or cut sheets for storefront system and for each item of hardware.
            b) Manufacturer’s literature of cut sheets for low-energy door operators.
            c) Color and finish selections.
            d) Parts lists.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:

1. Storefront System Performance Requirements:
   a. Provide test reports from AAMA accredited laboratories certifying performances if requested:
      1) Air Leakage: Meet requirements of ASTM E283.
      2) Limit air leakage through assembly to 0.06 CFM/min/sq ft (.00003 m3/sm2) of wall area at 6.24 PSF (300 Pa) as measured in accordance with ASTM E283.
      3) Water Resistance: No water leakage when measured in accordance with ASTM E331 with static test pressure of 8PSF (384 Pa) as defined by AAMA 501.
      4) Dynamic Water Resistance: No water leakage, when measured in accordance with AAMA 501 with dynamic test pressure of 8 PSF (384 Pa).
      5) Limit mullion wind load deflection of L/175 with full recovery of glazing materials, when measured in accordance with ASTM E330/E330M.
      6) System shall not deflect more than 1/8 inch (3 mm) at center point, or 1/16 inch (1.58 mm) at enter point of horizontal member, once dead load points have been established.
      7) System shall accommodate expansion and contraction movement due to surface temperature differential of 180 deg F (82 deg C).
      8) Seismic testing shall conform to AAMA recommended static test method for evaluating performance of curtain walls and storefront wall systems due to horizontal displacements associated with seismic movements and building sway.
2. Provide wind load and impact testing by testing laboratory when required by local codes and jurisdictions:

B. Qualifications: Requirements of Section 01 4301 applies, but not limited to following:
1. Manufacturer Qualifications:
   a. Provide aluminum entrances and storefront systems produced by firm experienced in manufacturing systems that are similar to those indicated for this project and have record of successful in-service performance.
2. Fabricator Qualifications:
   a. Provide aluminum entrances and storefront systems fabricated by a firm experienced in producing systems that are similar to those indicated for this Project, and have record of successful in-service performance.
   b. Fabricator shall have sufficient production capacity to produce components required without causing delay in progress of the Work.
3. Installer Qualifications:
   a. Minimum three (3) years experience in storefront installations.
   b. Minimum five (5) satisfactorily completed projects of comparable quality, similar size, and complexity in past three (3) years before bidding.
   c. Upon request, submit documentation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
1. Deliver all parts of door, together with hardware, in original, unopened packages with labels intact to Project at same time.

B. Storage And Handling Requirements:
1. Store in clean, dry location, indoors in Manufacturer’s unopened packaging until ready for installation and in accordance with Manufacturer’s instructions.
2. Stack framing components in a manner that will prevent bending and avoid significant or permanent damage.
3. Protect materials and finish from damage during storage, handling and installation.

1.6 WARRANTY

A. Manufacturer Warranty:
   1. Storefront Entrances:
      a. Manufacturer’s Warranty to be free of defects in material and workmanship.
      b. Manufacturer’s Warranty against deterioration or fading.
      c. Manufacturer’s Lifetime Warranty for Door Construction for normal use.
   2. Closers:
      a. Closer Manufacturer's standard warranty, 10 years minimum.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. Kawneer

B. General:
   1. In addition to requirements shown or specified, comply with:
      a. Applicable provisions of AAMA SFM 1, ‘Aluminum Store Front and Entrance Manual’ for design, materials, fabrication and installation of component parts.

C. Design Criteria:
   1. Storefront System suitable for outside or inside glazing.

D. Materials:
   1. Framing Components and Accessories:
      a. Aluminum Extrusions:
         1) 6063-T6 aluminum alloy or meet requirements of ASTM B221, alloy GS 10a T6.
         2) Anchors, Clips, and Accessories:
            a) Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated (properly isolated steel from aluminum).
         3) Fasteners:
            a) Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
         4) Glazing Gasket:
            a) Compression-type design with replaceable extruded EPDM rubber.
         5) Reinforcing Members:
            a) Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
         6) Sills:
            a) Match height of door bottoms.
         7) Sealant:
            a) Structural Sealant meeting requirements of ASTM C1184 for fabrication within storefront system:
               (1) Permanently elastic, non-shrinking, and non-migrating type for joint size and movement.
               (2) Single-component neutral-curing silicone formulation compatible with system components specifically formulated and tested for use as structural sealant

and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.
(3) Color: Black.
b) Joint Sealants used at perimeter of storefront framing system: Elastomeric Sealant as specified in Section 07 9213.
c) Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when required by local codes or AHJ.
8) Tolerances:
a) Tolerances for wall thickness and other cross-sectional dimensions of storefront members in compliance with AA Aluminum Standards and Data.
b. Storefront Framing System:
1) Brackets and Reinforcements:
a) Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.
2) Fasteners and Accessories:
a) Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.
3) Perimeter Anchors:
a) When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
c. Finish:
1) Match doors.
d. Approved Products. See Section 01 6200.
1) Non-Thermal, 2 inch (50 mm) Sightline:
a) Double Stack header at exterior doors only if shown on Contract Drawings.
b) Double Glazed:
(1) Trifab VG 451 by Kawneer.
2. Manually Operated Doors:
a. Aluminum:
1) 6063-T6 aluminum alloy or meet requirements of ASTM B221, alloy GS 10a T6.
b. Stiles:
1) 3-1/2 inches by 1-3/4 inches by 0.125 inches (89 mm by 45 mm by 3.175 mm) thick nominal.
c. Top Rails:
1) 3-1/2 inches minimum by 1-3/4 inches by 0.125 inches (89 mm minimum by 45 mm by 3.175 mm) thick nominal.
d. Bottom Rails:
1) 10 inches minimum by 1-3/4 inches by 0.125 inches (254 mm minimum by 45 mm by 3.175 mm) thick nominal.
e. Construction:
1) Manufacturer's standard.
f. Glazing Stops:
1) Snap-in type with neoprene bulb-type glazing. Units shall be glazed from exterior side.
g. Weatherstripping:
1) Neoprene bulb-type.
2) Approved Products. See Section 01 6200.
a) Sealair by Kawneer.
h. Framing System Gaskets and Sealants:
1) Manufacturer's standard, recommended by manufacturer for joint type:
2) Sealants: As specified in Framing Components and Accessories.
i. Factory Finishing:
1) Medium Bronze Finish (match existing):
a) Approved Manufacturers. See Section 01 6200.
(1) BASF.
(2) PPG Industries, Inc.
(3) Valspar Corporation.
j. Approved Products. See Section 01 6200.
1) Non-Thermal:
a) 350 Medium Stile by Kawneer.

3. Glazing:
    a. Glazing as specified in Section 08 8100: 'Glass Glazing'.
    b. Glazing Gaskets:
        1) Compression-type design with replaceable extruded EPDM rubber.
    c. Spacers and Setting Blocks: Elastomeric.
    d. Bond-Breaker (Sealer) Tape: Standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
    e. Glazing Sealant:
        1) Structural Sealant meeting requirements of ASTM C1184:
            a) Permanently elastic, non-shrinking, and non-migrating type for joint size and movement.
            b) Single-component neutral-curing silicone formulation compatible with system components specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in aluminum-framed systems indicated.
            c) Color: Black.
        2) Weather Sealant:
            a) ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weather seal sealant, and aluminum-framed-system manufacturers for this use.
            b) Color: Match structural sealant.
        3) Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when required by local codes or AHJ.
4. Hardware:
    a. Hinging:
        1) Top and bottom offset, ball bearing pivots per door leaf.
    b. Overhead Door Closers:
        1) Provide parallel arms on closers unless door position requires otherwise.
        2) Where possible, closers shall allow for 180 degree opening and not be used as stop. Provide Cush-N-Stop or equivalent arm where wall stop cannot be used.
        3) Adjust closers to provide maximum opening force as required by governing code authority.
        4) Closers shall have following features:
            a) Adjustable sweep speed.
            b) Adjustable backcheck.
            c) Non-handed, non-sized.
            d) Cush arm by LCN or equal by Norton.
        5) Approved Products. See Section 01 6200.
            a) Surface mounted:
            b) 4041 Series parallel arm by LCN.
            c) 7500 Series Parallel arm by Norton.
    c. Exit Devices:
        1) Entry Doors:
            a) Operation:
                (1) Entry shall be by key. Device shall be locked by cylinder from outside. Key shall be removable when cylinder is in locked or unlocked position.
                (2) Dogging operation shall be by manufacturer's accessible thumbturn cylinder function.
                (3) Exterior Trim: Lever Handle or Pull equal to Kawneer CO-9
                (4) Types: Rim Type. Provide type of strike that will allow installation of specified panic devices on storefront system specified.
        2) Access Doors:
            a) Operation:
                (1) Access accomplished by dogging device. Dogging operation shall be by accessible, permanent knob, not by removable allen wrench devices.
                (2) Exterior Trim: Match Entry Doors.

(3) Types: Rim Type. Provide type of strike that will allow installation of specified panic devices on storefront system specified.

3) Emergency Egress Exit Doors:
   a) Operation:
      (1) Exit only with no dogging.
      (2) Exterior Trim: None.
      (3) Type: Rim Type with type of strike that will allow installation of specified panic devices on storefront system specified.
4) Color:
   a) Equivalent to clear medium bronze.
5) Approved Products. See Section 01 6200.
   a) Apex Series by Precision.
   b) 80 Series by Sargent.
   c) 98 or 99 Rim Series by Von Duprin.

d. Thresholds:
   1) Exterior:
      a) Design Criteria: Meet handicap accessibility requirements.
      b) Exterior to Thin-Set Paver Tile: Similar to Pemko 253, 254, or 255 Profile.
      c) Exterior to Carpet Tile: Similar to Pemko 273 Profile.
   2) Interior:
      a) Design Criteria: Meet handicap accessibility requirements.
      b) Carpet Tile / Carpet to Carpet: Similar to Pemko 236.
e. Sweep Strips:
   1) Quality Standard:
      a) Entrance Manufacturer's standard (cover cap with no exposed fasteners).
      b) Pemko 293100 N8.
f. Push / Pulls:
   1) Approved Products. See Section 01 6200.
      a) Kawneer CP and CO-9, clear anodized.
g. High Security Cylinders And Cores:
   1) Schlage cores with Primus Level 4+ keying system:
h. Kick Plates:
   1) Push side of Door only.
   2) 10 inches (254 mm) high by width of door less 3/4 inch (19 mm) on each side.
   3) Material: 0.050 inch (1.27 mm) thick Stainless Steel.
   4) Acceptable Manufacturers:
      a) Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b) Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
      c) Ives, Wallingford, CT www.iveshardware.com.
      d) Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      e) Equal as approved by Architect before bidding. See Section 01 6200.

E. Fabrication:
   1. Construction shall meet Manufacturer’s recommendations.
   2. Fabricate components that, when assembled, have following characteristics:
      a. Profiles sharp, straight, and free of defects or deformations.
      b. Accurately fit joints; make joints flush, hairline and weatherproof.
      c. Means to drain water passing joints, condensation within framing members, and moisture migrating within system to exterior.
      d. Physical and thermal isolation of glazing from framing members.
      e. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
      f. Provisions for field replacement of glazing.
      g. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
      h. Framing members shall be internally reinforced and secured at head and sill as necessary for structural performance requirements and for hardware attachment.
   3. Fabricate in factory to dimensions required to fit framed openings detailed on Contract Documents. Joints shall be tightly closed.

4. Mortise in manner to give maximum hardware-door connection strength and neatness of appearance. Adequately reinforce with back plates or rivnuts to hold pivots and closers.
5. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
6. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
7. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.
8. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

F. Hardware Finishes:
1. Finishes for steel, brass, or bronze hardware items shall be satin chromium plated.
2. Materials other than steel, brass, or bronze shall be finished to match the appearance of satin chromium plated.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Performance Standard Installers: See Section 01 6200 for definitions of Categories. See Section 01 4301 and 'Quality Assurance' in Part 1 'General' for Installer Qualifications of this specification:
1. General Contractor responsible for Installer(s), verification of qualifications, and performance. Contact Approved Manufacturer's Representative specified in Part 2 'Products' of this specification for potential installers if desired.

3.2 EXAMINATION

A. Verification Of Conditions:
1. Verify that framed openings will accommodate factory-fabricated storefront entry and window frames of dimensions agreed upon by Owner and Manufacturer and shown on Standard Plan documents.
2. Verify floor is level across entire width of automatic door opening.
3. Verify sill conditions are level and/or sloped away from openings as specified.
4. Verify wall framing is dry, clean, sound, and free of voids and offsets, construction debris, sharp edges or anything that will prevent a successful installation of storefront system.
5. Notify Architect and Owner in writing if framed openings are not as agreed upon.
   a. Do not install storefront entry and window frames until deficiencies in framed openings have been corrected to allow installation of standard entries and windows.
   b. Commencement of Work by installer is considered acceptance of substrate.

3.3 INSTALLATION

A. General:
1. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
2. All installation shall be in accordance with manufacturer's published recommendations and in accordance with approved shop drawings.
3. Do not install damaged components. Fit frame joints tight, free of burrs and distortion. Rigidly secure non-movement joints.
4. Isolate metal surfaces in contact with incompatible metal or corrosive substrates, including wood, by applying sealer tape to prevent electrolytic action.

B. Set plumb, square, level, and in correct alignment and securely anchor to following tolerances:

1. Variation from plane: Limit to 1/8 inch (3 mm) in 12 feet (3.6 meters); 1/4 inch (6 mm) over total length.
2. Offset from Alignment: For surfaces abutting in line, limit offset to 1/16 inch (1.6 mm).
3. Offset at Corners: For surfaces meeting at corner, limit offset to 1/32 inch (0.8 mm).
4. Diagonal measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).
5. Sidelites: Line up horizontal rail in sidelight with door rail.

C. Install doors without warp or rack. Adjust doors and hardware to provide ninety (90) degree operation, tight fit at contact points and smooth operation.

D. Install exterior window units with through wall sill flashing.

E. Thresholds:
1. Accurately cut thresholds to fit profile of storefront frame. Bed exterior thresholds in specified sealant at contact points with floor and make watertight.

F. Sealants:
1. Apply in accordance with Section 07 9213 ‘Elastomeric Joint Sealant’ requirements.
2. Caulk joints between frames and walls, both interior and exterior to provide weather tight installation.

G. Glazing Characteristics:
1. Interior Vestibule Glazing: Clear.
2. Exterior Storefront Doors And Sidelights
   a. Clear interior pane and Clear exterior pane with Low E treatment on surface 2.

3.4 FIELD QUALITY CONTROL

A. Field Tests And Inspections:
1. Pull test doors, especially pairs of single doors separated by permanent mullions, to ensure security of opening.
2. Make all necessary final adjustments to attain normal operation of each door and its mechanical hardware.

B. Non-Conforming Work: Non-conforming work as covered in the General Conditions applies, but is not limited to the following:
1. Correct any work found defective or not complying with contract document requirements including removal and replacement of glass that has been broken, chipped, cracked, abraded, or damaged during construction period at no additional cost to the Owner.

3.5 ADJUSTING

A. Adjust swing doors for proper operation after glazing entry. After repeated operation of completed installation, re-adjust door for optimum operating condition and safety if required.

3.6 PROTECTION

A. During Installation:
1. Installer’s Responsibility:
   a. During installation, all adjacent work shall be protected from damage.

B. After Installation:
1. General Contractor’s Responsibility:

a. Institute protective measures required throughout remainder of construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

3.7 CLEANING

A. General:
1. Installer's Responsibility:
a. Follow Manufacturer's written recommendations for cleaning and maintenance or guidelines of AAMA 609 & 610 'Cleaning and Maintenance Guide for Architecturally Finished Aluminum' (combined documents). Avoid damaging protective coatings and finishes.
b. Clean glass and aluminum surfaces, inside and out, promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Exercise care to avoid damage to coatings.
c. Remove nonpermanent labels, protective films, and clean surfaces following recommended procedures.
1) Do NOT remove permanent AAMA/CSA or NFRC labels.

B. Waste Management:
1. Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

SECTION 08 7101

COMMON FINISH HARDWARE REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. General requirements for finish hardware related to architectural wood and hollow metal doors.

B. Related Requirements:
   1. Section 06 2024: 'Door, Frame, And Finish Hardware Installation' for installation of hardware.
   2. Section 06 4116: 'Plastic Laminate-Faced Architectural Cabinets' for architectural woodwork hardware.
   3. Section 08 0601: 'Hardware Group and Keying Schedules'.
   4. Section 08 4000: 'Entrances and Storefronts' for hardware.

1.2 REFERENCES

A. Association Publications:
   1. Builders Hardware Manufacturers Association (BHMA), 355 Lexington Avenue, 15th Floor, New York, NY 10017-6603, Tel: 212-297-2122 Fax: 212-370-9047, www.buildershardware.com.

B. Reference Standards:
   1. International Code Council / American National Standards Institute:
      a. ICC / ANSI A117.1-2009, 'Accessible and Usable Buildings and Facilities'.
   2. Underwriters Laboratories (UL):
      a. UL 10B, 'Fire Tests of Door Assemblies' (10th Edition).
      b. UL 10C, 'Positive Pressure Fire Tests of Door Assemblies' (Third Edition).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Hardware Templates:
      a. Provide hardware templates to Sections 08 1213, 08 1313, and 08 1429 within fourteen (14) days after Architect approves hardware schedule.
      b. Supply necessary hardware installation templates to Section 06 2024 before pre-installation conference.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's cut sheets.
      b. Two (2) copies of Manufacturer's installation, adjustment, and maintenance instructions for each piece of hardware. Include one (1) set in 'Operations And Maintenance Manual' and send one (1) set with hardware when delivered.
      c. Copy of hardware schedule.
      d. Written copy of keying system explanation.
   2. Shop Drawings:
      a. Submit hardware schedule indicating hardware to be supplied.

b. Schedule shall indicate details such as proper type of strikeplates, spindle lengths, hand, backset, and bevel of locks, hand and degree opening of closer, length of kickplates, length of rods and flushbolts, type of door stop, and other necessary information necessary to determine exact hardware requirements.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data:
1) Manufacturer’s installation, adjustment, and maintenance instructions for each piece of hardware.
b. Record Documentation:
1) Manufacturers documentation:
a) Manufacturer's literature and/or cut sheets.
b) Include keying plan and bitting schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
1. Neatly and securely package hardware items by hardware group and identify for individual door with specified group number and set number used on Supplier's hardware schedule.
2. Include fasteners and accessories necessary for installation and operation of finish hardware in same package.

PART 2 - PRODUCTS

2.1 FINISHES

A. Hardware Finishes:
1. Finishes for brass or bronze hardware items shall be:
a. ANSI / BHMA Finish Code 626.
1) Description: Satin Chromium Plated.
2) Base Metal: Brass. Bronze.
2. Finishes for flat goods items may be:
a. ANSI / BHMA Finish Code 630.
1) Description: Satin Stainless Steel.
2) Base Metal: Stainless Steel (300 Series).
3. Materials other than steel, brass, or bronze shall be finished to match appearance satin chromium plated, except flat goods which shall be satin stainless steel.

2.2 FASTENERS

A. Fasteners shall be of suitable types, sizes and quantities to properly secure hardware. Fasteners shall be of same material and finish as hardware unless otherwise specified. Fasteners exposed to weather shall be non-ferrous or corrosion resisting steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before ordering materials, examine Contract Documents to be assured that material to be ordered is appropriate for thickness and substrate to which it is to be secured and will function as intended.

END OF SECTION

SECTION 08 7102

HANGING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Hinges for flush wood and hollow metal doors.

B. Related Requirements:
   1. Section 08 7101: 'Common Hardware Requirements'.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Hager Companies, St Louis, MO www.hagerhinge.com.
      b. Ives, New Haven, CT www.iveshardware.com.
      c. McKinney, Scranton, PA www.mckinneyhinge.com.
      d. PBB, Ontario, CA www.pbbinc.com.
      e. Stanley (dormakaba Americas), Indianapolis IN www.stanleyhardwarefordoors.com/products/.

B. Hinges:
   1. Doors:
      a. Sizes:
         1) Non-Fire-Rated Doors:
            a) 1-3/4 inch 44.5 mm non-fire-rated wood doors in wood frames: 4 inches by 4 inches (100 mm by 100 mm).
            b) 1-3/8 inch 35 mm wood or metal doors: 3-1/2 inches by 3-1/2 inches (89 mm by 89 mm).
   2. Use non-removable pins on exterior opening doors.
   3. Hinges on exterior doors shall be solid brass, plated to achieve specified finish.
   4. Approved Products. See Section 01 6200.
      a. Interior:
         1) Hager: BB 1279.
         2) Ives: 5BBI.
         3) McKinney: TA 2714.
         4) MacPro / McKinney: MPB79.
         5) PBB: BB81.
         6) Stanley: FBB 179.
      b. Exterior:
         1) Hager: BB 1191.
         2) Ives: 5BBI.
         3) McKinney: TA 2314.
         4) PBB: BB21.
         5) Stanley: FBB 191.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 7103

SECURING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Items for architectural wood or hollow metal doors:
      a. Flush bolts.
      b. Locksets and latchsets.
      c. Deadbolts.
      d. Cylinders.
      e. Interior exit devices.

B. Related Requirements:
   1. Section 08 7101: Common Hardware Requirements.

1.2 REFERENCES

A. Definitions:
   1. Grade 2 Standard Duty Key-In Lever Cylindrical Lockset:
      a. Performance Features:
         1) Exceeds 400,000 ANSI cycles.
         2) Single motion egress provides easy emergency exit.
         3) Full 1 inch (25 mm) throwbolt with saw resistant hardened steel roller pin.
         4) Anti-drill design deadbolt. Two (2) ball bearings inserted to prevent drill attacks.
         5) ADA-compliant thumbturn.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Standard Key Delivery:
      a. Include change keys with hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer List:
      a. Best Locks by Stanley, Indianapolis IN www.stanleysecuritysolutions.com.
      b. Hager, St Louis, MO www.hagerhinge.com.
      c. Ives, New Haven, CT www.iveshardware.com.
      d. Marks USA, Amityville, NY www.marksusa.com.
      e. Precision Hardware, Romulus, MI www.precisionhardware.com.
      f. Sargent, New Haven, CT www.sargentlock.com.
      g. Schlage, Colorado Springs, CO www.schlage.com.
      h. Von Duprin, Indianapolis, IN www.vonduprin.com.
      i. Yale Commercial Locks, Lenoir City, TN www.yalecommercial.com.

B. General:
   1. Backsets shall be 2-3/4 inches (70 mm).
   2. Furnish lead shields where required.

C. Flush Bolts:
   1. Rod length: 12 inch (300 mm) minimum.
   2. Acceptable Products:
      a. Manual Flush Bolts (Wood Doors):
         1) Hager 283D.
         2) Ives FB458.
      b. Equal as approved by Architect before installation. See Section 01 6200.
   3. Dust Proof Strike:
      a. Floor and/or threshold.
      b. Acceptable Products:
         1) Hager: 280X.
         2) Ives: DP2.
         3) Equal as approved by Architect before installation. See Section 01 6200.

D. Locksets And Latchsets:
   1. Design Criteria:
      a. Grade 2 Standard Duty Key-In Lever Cylindrical Lockset:
         1) ANSI/BHMA A156.02 Series 4000 Grade 2.
         2) Meet UL 3 hour fire rating.
         3) Meet ADA Compliant ANSI A117.1 Accessibility Code.
         4) Door Lever - Meet California code for 1/2 inch (12.7 mm) or less return to door.
   2. Lever Operated:
      a. Approved Products. See Section 01 6200.
         1) Grade 2 Standard Duty Key-In Lever Cylindrical Locksets:
            a) 7K Series Best Lock with 15D Lever by Stanley standard cylinders - (I/C cores may be used when authorized by AEC).
            b) 175 Series with American Lever by Marks USA.
            c) 7 Line Series with L Lever by Sargent.
            d) AL Series with Saturn (SAT) Lever by Schlage.
            e) 5300LN Series with Augusta (AU) Lever by Yale.

E. Deadbolts:
   1. Approved Products. See Section 01 6200.
      a. Match manufacturer of locksets.

F. Standard Cylinders:
   1. Provide cylinders for interior exit devices requiring cylinders.
   2. Approved Products. See Section 01 6200.
      a. Match Manufacturer of locksets.

G. Exit Devices:
   1. Use operable lever trim.
   2. Provide labeled hardware where required by local code authority.
   3. Approved Products. See Section 01 6200.
      a. Apex Series by Precision.
      b. 80 Series by Sargent.
      c. 99 or 98 Series by Von Duprin.
      d. 7100 Series by Yale.

PART 3 - EXECUTION

3.1 CLOSE-OUT ACTIVITIES

A. Owner's Instructions:
   1. Before Final Acceptance Meeting, send master keys to Owner's representative.

END OF SECTION

SECTION 08 7104

OPERATING TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Interior push / pulls.

B. Related Requirements:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Standard Door Push / Pulls:
   1. Size: 15 inches (380 mm) by 3-1/2 inch (89 mm).
   2. Acceptable Products:
      a. PS3515, PL3515 / 80301 by Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b. 39E, 30S by Hager, St Louis, MO www.hagerhinge.com.
      c. 8200, 8302 by Ives, Wallingford, CT www.iveshardware.com.
      d. 70B, 105x70B by Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      e. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 7105

ACCESSORIES FOR PAIRS OF DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Coordinators.
   2. Astragals.

B. Related Requirements:
   1. Section 08 1313: Astragals for steel doors.
   2. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b. Hager, St Louis, MO www.hagerhinge.com.
      c. Ives, Wallingford, CT www.iveshardware.com.
      d. National Guard Products - NGP, Memphis, TN www.ngpinc.com.
      e. Pemko Manufacturing, Ventura, CA www.pemko.com.
      f. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.

B. Coordinators:
   1. Approved Products. See Section 01 6200.
      a. CO2 x FB1 by Glynn Johnson.
      b. 297D by Hager.
      c. Series 900 by Ives.
      d. 1600 Series by Rockwood.

C. Astragals:
   1. Acceptable Products:
      a. 835S by Hager.
      b. 139 DKB by NGP.
      c. 357D by Pemko.
      d. Equal as approved by Architect before installation. See Section 01 6200.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 7106

CLOSING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Closers for flush wood doors and hollow metal doors.

B. Related Requirements:
   1. Section 08 7101: 'Common Finish Hardware Requirements'.
   2. Section 08 7108: 'Stops And Holders'.

1.2 SUBMITTALS

A. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Manufacturer's final executed copy of warranty.

1.3 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's Standard Warranty, five (5) years minimum.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. 8900 Series by Dorma Architectural Hardware, Reamstown, PA www.dorma.com/usa.
      b. 1461 Series by LCN Closers, Princeton, IL www.lcnclosers.com.
      c. 8501 Series by Norton Door Controls, Charlotte, NC www.nortondoorcontrols.com.
      d. 1431 Series by Sargent, New Haven, CT www.sargentlock.com.
      e. D-3550/D-3551 Series by Stanley (dormakaba Americas), Indianapolis IN www.stanleyhardwarefordoors.com/products/.

B. Surface-Mounted Overhead Door Closers:
   1. Closers provided under this Section shall be from same Manufacturer.
   2. Provide parallel arms on closers unless door position in relation to adjacent wall requires otherwise. Provide covers.
   3. Door Closers on doors that swing 180 degree as shown on Contract Documents:
      a. Closers shall allow for 180 degree opening without engaging stop function. Wall stop or Floor stop is specified in Door Schedule and Section 08 7108, 'Stops And Holders'.
      b. Closers shall have following features:
         1) Adjustable sweep speed.
         2) Adjustable backcheck.
         3) Non-handed, non-sized.
         4) Hold open arm function (Friction Hold Open) (Non-Fire-Rated Corridors).
         5) Delayed action closing.

4. Door Closers on doors that swing 90 degree as shown on Contract Documents:
   a. Closers shall allow for 100 degree opening with engaging stop function.
   b. Closers shall have following features:
      1) Adjustable sweep speed.
      2) Adjustable backcheck.
      3) Non-handed, non-sized.
      4) Hold open arm function with thumb turn or handle control (Cush And Hold) (Non-Fire-Rated Corridors).
      5) Delayed action closing where noted on Door Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount closers on stop side of door wherever conditions permit.

B. Through-bolt hardware-to-door connections.

3.2 ADJUSTING

A. Adjust closers to provide maximum opening force as required by governing code authority and proper backcheck and sweep speed.

END OF SECTION

SECTION 08 7107

PROTECTIVE PLATES AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Kick plates.

B. Related Requirements:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b. Hager, St Louis, MO (800) 255-3590 or (314) 772-4400 www.hagerhinge.com.
      c. Ives, Wallingford, CT www.iveshardware.com.
      d. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      e. Equal as approved by Architect before installation. See Section 01 6200.

B. Protective Plates:
   1. Material: 0.050 inch thick - Stainless Steel.
   2. Sizes:
      a. Kick Plates: 10 inches high by width of door less 3/4 inch on each side.
      b. Armor Plate: 34 inches high by width of door less 3/4 inch on each side.

PART 3 - EXECUTION: Not Used

END OF SECTION

SECTION 08 7108

STOPS AND HOLDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section:
   1. Door stops.
   2. Door stops and holders.

B. Related Sections:
   1. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Glynn-Johnson, Indianapolis, IN www.glynn-johnson.com.
      b. Hager, St Louis, MO www.hagerhinge.com.
      c. Ives, Wallingford, CT www.iveshardware.com.
      d. Rockwood Manufacturing Co, Rockwood, PA www.rockwoodmfg.com.
      e. Sargent, New Haven, CT (800) 906-6606 or (203) 562-2151 www.sargentlock.com.

B. Stops:
   1. Use wall type stops unless indicated condition does not allow.
   2. Provide model appropriate for substrate. Wall stops may be either cast or wrought.
   3. Acceptable Products:

		Interior Wall	Exterior Wall	Floor Mount	Overhead.
b.	Hager	236W	255W	243F	- - -
c.	Ives	WS407CCV	WS447	FS438	- - -
d.	Rockwood	409	474 / 475	440 / 441	- - -
e.	Glynn Johnson	- - -	- - -	- - -	GJ 90S
f.	Sargent	- - -	- - -	- - -	590S Series

      g. Equal as approved by Architect before Installation. See Section 01 6200.

C. Door Stops And Holders:
   1. Acceptable Products:
      a. Hager: 268F, 268S or 256S, 256W.
      b. Ives: WS444, WS449, FS446, FS450.
      c. Rockwood: 472, 473, 476, 477.
      d. Equal as approved by Architect before Installation. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work: When using overhead stops, coordinate installation with door closer and other door hardware.

END OF SECTION

SECTION 08 7109

ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Acoustical seals.
   2. Smoke Gaskets.
   3. Sweep Strip (door bottom sweep) for hollow metal door only.
   4. Thresholds (metal) where required for wood doors and hollow metal doors.
   5. Weatherstripping for exterior hollow metal doors.
   6. Door bottoms/door sweeps.

B. Related Requirements:
   1. Section 08 4000: 'Entrances And Storefronts'.
   2. Section 08 7101: 'Common Finish Hardware Requirements' .

1.2 REFERENCES

A. Association Publications:
   1. American Architectural Manufacturers Association (AAMA:
      a. AAMA 609 & 609-09, 'Cleaning and Maintenance Guide for Architecturally Finished Aluminum' (combined document).
      b. AAMA 611-12, 'Voluntary Standards for Anodized Architectural Aluminum'.
      c. AAMA 701/702-11, 'Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals'.
   2. National Association of Architectural Metal Manufacturers (NAAMM):
      a. AMP 500-06, 'Metal Finishes Manual' for Architectural and Metal Products.

B. Reference Standards:
   1. American National Standards Institute / Builders Hardware Manufacturers Association:
      a. ANSI / BHMA A156.18-2012, 'Materials and Finishes'.
      b. ANSI / BHMA A156.21-2014, 'American National Standard for Thresholds'.
   2. International Code Council / American National Standards Institute:
      a. ICC / ANSI A117.1-2009, 'Accessible and Usable Buildings and Facilities'.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Hager, St Louis, MO www.hagerhinge.com.
      b. Ives, Wallingford, CT www.iveshardware.com.
      c. NGP - National Guard Products, Memphis, TN www.ngpinc.com.
      d. Pemko Manufacturing, Ventura, CA www.pemko.com.
      e. Equal as approved by Architect before bidding. See Section 01 6200.

B. Latch Guard:
   1. Acceptable Products:
      a. Latch Protector
         1) 320CL by Rockwood.
      b. Equal as approved by Architect before bidding. See Section 01 6200.

C. Acoustical Seals
   1. Color as selected by Architect.
   2. Acceptable Products:
      a. Door Bottom Shoe for Wood Door:
         1) 13VDkB by NGP.
         2) 211DV by Pemko.
      b. Door Bottom Shoe for Metal Door:
         1) 779S-A by Hager.
         2) 35EV by NGP.
         3) 217AV by Pemko.
      c. Equal as approved by Architect before bidding. See Section 01 6200.

D. Smoke Gaskets:
   1. Color as selected by Architect.
   2. Acceptable Products:
      a. 726 by Hager.
      b. 5050 by NGP.
      c. PK 55 by Pemko.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

E. Sweepstrip (metal door bottom):
   1. Clear anodized aluminum with black neoprene insert.
   2. Reduce infiltration of air, wind, dust, rain, and snow.
   3. Meet UL requirements.
   4. For use with saddle thresholds.
   5. Type One Acceptable Products:
      a. 750S CLR by Hager.
      b. 198N A by NGP.
      c. 321 CN by Pemko.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

F. Thresholds:
   1. Acceptable Products:
      a. Design Criteria:
         1) Meet handicap accessibility requirements (ADA):
      b. Interior Doors at Acoustic Seals, Approved Products:
         1) Carpet threshold (carpet to carpet):
            a) 505S DBA by Hager.
            b) 414 DKB by NGP.
            c) 236 D by Pemko.
         2) Carpet threshold (carpet to concrete, wood, synthetic, or resilient flooring:
            a) 417 DKB by NGP.
            b) 174 D by Pemko.
         3) Saddle threshold:
            a) 418S DBA by Hager.
            b) 411 DKB by NGP.
            c) 151 D by Pemko.
      c. Out swinging metal exterior doors
         1) 8426 by NGP.
         2) 253 x 3 FG by Pemko.
      d. Out swinging metal exterior doors (exterior Utility Rooms only):
         1) 891 V by NGP.
         2) 185 V by Pemko.

e. Equals as approved by Architect before bidding. See Section 01 6200.

G. Weatherstripping:
1. Acceptable Products:
a. Finish: clear anodized aluminum.
b. Perimeter:
1) 800S by Hager.
2) A625 A by NGP.
3) 35041 CP by Pemko.
c. Equal as approved by Architect before bidding. See Section 01 6200.
d. Bottom (see Sweepstrip)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install smoke gaskets and acoustical seals in manner to give continuous air-tight fit.
1. Install smoke gaskets as per Manufacturer's installation requirements:
a. Hinge Jamb: Install smoke gaskets on jamb face of door frame so door will compress smoke gasket.
b. Header and Strike Jamb: Install smoke gaskets on face of stop of door frame so door will compress smoke gasket.
2. Install acoustical seal with seal under door.

END OF SECTION

SECTION 08 7913

KEY STORAGE AND CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Key cabinet.

B. Related Requirements:
   1. Section 08 0601: Keying schedule.
   2. Section 08 7101: Common Hardware Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Key Cabinet:
   1. Provide cabinet with 60 hooks minimum.
   2. 20 ga (0.95 mm) steel with prime coat and provided with lock.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Turn key cabinet over to Owner's designated representative at Substantial Completion with all keys required for every locking device on Project identified by tags and on hooks. Owner will be responsible for installation.

END OF SECTION

SECTION 08 8100

GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Quality of glazing used in entries, doors, and windows.

B. Related Requirements:
   1. Sections Under 08 1000 Heading: 'Doors And Frames' for furnishing and installing of flush wood door lites in new doors.
   2. Section 08 4229: 'Aluminum-Framed Entrances And Storefronts' for furnishing and installing of glazing in aluminum-framed storefront.

1.2 REFERENCES

A. Definitions:
   1. Glass Surface:
      a. Insulated glass unit:
         1) Surface 1: Exterior surface of outer lite.
         2) Surface 2: Interspace-facing surface of outer lite.
         3) Surface 3: Interspace-facing surface of inner lite.
         4) Surface 4: Interior surface of inner lite.
      b. Monolithic glass:
         1) Surface 1: Exterior surface.
         2) Surface 2: Interior surface.
   2. Insulated Glass: Two pieces of glass spaced apart and hermetically sealed to form single-glazed unit with air space between. Heat transmission through this type of glass may be as low as half that without air space. Also called double glazing, double pane, insulated unit, and thermal pane.
   3. Laminated Glass: Two or more sheets with inner layer of transparent plastic to which glass adheres if broken. Used for overhead, safety glazing, and sound reduction.
   4. Low-Emissivity Glass (Low-E): Reduces wintertime heat loss from interior with thin, almost colorless metallic coating that reflects heat back inside structure. Allows moderate solar heat gain while reducing harmful ultraviolet light in any season. Minimizes summertime air conditioning loss by reflecting radiated heat to outside. May be tempered for where safety glass is required. Available in single strength clear, gray and bronze (brown) color.
   5. Obscure Glass: Adds privacy where window coverings are impractical or undesirable. Various colors and texture patterns provide translucent or semi-opaque effect. May be tempered for use where safety glass is required.
   6. Shading Coefficient: Ratio of solar heat gain passing through a glazing system to solar heat gain that occurs under the same conditions if the window was made of clear, unshaded double strength glass. Lower SC number, the better solar control efficiency of glazing system.
   7. Solar Heat Gain Coefficient (SHGC): Ratio of total solar heat passing through a given window relative to the solar heat incident on the projected window surface at normal solar incidence. (Percentage of solar energy directly transmitted or absorbed and re-radiated into a building). Lower SHGC, the better it is able to reduce heat.
   8. Solar Reflectance (R): Percent of incident solar radiation that is reflected by window film/glass system. Lower the number, the less solar radiation reflected.
   9. Tempered Glass: Glass strengthened through process of heating, creating tensile strength that causes glass to resist breakage, yet disintegrate into small pieces if break occurs. Tempered glass is type of safety glass.
   10. U-Value: Measurement of heat transfer through film due to outdoor/indoor temperature differences. Lower U-value, less heat transfers. When using performance data, the lower U-value, better insulating qualities of window film/glass system.

11. Visible Light Transmitted (VLT): Percent of total visible light (380-780 nanometers) that passes through glass. Lower the number, the less visible light transmitted.

B. Reference Standards:
   1. American National Standards Institute:
      a. ANSI Z97.1-2009, 'Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test'.
   2. ASTM International:
      a. ASTM C1036-16, 'Standard Specification for Flat Glass'.
      b. ASTM C1048-18, 'Standard Specification for Heat-Treated Flat Glass - Kind H, Kind FT Coated and Uncoated Glass'.
      c. ASTM C1172-14, 'Standard Specification for Laminated Architectural Flat Glass'.
      d. ASTM C1281-16, 'Standard Specification for Preformed Tape Sealants for Glazing Applications'.
      e. ASTM E2190-10, 'Standard Specification for Insulating Glass Unit Performance and Evaluation'.
   3. Consumer Products Safety Commission (CPSC):
      a. 16 CFR, Part 1201 CAT 1 and 11, 'Safety Standard for Architectural Glazing Materials'.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's data sheets for each glass product and glazing material.

B. Informational Submittals:
   1. Qualification Statement:
      a. Installer:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Glazing shall meet applicable requirements of Federal Consumer Product Safety Standard 16 CFR 1201.
   2. Comply with published recommendations of glass product Manufacturers and organizations, except where more stringent requirements are indicated.

B. Qualifications:
   1. Installer: Requirements of Section 01 4301 applies, but not limited to following:
      a. Satisfactorily completed at least three (3) installations of similar size, scope, and complexity in each of past two (2) years and be approved by glass product Manufacturer before bidding.
      b. Upon request, submit documentation.

C. Certifications:
   1. Labels showing strength, grade, thickness, type, and quality are required on each piece of glass.
   2. Manufacturers/Fabricators certifying products furnished comply with project requirements.
   3. Insulating-Glass Certification Program: Indicate compliance with requirements of Insulating Glass Certification Council on applicable glazing products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Follow Manufacturer's instruction for receiving, handling, and protecting glass & glazing materials to prevent breakage scratching, damage to seals, or other visible damage.
   2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage And Handling Requirements:
   1. Follow Manufacturer's instruction for storing and protecting glass & glazing materials.
   2. Store materials protected from exposure to harmful environmental conditions and at temperatures and humidity conditions recommended by Manufacturer.
   3. Protect edge damage to glass, and damage/deterioration to coating on glass.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
   1. Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing material manufacturer or when joint substrates are wet due to rain, frost, condensation or other causes.

1.7 WARRANTY

A. Manufacturer Warranty:
   1. Insulating Glass Warranty:
      a. Manufacturer's standard form, signed by insulating-glass product Manufacturer/Fabricator, agreeing to replace insulating-glass units that exhibit failure of hermetic seal under normal use evidenced by obstruction of vision by dust, moisture, or film on interior surfaces of glass, for ten [10] years of date of installation.
   2. Installer's Warranty:
      a. Form acceptable to Owner, signed by glass product Installer, agreeing to replace glass products that deteriorate, or that exhibit damage or deterioration of glass or glazing products due to faulty installation, for two (2) years from date of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Manufacturer Contact List for Low E Glazing:
      a. AGC Flat glass North America, Kingsport, TN www.us.agc.com.
      b. Carlex (subsidiary of Central Glass Co., Ltd., Nashville, TN www.carlex.com.
      c. Guardian Industries Corp., Auburn Hills, MI www.guardian.com.
      d. Oldcastle BuildingEnvelope, Santa Monica, CA www.oldcastlebe.com.
      e. Pilkington North America Inc., Toledo, OH www.pilkington.com.
      f. Vitro Architectural Glass (formerly PPG glass), Cheswick, PA www.ppgglass.com

B. Design Criteria:
   1. Glazing for Fire-Rated Door and Window Assemblies: Glazing tested per NFPA 252 and NFPA 257, as applicable, for assemblies complying with NFPA 80 and listed and labeled per requirements of authorities having jurisdiction.

C. Storefront Glazing:
   1. Thickness: 1/4 inch (6 mm).
   2. Glazing shall have following characteristics:
      a. Low-Emissivity (or Low E):
         1) Design Criteria:

a) Clear.
b) Insulated Glass: 1 inch (25 mm) units with 1/2 inch (13 mm) airspace and two (2) 1/4 inch (6 mm) lites.
c) Meet requirements of ASTM C1036, Type I, Class I, Quality Q3.
d) Location: Surface 2.

2) Low-Emissivity (or Low E) Acceptable Product:
a) Performance Standard:
(1) 64 percent Visible Light Transmission (VLT).
(2) 0.28 U-value winter.
(3) 0.26 U-value summer.
(4) 0.27 Solar Heat Gain Coefficent (SHGC).
(5) 0.32 Shading Coefficient.
(6) 12 percent Visible Light Reflectance.
b) Quality Standard:
(1) Cardinal LoE³-366.
(2) Solarban 70 XL.
(3) Equal product by Acceptable Manufacturer as approved by Architect before bidding. See Section 01 6200.

3) Acceptable Manufacturers:
a) AGC.
b) Guardian.
c) Vitro Architectural Glass.
d) Equal as approved by Architect before bidding. See Section 01 6200.

b. Glazing Below Door Height:
1) Design Criteria:
a) Tempered.
b) Meet requirements of ASTM C1048, Kind FT, Condition A, Type I, Class I, Quality Q3.

D. Fabrication:
1. Except where glass exceeds 66 inches (1 675 mm) in width, cut clear glass so any wave will run horizontally when glazed.
2. Install muntins for exterior aluminum entries and aluminum windows between panes of insulating glazing units. No muntins on interior Vestibule storefront entries.
3. Sealed, Insulating Glazing Units:
a. Double pane, sealed insulating glass units. Install at exterior windows and exterior aluminum-framed storefront.
b. Unit Thickness: 5/8 inch (16 mm) minimum, one inch (25 mm) maximum.
c. Insulated obscure units shall consist of one pane of specified obscure glass and one pane of standard glass.
d. Type Seal:
1) Metal-to-glass bond and separated by 1/2 inch (12.7 mm) dehydrated air space.
2) Use non-hardening sealants.
e. Approved Fabricators. See Section 01 6200 for definitions of Categories.
1) Members of Sealed Insulating Glass Manufacturer's Association.

2.2 ACCESSORIES

A. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

B. Glazing Tape: Butyl-based elastomeric tape with integral resilient tube spacer, 10 to 15 Shore A durometer hardness, black color, coiled on release paper; widths required for specified installation, complying with ASTM C1281 and AAMA 800 for application.

PART 3 - EXECUTION: Not Used

END OF SECTION

DIVISION 09: FINISHES

END OF TABLE OF CONTENTS

SECTION 09 0503

FLOORING SUBSTRATE PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing floor substrate to receive flooring as described in Contract Documents.
   2. Remove existing flooring and prepare floor as described in Contract Documents.

B. Related Requirements:
   1. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
   2. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   3. Section 01 7800: 'Closeout Submittals'.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. ACI 302.2R-06, *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (August 15, 2006).
   2. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
   3. International Code Council (IBC):
      a. CBC Chapter 17, 'Structural Tests and Special Inspections'.

B. Definitions (Following are specifically referenced for testing):
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
   2. Approved: To authorize, endorse, validate, confirm, or agree to.
   3. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
   4. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
      a. Inspection: Not required by code provisions but may be required by Contract Documents.
      b. Special Inspection: Required by code provisions and by Contract Documents.
      c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
      d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.
   5. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operation, including installation, erection, application, and similar operations.

6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
7. Owner's Representative: Owner's Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.
8. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
9. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
10. Relative Humidity (RH) Testing: Testing of concrete slabs is defined as ratio of actual amount of water vapor present in volume of air at given temperature to maximum amount that air could hold at that temperature, expressed as percentage.
    a. Relative Humidity test method covers quantitative determination of percent relative humidity in concrete slabs for field or laboratory tests.
    b. Moisture test results indicate moisture condition of slab only at time of test.
11. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
12. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
13. Service Provider: Agency or firm qualified to perform required tests and inspections.
14. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
15. Special Inspection: See Inspection.
16. Special Inspector: Certified individual or firm that implements special inspection program for project.
17. Special Test: See Test.
18. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.
19. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
20. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
21. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

C. Reference Standards:
1. ASTM International:
    a. ASTM E329-11a: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
    b. ASTM E543-09, 'Standard Specification for Agencies Performing Nondestructive Testing'.
    c. ASTM E1212-09, 'Standard Practice for Quality Management Systems for Nondestructive Testing Agencies'.
    d. ASTM F710-10, 'Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring'.
    e. ASTM F2170-09, 'Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes'.

1.3 SUBMITTALS

A. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Record Documentation:
        1) Testing and Inspection Reports:

a) Testing Agency Testing Reports of Alkalinity and Concrete Moisture testing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage And Handling Requirements:
   1. Provide storage space and protection for flooring and installation accessories if materials are delivered before start of flooring installation.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
   1. Coordinate with each flooring system specification section for ambient conditions required for each floor system.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Flooring Preparation:
   1. Prepare floor substrate in accordance with Carpet And Rug Institute (CRI) best practices to receive carpet installation and to provide installation that meets Carpet Manufacturer's warranty requirements:
      a. Concrete floor slab patching:
         1) Cracks, chips and joints must be properly patched or repaired.
      b. Concrete surface cured, clean, dry, and free of foreign substances that will compromise carpet and/or other flooring installations.
         1) Removal of curing compounds.
         2) Remove glue, mastic, mortar, grout or residue after removal of existing flooring. Grind as necessary to remove any residue or slab imperfections prior to installation of new flooring.
         3) Remove paint, sealer, grease, oil, silicone sealants, and other materials incompatible with flooring adhesives.
         4) Removal of overspray from painted walls (essential so glue will stick).
   2. Vacuum and damp mop floor areas to receive flooring before flooring installation.

END OF SECTION

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install metal framing and furring systems and blocking as described in Contract Documents.

B. Related Requirements:
   1. Section 05 4010: 'Cold-Formed Load-Bearing Metal Framing'.
   2. Section 06 1100: 'Wood Framing' for wood blocking.

1.2 REFERENCES

A. Association Publications:
   1. Steel Framing Industry Association (SFIA):
      a. SFIA 'Technical Guide for Cold-Formed Steel Framing Products', www.sfia.net.
   2. Steel Stud Manufacturers Association (SSMA):
      a. 2015 IBC - SSMA 'Product Technical Guide'.

B. Definitions:
   1. Non-Structural Member: Member in steel-framed system that is not part of the gravity load resisting system, lateral force resisting system or building envelope.

C. Reference Standards:
   1. American Iron and Steel Institute (AISI):
      a. AISI S220-15, 'North American Specification For The Design Of Cold-Formed Steel Framing – Nonstructural Members'.
   2. ASTM International:
      a. ASTM A653/A653M-15, 'Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process'.
      b. ASTM A1003/A1003M-15, 'Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members'.
      c. ASTM C645-18, 'Standard Specification for Nonstructural Steel Framing Members'.
      d. ASTM C754-18, 'Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products'.
      e. ASTM C1513-18, 'Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections'.
      f. ASTM E119-18, 'Standard Test Methods for Fire Tests of Building Construction and Materials'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conferences:
   1. Schedule pre-installation conference to be held after submittals have been reviewed and returned by Architect, but before beginning metal framing work.
   2. In addition to agenda items specified in Section 01 3100, review following:
      a. Identify location of required blocking.

1.4 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Show special components and installations not fully dimensioned or detailed in Manufacturer's Product data.

B. Informational Submittals:
   1. Test And Evaluation Reports:
      a. ATI, ICC or other Approved Testing Agency (active member) Evaluation Report.
   2. Manufacturer Instructions:
      a. Technical product data, installation instructions, and recommendations for each component of system.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. ICC approved.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. CEMCO, City of Industry, CA www.cemcosteel.com.
      b. ClarkDietrich Building Systems, West Chester, OH www.clarkdietrich.com.
      c. Any member of Steel Framing Industry Association (SFIA).
      d. Any member of Steel Stud Manufacturer's Association (SSMA).
      e. Equal as approved by Architect before bidding. See Section 01 6200.

B. Materials:
   1. Framing:
      a. General:
         1) 20 gauge minimum, unless noted greater on Drawings, meeting requirements of ASTM C645.
         2) Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated.
         3) Steel Coating Requirement: Comply with ASTM C645 roll-formed from hot dipped galvanized steel complying with ASTM A1003/A1003M and/or ASTM A653/A653M G40 (Z120) or equivalent corrosion resistant coating. A40 galvannealed products are not acceptable.
            a) Coatings shall demonstrate equivalent corrosion resistance with evaluation report from approved testing agency.
      b. Steel Studs and Runners: Cold-formed galvanized steel C-studs, as per ASTM C645 for conditions indicated.
      c. Bridging, blocking, strapping, and other accessories shall be as described in Contract Documents or as required by Manufacturer's system.
      d. Acceptable Products:
         1) 362DS20P by CEMCO.
         2) ProSTUD 20 by ClarkDietrich Building Systems.
         3) 20 Ga 3-5/8 SS Series by Steeler Inc.
         4) Any member of Steel Framing Industry Association (SFIA).
         5) Any member of Steel Stud Manufacturer's Association (SSMA).
         6) Equal as approved by Architect before bidding. See Section 01 6200.

2. Firestop Tracks:
   a. Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
3. Headers and Jambs - Heavy-Duty Stud:
   a. Shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges.

C. Fasteners:
1. Corrosion resistant coated, self-drilling, self-threading steel drill screws complying with ASTM C1513.

2.2 ACCESSORIES

A. Sill Sealer: Closed-cell polyethylene foam, 1/4 inch (6 mm) thick by width of plate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Interface With Other Work:
1. Coordinate with other Sections to provide blocking necessary for their work.
2. Coordinate with other Sections for location of blocking required for installation of equipment and building specialties.

B. Tolerances:
1. 1/4 inch (6 mm) in 20 feet (6 meters), non-cumulative in length of wall.
2. 1/8 inch (3 mm) in 10 feet (3 meters) with 1/4 inch (6 mm) maximum in height of wall.
3. Distances between parallel walls shall be 1/4 inch (6 mm) maximum along length and height of wall.

C. Framing:
1. Installation Standard: ASTM C754.
2. Specifications of Stud Wall Manufacturer shall govern this work unless more stringent requirements are required by Contract Documents.
3. Install specified sill sealer under sill plates of exterior walls and of acoustically insulated interior walls.
4. Stiffen metal-framed walls with 3/4 inch (19 mm) 1-1/2 inches (38 mm) cold formed channels placed horizontally approximately 48 inch (1 200 mm) on center and securely attach to each stud.
5. Similarly reinforce door and window openings at headers with reinforcing channel extending 18 inches (450 mm) minimum each side of opening.
6. Apply double framing members at openings. Wrap multiple, adjacent framing members with duct tape or otherwise secure to eliminate 'chattering'.
7. Use grommets at framing penetrations where unsecured items pass through.

END OF SECTION

SECTION 09 2900

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install gypsum board as described in Contract Documents.

B. Related Requirements:
   1. Section 07 9219: Quality of acoustical sealants.
   2. Section 09 3013: Installation of backerboard joint reinforcing.
   3. Section 09 9413: Textured finishing.

1.2 REFERENCES

A. Definitions:
   1. Accessories: Metal or plastic beads, trim, or moulding used to protect or conceal corners, edges, or abutments of the gypsum board construction.
   2. Drywall Primer: Paint material specifically formulated to fill the pores and equalize the suction difference between gypsum board surface paper and the compound used on finished joints, angles, fastener heads, and accessories and over skim coatings.
   3. Skim Coat: Either a thin coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, over the entire surface.
   4. Texturing: Regular or irregular patterns typically produced by applying a mixture of joint compound and water, or proprietary texture materials including latex base texture paint, to a gypsum board surface previously coated with drywall primer.

B. Reference Standards:
   1. ASTM International:
      a. ASTM C11-10, 'Standard Terminology Relating to Gypsum and Related Building Materials and Systems.'
      b. ASTM C475/C475M-02(2007), 'Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.'
      c. ASTM C840-08, 'Standard Specification for Application and Finishing of Gypsum Board.'
      d. ASTM C1002-07, 'Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.'
      e. ASTM C1047-10, 'Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.'
      f. ASTM C1178/C1178M-08, 'Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.'
      g. ASTM C1396/C1396M-09a, 'Standard Specification for Gypsum Board.'
      h. ASTM E84-10, 'Standard Test Method for Surface Burning Characteristics of Building Materials.'
      i. ASTM E90-09, 'Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.'
      j. ASTM E119-10a, 'Standard Test Method for Fire Tests of Building Construction and Materials.'
      k. ASTM E413-04, 'Classification for Rating Sound Insulation.'

2. Gypsum Association:
   a. GA-214-07e, 'Recommended Levels of Gypsum Board Finish.'
   b. GA-216-07: 'Application and Finishing of Gypsum Panel Products.'
   c. GA-600-09, 'Fire Reference Design Manual.'
   d. GA-801-07, 'Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors.'
3. Underwriters Laboratories, Inc.
   a. UL 263: 'Test Method for Fire Tests of Building Construction and Materials.'
   b. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials; Tenth Edition September 10 2008.'

1.3 SUBMITTALS

A. Informational Submittals:
   1. Test And Evaluation Reports:
      a. Fire test results or assembly diagrams and numbers confirming products used will provide required fire ratings with installation configurations used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General:
   1. Following recommendations of GA-801 Guide for Handling and Storage of Gypsum Panel Products unless local, state or federal laws or agency rules differing from the recommendations shall take precedence.

B. Delivery And Acceptance Requirements:
   1. Deliver materials in original packages, containers, or bundles bearing brand name, applicable standard designation, and Manufacturer's name.

C. Storage And Handling Requirements:
   1. Store material under roof and keep dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack gypsum board flat to prevent sagging.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
   1. Comply with ASTM C840 or GA-216 requirements, whichever are more stringent:
      a. Do not install interior products until installation areas are enclosed and conditioned.
         1) Temperature shall be 50 deg F and 95 deg F maximum day and night during entire joint operation and until execution of Certificate of Substantial Completion.
         2) Provide ventilation to eliminate excessive moisture.
         3) Avoid hot air drafts that will cause too rapid drying.
      b. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. American Gypsum, Dallas, TX www.americangypsum.com.

b. CertainTeed Gypsum, Inc; Tampa, FL www.certainteed.com.
c. Georgia Pacific, Atlanta, GA www.gp.com.
d. National Gypsum, Charlotte, NC www.nationalgypsum.com.
e. Pabco Gypsum, Newark, CA www.pabcogypsum.com.
f. United States Gypsum Co, Chicago, IL www.usg.com.

B. Materials:
1. Interior Gypsum Board:
a. General:
1) Size:
a) Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
2) Quality Standard:
a) Core: Fire-resistant rated gypsum core.
b) Complies with Type X requirements of ASTM C1396/C1396M (Section 5).
c) Surface paper: Face paper suitable for painting.
d) Long edges: Tapered edge.
e) Overall thickness: 5/8 inch unless noted otherwise on the drawings.

2.2 ACCESSORIES

A. Manufacturers:
1. Manufacturer Contact List:
a. Kinetics Noise Control, Dublin, OH www.kineticsnoise.com.
b. Magnum Products, Lenaxa, KS www.levelcoat.com.
c. National Gypsum, Charlotte, NC www.nationalgypsum.com.
d. Soundproofing Co, San Marcos, CA www.soundproofing.org.
e. United States Gypsum Co, Chicago, IL www.usg.com.
f. Westpac Materials Inc, Orange, CA www.westpacmaterials.com.
g. Wm. Zinsser & Co, Somerset, NJ www.zinsser.com.
2. Gypsum Board Mounting Accessories:
a. Acceptable Products:
1) Resilient Sound Isolation Clips:
a) Sound Transmission: As per ASTM E90 and E413:
(1) IsoMax by Kinetics Noise Control.
(2) SSP Clips by Soundproofing Co.
(3) Equal as approved by Architect before installation. See Section 01 6200.
3. Corner And Edge Trim:
a. Metal, paper-faced metal, paper-faced plastic, or solid vinyl meeting requirements of ASTM C1047. Surfaces to receive bedding cement treated for maximum bonding.
4. Joint Compound:
a. Best grade or type recommended by Board Manufacturer and meeting requirements of ASTM C475/C475M.
1) Use Taping Compound for first coat to embed tape and accessories.
2) Use Taping Compound or All-Purpose Compound for subsequent coats except final coat.
3) Use Finishing Compound for final coat and for skim coat.

5. Joint Reinforcing:
a. Paper reinforcing tape acceptable to Gypsum Board Manufacturer.
6. Fasteners:
a. Bugle head screws meeting requirements of ASTM C1002:
1) Gypsum Board:
a) Type S: For fastening gypsum board to steel framing and ceiling suspension members, of length to penetrate steel framing 3/8 inch minimum.

b) Type W: For fastening gypsum board to wood members, of length to penetrate wood framing 5/8 inch minimum.

2) Glass Mat Gypsum Tile Backer:
a) Wood Framing: 11 ga (0.1233 in) galvanized with 7/16 inch head, hot dipped. Screws: Type W or Type S Hi-Lo, bugle head, rust resistant.
.

B. Primer / Surfacer On Surfaces To Receive Texturing:
1. Acceptable Products:
a. Sheetrock First Coat by USG.
b. Prep Coat by Westpac Materials.
c. Level Coat by Magnum Products.
d. Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Examine substrate and verify framing is suitable for installation of gypsum board.
2. Examine gypsum board before installation. Reject panels that are wet, moisture damaged, and mold damaged.
3. Notify Architect of unsuitable conditions in writing.
a. Do not install board over unsuitable conditions.
4. Commencement of Work by installer is considered acceptance of substrate.

3.2 INSTALLATION

A. Interface With Other Work:
1. Coordinate with Division 06 for location of backblocking for edges and ends of gypsum board and for blocking required for installation of equipment and building specialties.
2. Do not install gypsum board until required blocking is in place.

B. General: Install and finish as recommended in ASTM C840 or GA-216 unless specified otherwise in this Section.

C. Interior Gypsum Board:
1. General:
a. Install so trim and reinforcing tape are fully backed by gypsum board. No hollow spaces between pieces of gypsum board over 1/8 inch wide before taping are acceptable.
b. Rout out backside of gypsum board to accommodate items that extend beyond face of framing, but do not penetrate face of gypsum board, such as metal door frame mounting brackets, etc.
2. Single Layer Application:
a. Apply ceilings first using minimum of two men.
b. Use board of length to give minimum number of joints.
c. On walls over 108 inches high and on ceilings, apply board perpendicular to support.
d. Stagger end joints. End and edge joints of board applied on ceilings shall occur over framing members or be back blocked with 2x4 blocking. End joints of board horizontally applied on walls shall occur over framing members. Edge joints of board vertically applied on walls shall occur over framing members.
e. Butt edges in moderate contact. Do not force in place. Shim to level.

f. Leave facings true with joint, finishing flush. Vertical work shall be plumb and ceiling surfaces level.
g. Scribe work closely. Keep joints as far from openings as possible. If joints occur near an opening, apply board so vertical joints are centered over openings. No vertical joints shall occur within 8 inches of external corners or openings.
h. Install board tight against support with joints even and true. Tighten loose screws.
i. Caulk perimeter joints in sound insulated rooms with specified acoustical sealant.

3. Fastening:
   a. Apply from center of board towards ends and edges.
   b. Apply screws 3/8 inch minimum from ends and edges, one inch maximum from edges, and 1/2 inch maximum from ends.
   c. Spacing:
      1) Ends: Screws not over 7 inches on center at edges where blocking or framing occurs.
      2) Wood Framed Walls And Ceilings: Screws 7 inches on center in panel field.
      3) Metal Framed Walls: Screws 12 inches on center in panel field.
   d. Set screw heads 1/32 inch below plane of board, but do not break face paper. If face is accidentally broken, apply additional screw 2 inches away.
   e. Screws on adjacent ends or edges shall be opposite each other.
   f. Drive screws with shank perpendicular to face of board.
4. Trim:
   a. Corner Beads:
      1) Attach corner beads to outside corners.
         a) Attach metal corner bead with staples spaced 4 inches on center maximum and flat taped over edges of corner bead. Also, apply screw through edge of corner bead where wood trim will overlay corner bead.
         b) Set paper-faced trim in solid bed of taping compound.
   b. Edge Trim: Apply where gypsum board abuts dissimilar material. Hold channel and 'L' trim back from exterior window and door frames 1/8 inch to allow for caulking.
5. Finishing:
   a. General:
      1) Tape and finish joints and corners throughout building as specified below to correspond with final finish material to be applied to gypsum board. When sanding, do not raise nap of gypsum board face paper or paper-faced trim.
      2) First Coat:
         a) Apply tape over center of joint in complete, uniform bed of specified taping compound and wipe with a joint knife leaving a thin coating of joint compound. If metal corner bead is used, apply reinforcing tape over flange of metal corner bead and trim so half of tape width is on flange and half is on gypsum board.
         b) Completely fill gouges, dents, and fastener dimples.
         c) Allow to dry and sand lightly if necessary to eliminate high spots or excessive compound.
      3) Second Coat:
         a) Apply coat of specified joint compound over embedded tape extending 3-1/2 inches on both sides of joint center. Use finishing compound only if applied coat is intended as final coat.
         b) Re-coat gouges, dents, and fastener dimples.
         c) Allow to dry and sand lightly to eliminate high spots or excessive compound.
      4) Third Coat: Apply same as second coat except extend application 6 inches on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
      5) Fourth Coat: Apply same as second coat except extend application 9 inches on both sides of joint center. Allow to dry and sand with fine sandpaper or wipe with damp sponge.
   a. Finishing Levels: Finish panels to levels indicated below and according to ASTM C840, GA-216 or GA-214:

1) Gypsum Board Surfaces to Receive Multi-Color Coating System, and Painted Texturing, and Smooth Gypsum Board Surfaces:
   a) GA-214-07e Level 4: 'All and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer.'
2) Painted, Untextured Gypsum Board Surfaces, Except in Mechanical, Storage, And Utility Areas:
   a) GA-214-07e Level 5: 'All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over flat joints and one separate coat of joint compound applied over interior angles. Fastener heads and accessories shall be covered with three separate coats of joint compound. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges. Coat prepared surface with specified primer.'

3.3 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove and replace panels that are wet, moisture damaged, and mold damaged.
      a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
      b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.4 CLEANING

A. Remove from site debris resulting from work of this Section including taping compound spills.

END OF SECTION

SECTION 09 5113

ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install acoustical ceiling panels for suspended acoustical ceilings as described in Contract Documents.

B. Related Requirements:
   1. Section 09 5323: 'Metal Acoustical Suspension Assemblies'.
   2. Section 26 0000: 'Interior Lighting' for light fixtures.
   3. Division 23: Related sections for HVAC installed in ceiling.

1.2 REFERENCES

A. Association Publications:
   1. The Ceilings & Interior Systems Construction Association (CISCA), *Ceiling Systems Handbook*. 405 Illinois Avenue, 2B, St Charles IL. www.cisca.org.
      a. Recommendations for direct hung acoustical tile and lay-in panel ceilings.

B. Definitions:
   1. Acoustical Panel: Form of a prefabricated sound absorbing ceiling element used with exposed suspension systems.
   2. Absorption: Materials that have capacity to absorb sound. Absorption is the opposite of reflection.
   3. Ceiling Attenuation Class (CAC): Rates ceiling's efficiency as barrier to airborne sound transmission between adjacent closed offices. Shown as minimum value, previously expressed as CSTC (Ceiling Sound Transmission Class). Single-figure rating derived from normalized ceiling attenuation values in accordance with classification ASTM E413, except that resultant rating shall be designated ceiling attenuation class. (Defined in ASTM E1414.) Acoustical unit with high CAC may have low NRC.
   4. Center Line: Line indicating midpoint of surface in either direction. Used as guide in starting ceiling.
   5. Class A: Fire classification for product with flame spread rating of no more than 25 and smoke developed rating not exceeding 50, when tested in accordance with ASTM E84 or UL 723.
   6. Flame Spread: The propagation of flame over a surface.
   7. Flame Spread Index: Comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.
   8. Interior Finish: Interior finish includes interior wall and ceiling finish and interior floor finish.
   9. Mineral Base: Ceilings composed principally of mineral materials such as fibers manufactured from rock or slab, with or without binders.
   10. Noise Reduction Coefficient (NRC): Average sound absorption coefficient measured at four frequencies: 250, 500, 1,000 and 2,000 Hertz expressed to the nearest integral multiple of 0.05. Rates ability of ceiling or wall panel or other construction to absorb sound. NRC is fraction of sound energy, averaged over all angles of direction and from low to high sound frequencies that is absorbed and not reflected.
   11. Reflection Factor: Percentage of light a surface reflects.
   12. Reveal Edge: Acoustical lay-in panels with step-down edge are intended for use in direct hung exposed suspension systems.

13. Smoke-Developed Index: The numerical value assigned to a material tested in accordance with ASTM E84 or UL 723.
14. Sound Absorption: Property possessed by materials and objects, including air, of converting sound energy into heat energy. Sound wave reflected by surface always loses part of its energy. Fraction of energy that is not reflected is called sound absorption coefficient of reflecting surface. For instance, if material reflects 80 percent of sound energy, then sound absorption coefficient would be 20 percent (0.20).
15. Surface Burning Characteristic: Rating of interior and surface finish material providing indexes for flame spread and smoke developed, based on testing conducted according to ASTM Standard E84 or UL 723.
16. Textured Pattern: Granular or raised (fine, coarse, or a blend), felted or matted surface as an integral part of the basic product or superimposed on the product surface.

C. Reference Standards:
1. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (AASHRA):
   a. ASHRAE Standard 62.1-2016, 'Ventilation for Acceptable Indoor Air Quality'.
2. ASTM International:
   a. ASTM C423-17, 'Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method'.
   b. ASTM D3273-16, 'Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber'.
   c. ASTM E84-18b, 'Standard Test Method for Surface Burning Characteristics of Building Materials'.
   d. ASTM E119-18c, 'Standard Test Methods for Fire Tests of Building Construction and Materials'.
   e. ASTM E1111/E1111M-14, 'Standard Test Method for Measuring the Interzone Attenuation of Open Office Components'.
   f. ASTM E1264-14, 'Standard Classification for Acoustical Ceiling Products'.
   g. ASTM E1414/E1414M-16, 'Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum'.
   h. ASTM E1477 - 98a(2017), 'Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers'.
3. International Building Code (IBC) (2018 or most recent edition adopted by AHJ):
   a. Chapter 8, 'Interior Finishes':
      1) Section 803, 'Wall And Ceiling Finishes':
         a) 803.1.1, 'Interior Wall and Ceiling Finish Materials'.
         b) 803.1.2, 'Room Corner Test for Interior Wall or Ceiling Finish Materials'.
4. National Fire Protection Association:
   a. NFPA 101: 'Life Safety Code' (2018 or most recent edition adopted by AHJ).
   b. NFPA 265: 'Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls', (2015 or most recent edition adopted by AHJ).
5. Underwriters Laboratories Inc.:
   a. UL 723: 'Standard for Safety Test for Surface Burning Characteristics of Building Materials'; (11th Edition - 2018).
   b. ULC 102.2-18: 'Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies' (ULC S102.2).

1.3 SUBMITTALS

A. Action Submittals:
1. Produce Data: Technical data for each type of acoustical ceiling unit required.
2. Sample: Minimum 6 inch (150 mm) x 6 inch (150 mm) samples of specified acoustical panel.

B. Informational Submittals:
1. Certificates:
   a. Manufacturer's certifications that products comply with specified requirements including laboratory reports showing compliance with specified tests and standards. For acoustical

performance, each carton of material must carry approved independent laboratory classification of NRC, CAC, and AC.

2. Test And Evaluation Reports:
   a. If requested by Owner, provide copies of Quality Assurance requirements for ‘Class A’ flame spread rating and 'Room-Corner Test'.

C. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
   a. Warranty Documentation:
      1) Final, executed copy of Warranty.
   b. Record Documentation:
      1) Manufacturers Documentation:
         a) Manufacturer's literature.
         b) Color and pattern selection.

D. Maintenance Material Submittals:
1. Extra Stock Materials:
   a. Provide Owner with one (2) carton of each type of tile for future use.
      1) Packaged with protective covering for storage and identified with appropriate labels.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Fire-Test-Response Characteristics: As determined by testing identical ceiling tile applied with identical adhesives to substrates according to test method indicated below by qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Surface-Burning Characteristics:
      1) Ceiling tile shall have Class A flame spread rating in accordance with ASTM E84 or UL 723 Type 1.
         a) Class A (Flame spread index 0-25; Smoke-developed index 0-450).
         b) Flash point: None.
2. Passage of ‘Room-Corner Test' as recognized by AHJ, is required for system. Adhesive cited in test literature is required for installation of ceiling tile on Project.
   a. Room Corner Tests:
      1) ASTM E84, ‘Standard Test Method for Surface Burning Characteristics of Building Materials'.
      2) IBC 803.2.1, ‘Room Corner Test for Interior Wall or Ceiling Finish Materials’.
      3) NFPA 265: ‘Room Corner Test for Interior Wall or Ceiling Finish Materials’.
      4) UL 723, ‘Standard for Safety Test for Surface Burning Characteristics of Building Materials'.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
1. Store materials where protected from moisture, direct sunlight, surface contamination, and damage.
2. Store in cool, dry location, out of direct sunlight and weather, and at temperatures between 32 deg F (0 deg C) and 86 deg F (30 deg C).
3. Handle acoustical ceiling panels carefully to avoid chipping edges or damage. Use no soiled, scratched, or broken material in the Work.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
   1. Building shall be enclosed, mechanical system operating with proper filters in place, and temperature and humidity conditions stabilized within limits under which Project will operate before, during, and after installation until Substantial Completion.
   2. Installation shall be at temperatures between 32 deg F (0 deg C) and 86 deg F (30 deg C) or as per Manufacturer recommendations.

1.7 WARRANTY

A. Manufacturer's Warranty:
   1. Acoustical ceiling panels:
      a. Manufacturer’s warranty to be free from defects in materials and factory workmanship.
      b. Manufacturer’s warranty against sagging and warping.
      c. Manufacturer’s warranty against mold/mildew, and bacterial growth.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1. Armstrong World Industries, Lancaster, PA www.ceilings.com.
   2. USG Interiors Inc, Chicago, IL www.usg.com.

2.2 MATERIALS

A. Acoustic Ceiling Panels:
   1. Description:
      a. Color: White (surface factory-applied).
      b. Composition: Wet-formed mineral fiber.
   2. Design Criteria:
      a. Acoustics:
         1) Noise Reduction Coefficient (NRC): ASTM C423; 0.75 minimum.
         2) Ceiling Attenuation Class (CAC): ASTM E1414/E1414M; 35 minimum.
      b. Antimicrobial Protection: Resistance against growth of mold/mildew.
      c. Classification:
         1) Meet requirements of ASTM E1264, Type III (mineral base with painted finish), Form 1 (nodular) or Form 4 (cast or molded), Pattern E1 (lightly textured).
      d. Fire Performance: As specified in Quality Assurance in Part 1 of this specification.
      e. Light Reflectance (LR): ASTM E1477; 0.83 minimum.
      f. Sag Resistance: Resistance to sagging in high humidity conditions.
      g. VOC: Low.
   3. Wide Face Design:
      a. Design Criteria:
         1) Grid Face: 15/16 inch Prelude XL Exposed Tee.
         2) Size: 24 inch x 48 inch x 3/4" Ultima 1910 by Armstrong
      b. Acceptable Manufacturers. See Section 01 6200:
         1) Armstrong
         2) USG
         3) Equal as approved by Architect before bidding. See Section 01 6200.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Inspect for defects in support that are not acceptable.
      a. All wet work (concrete, painting, and etc.) must be completed and dry.
      b. Temperature conditions within Manufacturer's written recommendation.
   2. Notify Architect of unsuitable conditions in writing.
      a. Do not install acoustical ceiling panels until defects in support or environmental conditions are corrected.

3.2 PREPARATION

A. Materials shall be dry and clean at time of application.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less than half width units at borders and comply with reflected ceiling plans. Coordinate panel layout with mechanical and electrical fixtures.

3.3 INSTALLATION

A. Install acoustical panels in coordination with suspended system, with edges resting on flanges of main runner and cross tees. Cut and fit panels neatly against abutting surfaces. Support edges by wall moldings.

B. Special Techniques:
   1. If recommended by Manufacturer, use tile one at a time from at least four (4) open boxes to avoid creating any pattern due to slight variations from box to box. Use tile from same color run in individual rooms to assure color match.
   2. Leave tile in true plane with straight, even joints.

3.4 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Remove and replace defective materials at no additional cost to Owner including, but not limited to following:
      a. Remove and replace damaged or broken acoustical ceiling panels.
      b. Remove and replace discolored acoustical ceiling panels to match adjacent.
      c. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.5 CLEANING

A. Clean exposed surfaces of acoustical ceiling panels, including trim, edge moldings, and suspension members.
   1. Comply with Manufacturer's written instructions for cleaning and touch up of minor finish damage.

B. Waste Management:
   1. Remove from site all debris connected with work of this Section.

END OF SECTION

SECTION 09 5323

METAL ACOUSTICAL SUSPENSION ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install metal acoustical suspension system as described in Contract Documents including:
      a. Suspension system framing.
      b. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

B. Related Requirements:
   1. Section 09 5113: 'Acoustical Panel Ceiling'.
   2. Section 26 5100: 'Interior Lighting' for electrical fixtures installed in ceiling.
   3. Division 21: 'Fire Suppression' for sprinklers installed in ceiling.
   4. Division 23: 'Mechanical' for related sections for HVAC installed in ceiling.
   5. Division 26: 'Electrical' for related electrical work.
   6. Division 27: 'Communications' for related sound and video work.

1.2 REFERENCES

A. Association Publications:
   1. The Ceilings & Interior Systems Construction Association (CISCA), 405 Illinois Avenue, 2B, St Charles IL. www.cisca.org.
      a. *'Ceiling Systems Handbook':* Recommendations for direct hung acoustical tile and lay-in panel ceiling installation.
      b. CISCA 0-2, *'Guidelines for Seismic Restraint for Direct*-hung Suspended Ceiling Assemblies (zones 0-2)' Covers Seismic Design Category C.
      c. CISCA 3-4, *'Guidelines for Seismic Restraint for Direct*-hung Suspended Ceiling Assemblies (zones 3-4)' Covers Seismic Design Category D, E, and F.
      d. *'Production Guide'*: Practical reference for ceiling systems and estimating costs.

B. Definitions:
   1. Ceiling Suspension System: System of metal members, designed to support a suspended ceiling, typically acoustical ceiling. My also be designed to accommodate lighting fixtures or air diffusers.
   2. Clips: Several clip designs are available to suit applications such as fire resistance, wind uplift and impact. Fire-resistance rated designs have exact requirements, including mandatory use of hold down clips for acoustical panels or tiles weighing less than 1 lb per sq ft (4.9 kg per sq m). For rooms with significant air pressure differential from adjacent spaces, retention clips may be necessary to retain panels in place. Maintaining air pressure values may also require perimeter panel seals, typically closed cell foam gasket with adhesive on one side.
   3. Compression Post (Vertical Strut, Seismic Struts): Rigid member used to provide lateral force bracing of suspension system.
   4. Cross Runner, Cross Tee: Cross runner is secondary or cross beams of mechanical ceiling suspension system, usually supporting only acoustical tile. Cross tee is inserted into main runner to form different module sizes. In some suspension systems, however, cross runners also provide support for lighting fixtures, air diffusers and other cross runners.
   5. Exposed Grid System: Structural suspension system for lay-in ceiling panels. Factory-painted supporting members are exposed to view. Exposed tee surfaces may be continuous or have integral reveal. Reveals are typically formed as channel or rail profiles extending down from tee leg.

6. Flange: Horizontal surface on face of tee, visible from below ceiling. Part of grid to which color cap is applied. Most grid system flanges are either 15/16 inch (24 mm) or 9/16 inch (14 mm).
7. Hanger Wires: Wire employed to suspend acoustical ceiling from existing structure. Standard material is 12 gauge (0.105 inch - 2.70 mm) galvanized, soft annealed steel wire, conforming to ASTM A641/A641M. Heavier gauge wire is available for higher load carrying installations, or situations where hanger wire spacing exceeds 4 feet (1.20 m) on center. Seismic designs or exterior installations subject to wind uplift may require supplemental bracing or substantial hanger devices such as metal straps, rods or structural angles.
8. Heavy-Duty Systems: Primarily used for installations in which the quantities and weights of ceiling fixtures (lights, air diffusers, etc.) are greater than those for ordinary commercial structure.
9. Hold Down Clip: Mechanical fastener that snaps over bulb of grid system to hold ceiling panels in place.
10. Main Beam, Main Runner, Main Tee: Primary or main beams of type of ceiling suspension system in which structural members are mechanically locked together. Provide direct support for cross runners and may support lighting fixtures and air diffusers, as well as acoustical tile. Supported by hanger wires attached directly to existing structure; or installed perpendicular to carrying channels and supported by specially designed sheet metal or wire clips attached to carrying channels.
11. Splay Wires: Wires installed at angle rather than perpendicular to grid.
12. Stiffening Brace: Used to prevent uplift of grid caused by wind pressure in exterior applications.
13. Suspension System: Metal grid suspended from hanger rods or wires, consisting of main beams and cross tees, clips, splines and other hardware which supports lay-in acoustical panels or tiles. Completed ceiling forms barrier to sound, heat and fire. It also absorbs in-room sound and hides ductwork and wiring in plenum.
14. T-Bar: Any metal member of "T" cross section used in ceiling suspension systems.

C. Reference Standards:
1. American Society of Civil Engineers/Structural Engineering Institute:
   a. ASCE/SEI 7-16, ‘Minimum Design Loads for Buildings and Other Structures' (Section 9, ‘Earthquake Loads).
2. ASTM International:
   a. ASTM A568/A568M-17a, ‘Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for’.
   b. ASTM A641/A641M-09a(2014), ‘Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire’.
   c. ASTM B117-18, 'Standard Practice for Operating Salt Spray (Fog) Apparatus’.
   d. ASTM C635/C635M-15, ‘Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings’.
   e. ASTM C636/C636M-13, ‘Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels’.
   f. ASTM D610-08(2019), ‘Standard Practice for Evaluating Degree of Rusting on Painted Steel Surfaces’.
   g. ASTM E580/E580M-17, ‘Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions’.
3. International Building Code (IBC) ((2018 or most recent edition adopted by AHJ):
   a. IBC 808.1.1.1, ‘Suspended Acoustical Ceilings’.
4. Underwriters Laboratories / American National Standards Institute:
   a. UL 263: 'Standard for Fire Test of Building Construction and Materials' (14th Edition).
   b. UL 723, ‘Standard for Safety Test for Surface Burning Characteristics of Building Materials' (11th Edition).
   c. ULC 102.2-18: ‘Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies' (ULC S102.2).

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate layout of suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, and fire-suppression systems.

2. All work above ceiling should be completed prior to installing suspended system. There should be no materials resting against or wrapped around suspension system, hanger wires or ties.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Provide Manufacturer's technical literature on suspension system including listing dimensions, load carrying capacity and standard compliance.
   2. Samples:
      a. Minimum 8 inch (200 mm) long samples of exposed wall molding and suspension system, including main runner/tee and cross runner/tee with couplings.

B. Informational Submittals:
   1. Certificates:
      a. Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
      b. Installer's certificates of training.
   2. Manufacturer's Instructions:
      a. Manufacturer's details and installation instructions for seismic bracing. If requested, provide copy of code requirements applicable to Project.

1.5 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. All system components conform to ASTM standards.
   2. Fire-Resistance Rating: UL approved metal suspension system.
   3. Meet seismic bracing requirements of ASCE 7, ASTM C635/C635M and ASTM C636/C636M or equivalent governing standard for project site.
   4. Seismic Standard: Acoustical ceilings shall be designed and installed to withstand the effects of earthquake motions according to the following:
      a. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E580/E580M.
      b. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's *'Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings-Seismic Zones 0-2*' (Apply to Seismic Categories A & B).
      c. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's '*Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies-Seismic Zones 3 & 4'* (Apply to Seismic Categories C, D, E & F).

B. Qualifications. Requirements of Section 01 4301 applies, but not limited to following:
   1. Installer:
      a. Installer training (Ceiling Masters training course or equivalent).
   2. Manufacturer:
      a. Manufacturer in good standing of CISCA (Ceiling and Interior Systems Construction Association).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

2. Store material in fully enclosed space protected against damage from moisture, direct sunlight, surface contamination, and general damage.

1.7 WARRANTY

A. Manufacturer Warranty:
1. Suspension system: Manufacturer warranty including repair or replacement of rusting as defined by ASTM D610 and defects in material or factory workmanship.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
1. Acceptable Manufacturers. See Section 01 6200.
a. Grid Face: 15/16 inch:
1) Armstrong World Industries Co, Lancaster, PA www.armstrong.com.

B. Materials:
1. Grid:
a. Systems shall meet requirements of ASTM C635/C635M, Heavy Duty suspension system required for Seismic Design Categories D, E, or F.
b. Exposed surfaces shall be finished with factory-applied white baked enamel.
c. Meet requirements of ASTM D610 for red rust.
d. Main runners and cross tees:
1) All main beams and cross tees shall be commercial quality hot-dipped galvanized (galvanized steel, aluminum, or stainless steel) as per ASTM A653/A653M. Main beams and cross tees are double-web steel construction with type exposed flange design.
2) Wide-face design - main runners and cross tees shall have 15/16” exposed face.
2. Performance Standards:
a. Prelude XL Systems by Armstrong required for Seismic Design Categories D, E, or F.
3. Wire Hangers, Braces, and Ties:
a. Zinc-Coated, carbon-steel wire meeting requirements of ASTM A641/A641M, Class 1 zinc coating, soft temper.
b. Size:
1) Standard size: 12 gauge (0.105 inch) (2.70 mm) galvanized, soft annealed steel wire.
2) Select wire diameter so its stress is less than yield when loaded at three (3) times hanger design load (ASTM C635/C635M), Table 1, ‘Direct Hung’) will be less than yield stress of wire but provide not less than 12 gauge (0.105 inch) (2.70 mm).
c. Protect with rust inhibitive paint.
4. Wall Molding: Channel section of cold-rolled electro-galvanized steel.
5. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations, including light fixtures, that fit type of edge detail and suspension system indicated. Provide moldings with exposed flange of same width as exposed runner.
6. Hold-down Clips: As required by UL to prevent lifting of panels under unusual draft conditions.
7. Seismic Joint Clip:
a. Required for Seismic Design Categories D, E, or F.
b. Quality Standard Product:
1) SJCG by Armstrong World Industries, Lancaster, PA www.armstrong.com.
2) Equal as approved by Architect before bidding. See Section 01 6200.
8. Seismic Suspension System:
a. Required for Seismic Design Categories A, B, C, D, E, or F:
b. Design Criteria:

1) Installation of ceiling system must be as prescribed by ICC-ES Evaluation Reports ESR-1222 or ESR-1308 and applicable code.
2) Meet requirements of ASTM A568/A568M for hot-dipped galvanized, cold-rolled steel.
3) Attach cross runners to wall with seismic clips.

c. Wall Molding Size: 7/8 inch (22 mm) for all seismic design categories (code approved).
d. Category Four Acceptable Products. See Section 01 6200 for definition of Categories.
1) ACM7 Clip by USG Inc, Chicago, IL www.usg.com.
2) BERC-2 Clip by Armstrong World Industries, Lancaster, PA www.ceilings.com.

9. Compression Posts/Struts:
a. Required for Seismic Design Categories D, E, or F.
b. Meet seismic requirements for Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
1. Inspect area receiving suspension system to identify conditions which will adversely affect installation.
a. Work trades work to be thoroughly dry and complete prior to installation.
b. Verify weather tightness of area to receive suspension system prior to installation.
2. Notify Architect of unsuitable conditions in writing.
a. Do not install ceiling panels until adverse conditions have been remedied.

3.2 INSTALLATION

A. Interface With Other Work:
1. All work above ceiling should be completed prior to installing suspended ceiling system including related work including drywall furring work, acoustical tile, light fixtures, mechanical systems, electrical systems, and sprinklers.

B. General:
1. Install suspension system and panels in accordance with Manufacturer's written instructions, and in compliance with ASTM C636/C636M, and with authorities having jurisdiction (AHJ).

C. Lay out suspension system symmetrically about center lines of room unless shown otherwise by Contract Drawings. Lay out system so use of tiles less than 1/2 size is minimized.

D. Suspend main runner/tee from overhead construction with hanger wires spaced 4 feet (1.20 m) on center along length of main runner/tee. Install hanger wires plumb and straight. Hanger wires shall not be installed in convenience holes.

E. Maintain suspension system in true plane with straight, even joints.

F. Suspension system joints shall be straight and in alignment, and exposed surface flush and level. Wherever system abuts walls, columns, and other vertical surfaces, furnish and install appropriate molding.

G. Install wall moldings at intersection of suspended ceiling and vertical surfaces. Miter corners where wall moldings intersect or install corner caps.

H. Support edges with wall moldings.

I. Locate light fixtures, speakers, and mechanical diffusers and grilles symmetrically in room insofar as possible (unless shown otherwise). Locate fixtures, speakers, diffusers, and grilles within suspension grid spaces and centered at least one (1) direction within grid. Installed fixtures shall not compromise ceiling performance.

J. Pay attention to required hanger wire placement and fixture protection. Individual component deflection not to exceed 1/360 of span.

K. Nails installed vertically into bottom of structural members, which are subject to pullout, shall not be used to support metal acoustical suspended assemblies:
   1. Nails may be used when installed horizontally into sides of structural members.
   2. Embedment must be at least 5/8 inch (15.9 mm).

L. Screws, eyebolts or lag bolts used to support metal acoustical suspended assemblies must have minimum embedment of 5/8 inch (15.9 mm) when installed into structural members.

3.3 FIELD QUALITY CONTROL

A. Field Inspections:
   1. Inspect:
      a. Suspended ceiling system.
      b. Hangers, anchors and fasteners.

B. Non-Conforming Work:
   1. Correct any work found defective or not complying with contract document requirements at no additional cost to Owner.

END OF SECTION

SECTION 09 6513

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install rubber base as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM F1861–08, ‘Standard Specification for Resilient Wall Base.'

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature or cut sheet on base and adhesive.
      b. Color selection.

1.4 FIELD CONDITIONS

A. Ambient Conditions:
   1. Store materials at not less than 70 deg F for at least 24 hours before using.
   2. Do not apply in temperatures below 70 deg F .

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Manufacturers. See Section 01 6200.
      a. Activa Rubber Flooring, Carlstadt, NJ www.rubberfloors.com.or Activa PRF,
      b. American Floor Products Co Inc (AFCO-USA), Gaithersburg, MD www.afco-usa.com.
      c. Burke Mercer Flooring Products, San Jose, CA www.burkemercer.com.
      d. Flexco by ESD Flooring Systems, Tuscumbia, AL www.marleyflexco.com.
      e. Johnsonite Flooring Products Div, Chagrin Falls, OH www.johnsonite.com.
      f. Roppe Rubber Corporation, Fostoria, OH www.roppe.com.
      g. Vinyl Plastics Inc VPI, Sheboygan, WI www.vpicorp.com.

B. Materials
   1. General:
      a. Molded or extruded meeting requirements of ASTM F1861, Type TP:
         1) Thermoplastic rubber, free from objectionable odors, blisters, cracks, and other defects affecting appearance or serviceability of rubber, and not containing fabric.
         2) Color pigments used shall be highly fade-resistant, insoluble in water, and resistant to light, alkali, and cleaning agents.

3) Design Standard.
a) Color as selected by architect from manufacturer’s standard colors.

2. Base:
   a. Size: 1/8 inch by 4 inch .
   b. Use preformed, molded external corners. Butt joint interior corners.
   c. Style: Coved.
3. Adhesive: Best for work as recommended by Manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect surfaces for conditions not suitable for installation. Surface to receive specified items shall be sound, clean, free from foreign matter, tightly nailed, and dry. Do not start work until defects are corrected.

3.2 PREPARATION

A. Remedy cracks and minor irregularities in substrate in accordance with Manufacturer's recommendations.

3.3 INSTALLATION

A. Install in manner to produce smooth, even finished surfaces tightly jointed and accurately aligned.

B. Fit specified items tightly. Use fillers where necessary. Fit neatly against projections, piping, electrical service outlets, etc.

C. Secure specified items with specified adhesive. Cement substantially to vertical surfaces including rubber base to cabinet work base.

D. Line up top and bottom lines of base throughout.

E. Roll until firm bond has been established. Leave level, free from buckles, cracks, and projecting edges.

F. In wall runs longer than 12 inches, install no lengths of base shorter than 12 inches long.

3.4 ADJUSTING

A. Inspect and make necessary adjustments within one month after mechanical heat or other heat has been supplied continuously in finished areas.

3.5 PROTECTION

A. Keep traffic away until adhesive has set.

END OF SECTION

SECTION 09 6519

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install resilient tile flooring as described in Contract Documents.

B. Related Requirements:
   1. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
   2. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
   3. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   4. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   5. Section 01 7800: 'Closeout Submittals'.
   6. Section 03 3111: Provision of acceptable concrete substrate.
   7. Section 09 0503: Floor substrate preparation.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. ACI 302.2R-06, *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (August 15, 2006).

B. Reference Standards:
   1. ASTM International:
      a. ASTM F710-11, 'Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.'
      b. ASTM F2170-09, 'Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.'

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate completion of flooring installation with other trades.

B. Pre-Installation Conference: In addition to agenda items specified in Section 01 3100, review following:
   1. Participate in Pre-Installation Conference specified in Section 09 0503.
   2. In addition to agenda items specified in Section 01 3100, review following:
      a. Schedule conference after substrate preparation and TWO weeks before installation of flooring system.
      b. Review Testing Agency testing report of Alkalinity and Concrete Moisture of concrete slab.
         1) See Section 09 0503 for Options if concrete moisture tests of concrete slab exceeds Alkalinity and Concrete Moisture requirements for flooring.
   3. Review Flooring Manufacturer's installation conditions verification procedure and requirements.

4. Review Building Ambient Conditions including normal levels of humidity, lighting, heating, and air conditioning for acceptability for beginning floor preparation and flooring installation.

C. Scheduling:
1. Notify Testing Agency and Architect two weeks minimum before Pre-Installation Conference to allow testing for Alkalinity and Concrete Moisture of concrete slab.

1.4 SUBMITTALS

A. Action Submittals:
1. Product Data:
a. Manufacturer's literature or cut sheet on each component of system.
b. Maintenance instructions.
c. Color and style selection.

B. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Manufacturers documentation:
a) Manufacturer’s literature.
b) Color and style selection.
2) Testing and Inspection Reports:
a) Testing Agency Testing Reports of Alkalinity and Concrete Moisture testing.

C. Maintenance Material Submittals:
1. Extra Stock Materials:
a. Leave box of 20 extra tile of each pattern and color used on Project with Owner.

1.5 FIELD CONDITIONS

A. Ambient Conditions:
1. Building Conditions:
a. Conditions inside building shall be brought to levels to be normal at occupancy of building.
b. Conditions include normal levels of humidity, lighting, heating, and air conditioning.
2. Concrete Slab:
a. General:
1) Final determination as to whether or not a concrete slab is dry enough for flooring installation should be based on evaluating both Alkalinity and Concrete Moisture Vapor Emission Rate (MVER) testing.
b. Alkalinity:
1) Do not install sheet carpeting if alkalinity of concrete surface exceeds pH level 9. Corrective procedures are required.
c. Concrete Moisture Vapor Emission Rate (MVER):
1) Testing conditions inside building shall be brought to same ambient temperature and relative humidity levels to be normal at occupancy of building. Conditions include normal levels of humidity, lighting, heating, and air conditioning.
2) Do not install sheet carpeting if moisture vapor emission rate (MVER) of concrete slab relative humidity (RH) exceeds 75% as per ASTM F2170. Corrective procedures are required.
3. Application:
a. Maintain 70 deg F (21 deg C) minimum during application.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Patcraft: PO Box 2128, Dalton, GA 800-241-4014 info@patcraft.com
      b. Equals as approved by architect prior to bidding.

B. Materials:
   1. Reinforced Vinyl Tile:
      a. Product: 18 inch by 18 inches square - Verify size with Architect.
         1. Collection - Typography
         2. Style - Charted 1212V
         3. Color - Script 00530
      b. Meet or exceed Fed Spec SS-T-312b, Type IV.
         1) Equals as approved by Architect before bidding. See Section 01 6200.
   2. Adhesive: Water-resistant type. Best grade in accordance with Tile Manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify concrete surfaces are sufficiently cured and moisture content is within acceptable levels before beginning installation.

B. Evaluation And Assessment:
   1. Variation In Grade: Plus or minus 1/8 inch (3 mm) in any 10 feet (3 meters) of floor slab and distance between high point and low point of slab of 1/2 inch (12 mm).
   2. Testing Procedure: Place ends of straightedge on 3/8 inch (9 mm) high shims. Floor is satisfactory if 1/4 inch (6 mm) diameter steel rod rolled under straightedge will not touch anywhere along 10 foot (3 meter) length and 1/2 inch (12 mm) diameter steel rod will not fit under straightedge anywhere along 10 foot (3 meter) length.
   3. Notify Architect in writing if floor surface is not acceptable to install tile. Do not lay tile over unsuitable surface. Commencing installation constitutes acceptance of floor and approval of existing conditions.
   4. Confirm acceptance and approval of substrate with Architect before beginning installation of flooring system.

3.2 INSTALLATION

A. Special Techniques:
   1. Lay tile symmetrically about center line of spaces to insure even borders, unless shown differently on Drawings.
   2. Install beveled edge stripping at terminal edges of tile except at ceramic tile, carpet, and where Drawings indicate different detail. Conceal edging strips beneath doors.

3.3 FIELD QUALITY CONTROL

A. Field Tests:
   1. See Section 09 0503 ‘Flooring Substrate Preparation’ for Field Testing for Alkalinity and Concrete Moisture of concrete slab.

END OF SECTION

SECTION 09 9001

COMMON PAINTING AND COATING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Common procedures and requirements for field-applied painting and coating.

B. Related Requirements:
   1. Section 07 9213: 'Elastomeric Joint Sealants' for quality of Elastomeric Joint Sealants.

1.2 REFERENCES

A. Definitions:
   1. Damage Caused By Others: Damage caused by individuals other than those under direct control of Painting Applicator (MPI(a), PDCA P1.92).
   2. Gloss Levels:
      a. Specified paint gloss level shall be defined as sheen rating of applied paint, in accordance with following terms and values, unless specified otherwise for a specific paint system.

Gloss Level ‘1’	Traditional matte finish - flat	0 to 5 units at 60 degrees to 10 units maximum at 85 degrees.
Gloss Level ‘2’	High side sheen flat - 'velvet-like' finish	10 units maximum at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level ‘3’	Traditional 'eggshell-like finish	10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
Gloss Level ‘4’	'Satin-like' finish	20 to 35 units at 60 degrees and 35 units minimum at 85 degrees.
Gloss Level ‘5’	Traditional semi-gloss	35 to 70 units at 60 degrees.
Gloss Level ‘6’	Traditional gloss	70 to 85 units at 60 degrees.
Gloss Level “7’	High gloss	More than 85 units at 60 degrees.

   3. Properly Painted Surface:
      a. Surface that is uniform in appearance, color, and sheen and free of foreign material, lumps, skins, runs, sags, holidays, misses, strike-through, and insufficient coverage. Surface free of drips, spatters, spills, and overspray caused by Paint Applicator. Compliance will be determined when viewed without magnification at a distance of 5 feet (1.50 m) minimum under normal lighting conditions and from normal viewing position (MPI(a), PDCA P1.92).
   4. Latent Damage: Damage or conditions beyond control of Painting Applicator caused by conditions not apparent at time of initial painting or coating work.

B. Reference Standards:
   1. The latest edition of the following reference standard shall govern all painting work:
      a. MPI(a), 'Architectural Painting Specification Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.
      b. MPI(r), 'Maintenance Repainting Manual' by Master Painters Institute (MPI), as issued by local MPI Accredited Quality Assurance Association having jurisdiction.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Include following information for each painting product, arranged in same order as in Project Manual.
         1) Manufacturer's cut sheet for each product indicating ingredients and percentages by weight and by volume, environmental restrictions for application, and film thicknesses and spread rates.
         2) Provide one (1) copy of 'MPI Approved Products List' showing compliance for each MPI product specified.
            a) MPI Information is available from MPI Approved Products List using the following link: http://www.paintinfo.com/mpi/approved/index.shtml.
         3) Confirmation of colors selected and that each area to be painted or coated has color selected for it.
   2. Samples: Provide two 4 inch by 6 inch (100 mm by 150 mm) minimum draw-down cards for each paint or coating color selected for this Project.

B. Informational Submittals:
   1. Manufacturer Instructions:
      a. Manufacturer's substrate preparation instructions and application instruction for each painting system used on Project.
   2. Qualification Statement:
      a. Applicator:
         1) Provide Qualification documentation if requested by Architect or Owner.

C. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Record Documentation:
         1) Manufacturer's documentation:
            a) Manufacturer's cut sheet for each component of each system.
            b) Schedule showing rooms and surfaces where each system was used.

D. Maintenance Materials Submittals:
   1. Extra Stock Materials:
      a. Provide painting materials in Manufacturer's original containers and with original labels in each color used. Label each can with color name, mixture instructions, date, and anticipated shelf life.
      b. Provide one (1) quart of each finish coat and one (1) pint of each primer and of each undercoat in each color used.

1.4 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approval:
   1. Conform to work place safety regulations and requirements of those authorities having jurisdiction for storage, mixing, application and disposal of all paint and related hazardous materials.
   2. Paint and painting materials shall be free of lead and mercury, and have VOC levels acceptable to local jurisdiction.
   3. Master Painters Institute (MPI) Standards:
      a. Products: Comply with MPI standards indicated and listed in 'MPI Approved Products List'.
      b. Preparation and Workmanship: Comply with requirements in 'MPI Architectural Painting Specification Manual' for products and coatings indicated.

B. Field Samples:
   1. Before application of any paint system, meet on Project site with Architect, Owner's representative, and Manufacturer's representative. Architect may select one (1) surface for

application of each paint system specified. This process will include establishing acceptable substrate conditions required for Project before application of paints and coatings.

2. Apply paint systems to surfaces indicated by Architect following procedures outlined in Contract Documents and Product Data submission specified above.
3. After approval of samples, proceed with application of paint system throughout Project. Approved samples will serve as standard of acceptability.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Deliver specified products in sealed, original containers with Manufacturer's original labels intact on each container.
   2. Deliver amount of materials necessary to meet Project requirements in single shipment.

B. Storage And Handling Requirements:
   1. Store materials in single place.
   2. Keep storage area clean and rectify any damage to area at completion of work of this Section.
   3. Maintain storage area at 55 deg F (13 deg C) minimum.

1.6 FIELD CONDITIONS

A. Ambient Conditions:
   1. Perform painting operations at temperature and humidity conditions recommended by Manufacturer for each operation and for each product for both interior and exterior work.
   2. Apply painting systems at lighting level of 540 Lux (50 foot candles) minimum on surfaces to be painted.
      a. Inspection of painting work shall take place under same lighting conditions as application.
      b. If painting and coating work is applied under temporary lighting, deficiencies discovered upon installation of permanent lighting will be considered latent damage as defined in MPI Manual, PDCA P1-92.

PART 2 - PRODUCTS

2.1 SYSTEMS

A. Performance:
   1. Design Criteria:
      a. Provide materials for use within each coating 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.
      b. All materials, preparation and workmanship shall conform to requirements of ‘Architectural Painting Specification Manual’ by Master Painters Institute (MPI).
      c. All paint manufacturers and products used shall be as listed under Approved Product List section of MPI Painting Manual.
      d. Provide Premium Grade systems (2 top coats) as defined in MPI Architectural Painting Specification Manual, except as otherwise indicated.
      e. Where specified paint system does not have Premium Grade, provide Budget Grade.
      f. Provide products of same manufacturer for each coat in coating system.
      g. Where required to meet LEED (Leadership in Energy and Environmental Design) program requirements, use only MPI listed materials having an “L” rating designation.

B. Materials:
   1. Materials used for any painting system shall be from single manufacturer unless approved otherwise in writing by painting system manufacturers and by Architect. Include manufacturer approvals in Product Data submittal.
   2. Linseed oil, shellac, turpentine, and other painting materials shall be pure, be compatible with other coating materials, bear identifying labels on containers, and be of highest quality of an approved manufacturer listed in MPI manuals. Tinting color shall be best grade of type recommended by Manufacturer of paint or stain used on Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Directing applicator to begin painting and coating work will indicate that substrates to receive painting and coating materials have been previously inspected as part of work of other Sections and are complete and ready for application of painting and coating systems as specified in those Sections.

B. Pre-Installation Testing:
   1. Before beginning work of this Section, examine, and test surfaces to be painted or coated for adhesion of painting and coating systems.
   2. Report in writing to Architect of conditions that will adversely affect adhesion of painting and coating work.
   3. Do not apply painting and coating systems until party responsible for adverse condition has corrected adverse condition.

C. Evaluation And Assessment:
   1. Report defects in substrates that become apparent after application of primer or first finish coat to Architect in writing and do not proceed with further work on defective substrate until such defects are corrected by party responsible for defect.

3.2 PREPARATION

A. Protection Of In-Place Conditions:
   1. Protect other finish work and adjacent materials during painting. Do not splatter, drip, or paint surfaces not intended to be painted. These items will not be spelled out in detail but pay special attention to the following:
      a. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly specified.
      b. Keep cones of ceiling speakers completely free of paint.
      c. On existing work where ceiling is to be painted, speakers and grilles are already installed, and ceiling color is not being changed, mask off metal grilles installed on ceiling speakers. If ceiling color is being changed, remove metal grilles and paint, and mask off ceiling speakers.

B. Surface Preparation:
   1. Prepare surfaces in accordance with MPI requirements and requirements of Manufacturer for each painting system specified, unless instructed differently in Contract Documents. Bring conflicts to attention of Architect in writing.
   2. Fill minor holes and cracks in wood surfaces to receive paint or stain.
   3. Surfaces to be painted shall be clean and free of loose dirt. Clean and dust surfaces before painting or finishing.

3.3 APPLICATION

A. Interface With Other Work:
   1. Coordinate with other trades for materials and systems that require painting before installation.
   2. Schedule painting and coating work to begin when work upon which painting and coating work is dependent has been completed. Schedule installation of pre-finished and non-painted items, which are to be installed on painted surfaces, after application of final finishes.

B. Paint or finish complete all surfaces to be painted or coated as described in Contract Documents,

C. Apply sealant in gaps 3/16 inch (5 mm) and smaller between two substrates that are both to be painted or coated. Sealants in other gaps furnished and installed under Section 07 9213.

D. Spread materials smoothly and evenly. Apply coats to not less than wet and dry film thicknesses and at spreading rates for specified products as recommended by Manufacturer.

E. Touch up suction spots after application of first finish coat.

F. Paint shall be thoroughly dry and surfaces clean before applying succeeding coats.

G. Make edges of paint adjoining other materials or colors clean, sharp, and without overlapping.

H. Finished work shall be a 'Properly Painted Surface' as defined in this Section.

3.4 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Correct deficiencies in workmanship as required to leave surfaces in conformance with 'Properly Painted Surface,' as defined in this Section.
   2. Correction of 'Latent Damage' and 'Damage Caused By Others,' as defined in this Section, is not included in work of this Section.

3.5 CLEANING

A. General:
   1. As work proceeds and upon completion of work of any painting Section, remove paint spots from floors, walls, glass, or other surfaces and leave work clean, orderly, and in acceptable condition.

B. Waste Management:
   1. Remove rags and waste used in painting operations from building each night. Take every precaution to avoid danger of fire.
   2. Paint, stain and wood preservative finishes and related materials (thinners, solvents, caulking, empty paint cans, cleaning rags, etc.) shall be disposed of subject to regulations of applicable authorities having jurisdiction.
   3. Remove debris caused by work of paint Sections from premises and properly dispose.
   4. Retain cleaning water and filter out and properly dispose of sediments.

END OF SECTION

SECTION 09 9112

EXTERIOR PAINTED FERROUS METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing exterior ungalvanized iron and steel surfaces as described in Contract Documents.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200:
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved.

B. Description:
   1. New Surfaces: Use MPI(a) EXT 5.1M Waterborne Light Industrial Coating system .
   2. Previously Finished Surfaces: Use MPI(r) REX 5.1K Waterborne Light Industrial Coating.

C. Design Criteria:
   1. Systems specified are in addition to prime coats provided under other Sections of Project Manual.
   2. Finish Requirements: Use MPI Premium Grade finish requirements for work of this Section.
   3. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. All paints and coatings.
      a. Primer Coat: MPI Product 107, ‘Primer, Rust-Inhibitive, Water Based’.
      b. Finish Coats: MPI Product 163, ‘Light Industrial Coating, Exterior, Water Based, Semi-Gloss (MPI Gloss Level 5).
   2. Traffic signage:
      a. Green Performance Standard:
         1) Primer Coat: MPI Product 101, ‘Primer, Epoxy, Anti-Corrosive, for Metal’.
         2) Finish Coats: MPI Product 77, ‘Epoxy, Gloss (MPI Gloss Level 5).

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. New Surfaces: Clean metal to be painted of rust, mill scale, grease, oil, and welding spatters, burrs, flux, slag, and fume. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.

C. Existing Painted Surfaces:
   1. Remove deteriorated and chalked existing paint and rust down to sound substrate by scraping or power tools.
   2. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying primer coat.
   3. Spot prime bare metal surfaces followed by a prime coat over entire surface to be painted.
   4. Lightly sand entire surface.
   5. Clean surface as recommended by Paint Manufacturer.
   6. Apply specified finish coats.

END OF SECTION

SECTION 09 9113

EXTERIOR PAINTED GALVANIZED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing exterior exposed galvanized metal surfaces as Described in Contract Documents.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200.
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Handrails And Exposed Miscellaneous Structural Steel:
      a. New Surfaces: Use MPI(a) EXT 5.3D Pigmented Polyurethane Finish system.
      b. Previously Finished Work: Use MPI(r) REX 5.3D Pigmented Polyurethane Finish system.
   2. All Other:
      a. New Surfaces: Use MPI(a) EXT 5.3H Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 5.3H Latex Finish system.

C. Performance:
   1. Design Criteria:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
      d. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. Polyurethane:
      a. Vinyl Wash Primer Coat: MPI Product 80: ‘Primer, Vinyl Wash’.
      b. Finish Coats:
         1) Epoxy MPI Product 101: ‘Primer, Epoxy, Anti-Corrosive, for Metal’.
         2) Polyurethane MPI Product 72: ‘Polyurethane, Two-Component, Pigmented, Gloss (MPI Gloss Level 6-7)’.
   2. Latex:
      a. Waterborne Primer Coat: MPI Product 134: ‘Primer, Galvanized, Water Based’.
      b. Finish Coats: MPI Product 11: ‘Latex, Exterior Semi-Gloss (MPI Gloss Level 5)’.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. New Surfaces:
1. Clean 'passivated' or 'stabilized' galvanized steel as specified in SSPC-SP1.
2. After removal of 'passivated' or 'stabilized' coating or for surfaces without coating, clean surfaces to be painted with mineral spirits or product recommended by Paint Manufacturer. Change to clean rags or wiping cloths regularly to reduce possibility of re-contamination of surface.
3. Apply prime coat.
4. Apply finish coats.

C. Existing Painted Surfaces:
1. Remove deteriorated and chalked existing paint and rust deposits down to sound substrate by sanding, scraping, or wire brushing.
2. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
3. Apply prime coat.
4. Apply finish coats.

D. Existing Unpainted Surfaces:
1. Wirebrush or power wash as necessary to remove 'white rust'.
2. Apply prime coat.
3. Apply finish coats.

END OF SECTION

SECTION 09 9114

EXTERIOR PAINTED CMU, CONCRETE, STUCCO

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing exterior masonry, concrete, and stucco surfaces as described in Contract Documents.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200:
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Concrete:
      a. New Surfaces: Use MPI(a) EXT 3.1A Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 3.1A Latex Finish system.
   2. Stucco:
      a. New Surfaces: Use MPI(a) EXT 3.1A Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 3.1A Latex Finish system.
   3. CMU:
      a. New Surfaces: Use MPI(a) EXT 4.2A Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 4.2A Latex Finish system.

C. Performance:
   1. Finish Requirements:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
      d. Gloss / Sheen Level Required: Gloss Level 1.

D. Materials:
   1. Block Filler, New CMU Only: MPI Product 4: ‘Block Filler, Latex, Interior/Exterior’.
   2. Finish Coats: MPI Product 10: ‘Latex, Exterior Flat (MPI Gloss Level 1-2)’.

PART 3 - EXECUTION

3.1 PREPARATION

A. Except for steam cured products, cure cement type surfaces from 60 to 90 days in accordance with Paint Manufacturer's recommendations before painting.

3.2 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. New Surfaces:
1. On highly porous surfaces when weather is exceptionally hot and dry, it may be desirable to dampen surface before applying first coat of an emulsion paint.
2. Completely cover voids in masonry block.
3. Roll after spraying if necessary to eliminate pinholing.

C. Existing Painted Surfaces:
1. Remove deteriorated and chalked existing paint down to sound substrate by scraping and or high-pressure spray. Feather edges of existing paint by sanding to be smooth with adjacent surfaces.
2. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
3. Fill cracks with masonry crack filler.
4. Prime scraped and sanded areas.
5. Apply finish coat as required for new work.

D. Existing Unpainted Surfaces:
1. Power wash surfaces to be painted.
2. Fill cracks with masonry crack filler.
3. Apply block filler and finish coat as required for new work.

END OF SECTION

SECTION 09 9121

INTERIOR PAINTED POURED CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting of new and existing concrete floors to be left exposed in finished building, as described in Contract Documents.
   2. Preparing and painting following existing concrete floors as described in Contract Documents:

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200.
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. New Surfaces: Use MPI(a) INT 3.2A Latex Finish system
   2. Previously Finished Surfaces: Use MPI(r) RIN 3.2A Latex Finish system.
   3. Finish Requirements: Use MPI Custom Grade finish requirements.

C. Performance:
   1. Design Criteria:
      a. Gloss / Sheen Level Required: Semi-Gloss.

D. Materials:
   1. MPI Product 60: ‘Floor Paint, Latex, Low Gloss’.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. Existing Painted Surfaces:
   1. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Acid etch bare concrete areas, if necessary.
   2. Clean floors as recommended by Paint Manufacturer.
   3. Apply coating system.

END OF SECTION

SECTION 09 9122

INTERIOR PAINTED CMU

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing interior CMU walls as described in Contract Documents.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturer:
   1. Approved Products and Manufacturers. See Section 01 6200:
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Rest Rooms, And Custodial Rooms:
      a. New Surfaces: Use MPI(a) INT 4.2F Waterborne Epoxy Finish system.
      b. Previously Finished Surfaces: Use MPI(r) RIN 4.2E Waterborne Epoxy Finish system.
   2. All Other:
      a. New Surfaces: Use MPI(a) INT 4.2D Latex Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 4.2H Latex Finish system.

C. Performance:
   1. Design Criteria:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
      d. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. Block Filler, Over New Masonry Only: MPI Product 4: ‘Block Filler, Latex, Interior/Exterior’.
   2. Finish Coats: MPI Product 141: ‘Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)’.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. Existing Painted Surfaces:
   1. Remove deteriorated existing paint by scraping or sanding. Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
   2. Sand areas of existing sound paint if necessary for bonding of new paint system. Clean existing painted surfaces, sanded or not, with mild soap and water, or with tri-sodium phosphate (TSP).
   3. Fill large holes with patching and small holes and cracks with spackle.
   4. Apply one coat primer to scraped and sanded areas.
   5. Apply one finish coat. Completely cover voids in masonry block but do not fill.

END OF SECTION

SECTION 09 9123

INTERIOR PAINTED GYPSUM BOARD, PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing, priming, and finish painting new and existing interior gypsum board and plaster surfaces as described in Contract Documents.

B. Related Requirements:
   1. Section 09 9413: 'Interior Textured Finishing' for textured finishes.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Manufacturers and Products.
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Breakroom:
      a. New Surfaces: Use MPI(a) INT 9.2F Waterborne Epoxy Finish system.
      b. Previously Finished Surfaces: Use MPI(r) RIN 9.2E Waterborne Epoxy Finish system.
   2. All Other:
      a. New Surfaces: Use MPI(a) INT 9.2B Latex Finish system.
      b. Previously Finished Work: Use MPI(r) RIN 9.2B Latex Finish system.

C. Performance:
   1. Design Criteria:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade requirements.
      d. Gloss / Sheen Required:
         1) Breakroom: Gloss Level 6.
         2) Ceiling: Gloss Level 1 or 2 to match existing.
         3) Remaining Painted Surfaces: Gloss Level 5.

D. Materials:
   1. Primers:
      a. MPI Product 50, 'Primer Sealer, Latex, Interior'.
   2. Finish Coats:
      a. Breakroom:
         1) Buildings with only Gypsum Board surfaces in rooms:
            a) MPI Product 115, 'Epoxy-Modified Latex, Interior, Gloss (MPI Gloss Level 6)'.
      b. Ceiling:
         1) MPI Product 53, 'Latex, Interior, Flat (MPI Gloss Level 1)'.
      c. Remaining Painted Surfaces:
         1) MPI Product 141, 'Latex, Interior, High Performance Architectural, Semi-Gloss (MPI Gloss Level 5)'.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. New Surfaces:
   1. Primer: Apply primer to be covered with other paint coats with roller only, or with spray gun and back-rolled.

C. Existing Painted Surfaces:
   1. Remove deteriorated existing paint down to sound substrate by scraping or sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces.
   2. Clean surface with mild soap and water, or with tri-sodium phosphate (TSP). Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
   3. Spackle and tape cracks. Sand to smooth finish and spot prime.
   4. Sand or chemically etch existing painted surface as required to prepare surface to accept new paint.
   5. Re-clean surface.
   6. Apply primer coat.
   7. Apply finish coats.

END OF SECTION

SECTION 09 9124

INTERIOR PAINTED METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing interior metal surfaces as described in Contract Documents.

B. Related Requirements:
   1. Section 05 5871: 'Metal Brackets'.
   2. Section 09 9001: 'Common Painting And Coating Requirements':
   3. Section 23 0553: 'I. D. For HVAC Piping And Equipment' for field painting requirements of HVAC piping and equipment.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
   1. Paint brackets furnished under Section 05 5871 before installation of bracket.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200.
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Ferrous Metal:
      a. New Surfaces: Use MPI(a) INT 5.1B Waterborne Light Industrial Finish system.
      b. Previously Finished Surfaces: Use MPI(r) RIN 5.1B Waterborne Light Industrial Finish system.
   2. Galvanized Metal:
      a. New Surfaces: Use MPI(a) INT 5.3J Latex Finish system
      b. Previously Finished Surfaces: Use MPI(r) RIN 5.3AH Latex Finish system.
   3. Aluminum:
      a. New Surfaces: Use MPI(a) INT 5.4E Waterborne Light Industrial Finish system.
      b. Previously Finished Surfaces: Use MPI(r) REX 5.4E Light Industrial Finish system.

C. Performance:
   1. Design Requirements:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
      d. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. Primers:
      a. Ferrous Metal: MPI Product 107, 'Primer, Rust-Inhibitive, Water Based'.
      b. Galvanized Metal: MPI Product 134: 'Primer, Galvanized, Water Based'.
      c. Aluminum: MPI Product 95: 'Primer, Quick Dry, for Aluminum'.
   2. Finish Coats: MPI Product 153: 'Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)'.

PART 3 - EXECUTION

3.1 APPLICATION

A. General:
   1. See appropriate paragraphs of Section 09 9001.
   2. Systems specified are in addition to prime coats furnished under other Sections.

B. New Surfaces: Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.

C. Existing Painted Surfaces:
   1. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare metal surfaces immediately.
   2. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
   3. Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
   4. Apply prime coat over entire surface to be painted.
   5. Lightly sand entire surface.
   6. Clean surface as recommended by Paint Manufacturer.
   7. Apply finish coats.

END OF SECTION

SECTION 09 9125

INTERIOR PAINTED WOOD

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Preparing and painting new and existing woodwork and wood floors not requiring transparent finish, as described in Contract Documents.

B. Related Requirements:
   1. Section 09 9001: 'Common Painting And Coating Requirements':

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Approved Products and Manufacturers. See Section 01 6200:
      a. Products listed in edition of MPI Approved Product List current at time of bidding and later are approved, providing they meet VOC requirements in force where Project is located.

B. Description:
   1. Systems:
      a. All Other:
         1) New Surfaces: Use MPI(a) INT 6.3T or U Latex Finish system.
         2) Previously Finished Surfaces: MPI(r) Rin 6.3U Latex Finish system.

C. Performance:
   1. Design Criteria:
      a. New Surfaces: MPI Premium Grade finish requirements.
      b. Deteriorated Existing Surfaces: MPI Premium Grade finish requirements.
      c. Sound Existing Surfaces: MPI Custom Grade finish requirements.
      d. Gloss / Sheen Level Required: Gloss Level 5.

D. Materials:
   1. Woodwork:
      a. Primer Coat: MPI Product 39, ‘Primer, Latex, for Interior Wood’ or MPI Product 45, ‘Primer Sealer, Alkyd, Interior’.
      b. Finish Coats: MPI Product 153, ‘Light Industrial Coating, Interior, Water Based, Semi-Gloss (MPI Gloss Level 5)’.

PART 3 - EXECUTION

3.1 APPLICATION

A. General: See appropriate paragraphs of Section 09 9001.

B. Interface With Other Work:
   1. Properly clean and paint light cove interiors before installation of light fixtures.
   2. Where back-priming is required, apply one (1) coat of primer.

C. New Surfaces:
   1. Spot prime nail holes, cracks, and blemishes before and after puttying.
   2. Apply stain blocker or other product recommended by Paint Manufacturer to knots before applying primer coat.

D. Existing Painted Surfaces:
   1. Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare wood areas on woodwork.
   2. Wash surfaces that have been defaced with marking pens, crayons, lipstick, etc, with solvent recommended by Paint Manufacturer. Spot prime such surfaces.
   3. Apply finish coats.

END OF SECTION

SECTION 09 9413

INTERIOR TEXTURED FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and apply texturing on walls and ceilings to match existing as described in Contract Documents.

B. Related Requirements:
   1. Section 09 2900: Priming.
   2. Section 09 9001: 'Common Painting And Coating Requirements':
   3. Section 09 9123: Finish painting.

1.2 REFERENCES

A. Definitions:
   1. Drywall Texture: Compound rolled, sprayed, or troweled onto sheetrock after taping and floating of joints is complete. Uses same material as joint compound, but thinned down with water and applied to wall surface:
      a. Light Orange Peel: Sprayed texture leaves light splatter on walls. Resembles peel of orange. If done with fine spray, can be one of the lightest, least noticeable of the texture styles.
      b. Smooth - Smooth application of texture over sheetrock wall that feathers out sheetrock joints, and creates even, non-textured wall.

1.3 SUBMITTALS

A. Action Submittals:
   1. Samples:
      a. Light Orange Peel Texture:
         1) Provide minimum of three (3) 24 inch (600 mm) square control samples on primed gypsum wallboard of ‘light orange peel’ texture to show possible variations.

1.4 QUALITY ASSURANCE

A. Field Samples:
   1. Before performing work of this Section, prepare control samples.
   2. Architect will inspect control sample at pre-installation conference following preparation of control sample. When sample is approved, work of this Section may proceed. Approved samples will be kept at site at all times work of this section is being performed.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Manufacturers:
   1. Manufacturer Contact List:
      a. National Gypsum, Charlotte, NC www.nationalgypsum.com.
      b. U S Gypsum Co, Chicago, IL www.usg.com.

B. Materials:
   1. Quality Standards:
      a. ProForm Perfect Spray EM/HF by National Gypsum.
      b. Sheetrock Wall & Ceiling Texture by U S Gypsum.

PART 3 - EXECUTION

3.1 APPLICATION

A. Location:
   1. Walls and ceilings:
      a. Light Orange Peel Texture to match existing:
         1) All areas except those listed in following paragraph.

B. Finishing:
   1. Light Orange Peel Texture:
      a. After gypsum board is taped, sanded, and primed, apply texture. Closely match samples accepted by Architect.
   2. Smooth:
      a. After gypsum board is taped, sanded, and primed, apply texture.

END OF SECTION

DIVISION 10: SPECIALTIES

END OF TABLE OF CONTENTS

SECTION 10 1453

TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnishing and installing of exterior post-mounted site signage as described in Contract Documents.

B. Related Requirements:
   1. Section 03 3053: 'Miscellaneous Exterior Cast-In-Place Concrete' for quality requirements of concrete used for parking sign posts.

1.2 REFERENCES

A. Reference Standards:
   1. International Code Council / American National Standards Institute:
      a. ICC/ANSI A117.1-2010, ‘Accessible and Usable Buildings and Facilities'.
   2. U.S. Department of Justice:
      a. 2010 'ADA Standards for Accessible Design'.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Sign shall meet ANSI A117.1 accessibility code and ADA standards for accessible design and local and state authorities having jurisdiction (AHJ) requirements.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Permanently Mounted:
   1. Post Foundation Concrete: One cu ft cement, 2 cu ft (0.0566 cu m) sand, 4 cu ft (0.1132 cu m) gravel, and 5 gallons (18.93 liters) minimum to 6 gallons (22.71 liters) maximum of water.
   2. Post Setting Grout at Sleeves:
      a. Acceptable Products:
         1) Normal Construction Grout A by Bonsal American, Charlotte, NC www.bonsal.com.
         2) Advantage 1107 Grout by Dayton Superior Specialty Chemicals, Kansas City, KS www.daytonsuperiorchemical.com.
         3) NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com
         4) 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
         5) Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com
         6) Sonneborn / BASF Building Systems, Shakopee, MN www.chemrex.com.
         7) Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
         8) U S Spec MP Grout by U S Mix Products Co www.usspec.com.
         9) CG-86 Grout by W R Meadows, Hampshire, IL www.wrmeadows.com.
         10) Equal as approved by Architect before use. See Section 01 6200.

3. Accessible Parking Signs:
    a. Design Criteria:
        1) Meet regulatory agency requirements for accessibility.
        2) Sign graphics and lettering shall be minimum required by agency having jurisdiction:
            a) International symbol of accessibility should be posted on all accessible parking spaces and all accessible parking lot entrances.
            b) Letters must contain visual characters and high dark to light contrast between characters and background as per ADA requirements:
            c) Provide reflective background.
            d) Van-accessible parking spaces to have additional ‘text’ or ‘sign’ below the accessibility symbol to mark the van-accessible area specifically:
        3) Size: 12 inches (305 mm) x 18 inches (457 mm) aluminum sign.
        4) Sign shall have rounded corners.
    b. Acceptable Products:
        1) Parking signs by My Parking Sign, Brooklyn, NY www.MyParkingSign.com.
        2) Equal as approved by Architect before use. See Section 01 6200.
4. Posts:
    a. Handicap Accessible Parking Signage:
        1) Provide galvanized post as shown on Contract Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permanently Mounted:
    1. Locate as shown on Site Plan.
        a. Follow ADA guidelines and local and state authorities having jurisdiction (AHJ) for placement of sign requirements:
            1) Van accessible sign should be placed so that it is not obscured by anything including a standing van, vehicle or other obtrusive objects.
            2) Signs should be placed at such a height (at least 60 inches (1 500 mm) above surface) that they do not get obscured by any parked vehicles or other obstructions. Signs must be viewable from drivers' seat of vehicle and located right in view of parking spaces.
    2. Install signs square and plumb.
    3. Post Foundations:
        a. Follow requirements of Section 03 3053: 'Miscellaneous Exterior Cast-In-Place Concrete' for post foundation:
            1) Mix concrete components thoroughly, place in post foundation holes sized as shown on Contract Drawings.
        b. Mow Strips:
            1) At mow strips where shown on Site Plan, set top of post foundation below grade sufficient to allow for placing of mow strip.
        c. Placement Before Installation of Slabs:
            1) Measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post.
        d. Placement After Installation of Slabs:
            1) Where posts are installed after installation of slabs, core slab width of foundation diameter as shown on Contract Documents to accommodate post foundation.
    4. Handicap Accessible Parking Signage:
            1) Attach sign to galvanized steel posts as shown on Contract Drawings with stainless steel self tapping screws.
            2) Isolate dissimilar materials (steel tube and aluminum sign).

5. Post Foundations:
   a. Mix concrete components thoroughly, place in post foundation holes 8 inches (200 mm) in diameter by 36 inches (900 mm) deep, and set mounting sleeves. Sleeves shall extend 2 inches (50 mm) maximum above top of finish concrete elevation.
      1) Where posts are installed before installation of slabs, measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post.
      2) Where posts are installed after installation of slabs, core slab 8 inches (200 mm) in diameter minimum to accommodate post foundation.
   b. Install post in mounting sleeve so bottom of post is 6 inches (150 mm) from top of sleeve. Rivet post to mounting sleeve or bolt using tamper-proof bolts.

END OF SECTION

SECTION 10 1490

MISCELLANEOUS CODE SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Supplied But Not Installed Under This Section
   1. Code Signs

B. Related Sections
   1. Division 06: Installation

1.2 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: Schedule showing signs required, location, and text.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Restroom Accessibility Signs
   1. Men's – equilateral triangle 1/4" thick, 12" long edges with base parallel to floor and vertex pointing upward. ANSI A117.1 symbol for men.
   2. Women's – circle 1/4" thick, 12" in diameter. ANSI A117.1 symbol for women.
   3. Unisex – circle 1/4" thick, 12" in diameter. ANSI A117.1 symbol for unisex facilities.
   4. Mount in center of door at 60" above floor to symbol center.
   5. Brown background with contrasting symbol, engraved.

B. Handicap Symbol of Accessibility
   1. Mount on building exterior adjacent to accessible entrance; mount 40" above floor.
   2. Mount adjacent to accessible restrooms.
   3. White symbol on blue background.

C. Tactile Exit Signs
   1. Provide tactile exit signs as shown on drawings in compliance with CBC Section 1117B.5

D. Approved Manufacturers
   1. Inland Pacific – Spokane, WA (800) 541-4000
   2. CCSW Graphics – Corpus Christi, TX (800) 322-4515
   3. Mark Master – Tampa, FL (800) 441-6275
   4. South Texas Graphics Specialties, Inc. – Houston, TX (713) 467-4499
   5. AA White Company – Providence RI (401) 453-4300

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install signs square and plumb.

B. Mount with permanent two-sided tape.

END OF SECTION

SECTION 10 2813

COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Selected accessories for Rest Rooms:
      a. Sanitary Napkin Disposal Container.
      b. Toilet Tissue Dispenser
      c. Mirrors.
      d. Grab Bars.
      e. Napkin Disposal
      f. Soap Dispenser
      g. Seat Cover Dispenser
      h. Towel Dispenser / Waste Receptacle

B. Related Requirements:
   1. Section 09 2216: Blocking for metal framing
   2. Section 06 2001: Installation.

1.2 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings:
      a. Schedule showing items used, location where installed, and proper attaching devices for substrate.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Final, executed copy of Warranty.
      b. Record Documentation:
         1) Manufacturers documentation:
            a) Manufacturer's literature or cut sheets.

1.3 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's standard warranty against rusting.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Manufacturers:
   1. Manufacturer List:
      a. A & J Washroom Accessories, New Windsor, NY www.ajwashroom.com.
      b. American Accessories Inc (AAI), Denison, TX www.aaiusaonline.com.
      c. American Specialties Inc (ASI), Yonkers, NY www.americanspecialties.com.

d. Bobrick Washroom Equipment Inc, North Hollywood, CA www.bobrick.com or Bobrick Washroom Equipment of Canada Ltd, Scarborough, ON (416) 298-1611.
e. Bradley Corp, Menomonee Falls, WI www.bradleycorp.com.
f. General Accessory Manufacturing Co (GAMCO), Durant, OK www.gamcousa.com.

B. Materials:
1. Approved Products. See Section 01 6200.
a. Rest Rooms:
1) Sanitary Napkin Disposal Container:
a) Bradley, model 4722-15, surface mounted, satin finish as design standards
b) Equal as approved prior to bidding
2) Soap Dispenser:
a) Bradley, model 6120, wall-mounted, automatic dispensing stainless steel finish as design standards
b) Equal as approved prior to bidding
3) Mirrors: Frameless Glass with clip fasteners
a) Bradley, model 747-3636, 36” x36”, design standards
b) Equal as approved prior to bidding
4) Grab Bars:
a) Concealed mount, 18 ga (1.27 mm), type 304 stainless steel, 1-1/2 inch (38 mm) diameter, and peened (non-slip) finish in configuration shown on Drawings. Bradley design standards.
b) Equal as approved prior to bidding
5) Toilet Tissue Dispenser
a) Bradley, model 5402, dual roll, stainless steel as design standards
b) Equal as approved prior to bidding
6) Seat Cover Dispenser:
a) Bradley, model 5831, surface-mounted, 250 capacity, stainless steel, satin finish as design standards
b) Equal as approved prior to bidding
7) Towel Dispenser / Waste Receptical Combination
a) Bradley, model 2252-10, semi-recessed, high capacity towel dispenser and 4.9 gallon waste receptacle, stainless steel, satin finish as design standard
b) Equal as approved prior to bidding.
8) Towel Dispenser
a) Waxie, model 850593, clean & soft manual no touch system towel dispenser, dispenses 12” per pull, smoke black finish as design standard
b) Equal as approved prior to bidding.

PART 3 - XECUTION

3.1 INSTALLATION

A. Install using mounting devices proper for base structure.

B. Where possible, mount like items in adjoining compartments back-to-back on same partition.

END OF SECTION

SECTION 10 2814

BABY-CHANGING STATION

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Baby-changing station.

B. Related Requirements:
   1. Section 09 2216: 'Non-Structural Metal Framing' for blocking in metal-framed walls.
   2. Section 06 2001: Installation.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the efforts of the various trades affected by the Work of this Section.
   2. Coordinate completions of blocking in walls.

B. Sequencing:
   1. Install baby-changing stations after the following as been completed:
      a. Adjacent walls and ceilings are finished and painted.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer Instructions:
      a. Printed installation instructions.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Bonds:
         1) $10,000,000 minimum product liability insurance policy.
      b. Warranty Documentation:
         1) Include copy of final, executed warranty.
      c. Record Documentation:
         1) Manufacturers Documentation:
            a) Manufacturer's literature or cut sheets.

1.4 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's standard 5-year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

A. Approved Manufacturers. See Section 01 6200.
   1. Koala, Denver, CO www.koalabear.com.
   2. Equal as approved by Architect prior to bidding.

B. Baby Changing Station:
   1. Molded high impact polyethylene with integral straps for securing baby.
   2. Surface mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Verify that solid blocking has been installed where changing station is to be installed.
   2. Do not install unit by any other means other than screws or lag bolts into solid blocking.

3.2 INSTALLATION

A. Install items in accordance with Manufacturer's submitted, written instructions for screws or lag bolts into solid substrate. Install using mounting devices proper for base structure.

END OF SECTION

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Wall hung extinguishers and brackets.
   2. Extinguishers with cabinets.

B. Related Requirements:
   1. Section 06 1100: 'Wood Framing' for blocking in wood-framed walls.
   2. Section 06 2001: 'Common Finish Carpentry Requirements' for installation.
   3. Section 09 2216: 'Non-Structural Metal Framing' for blocking in metal-framed walls.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's literature or cut sheets for cabinets and extinguishers.

B. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Warranty Documentation:
         1) Include copy of final, executed warranty.
      b. Record Documentation:
         1) Testing and Inspection Reports:
            a) Testing Agency Inspecting Reports of Drilled-In Mechanical Anchors / Adhesive Anchors / Screw Anchors.

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Fire extinguishers shall be inspected and have annual inspection tag attached before Substantial Completion.

1.4 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's standard, written warranty on fire extinguisher.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Manufacturers:
   1. Fire Extinguishers:
      a. Approved Manufacturers. See Section 01 6200.
         1) Amerex Corp, Trussville, AL www.amerex-fire.com.

2) Ansul Incorporated, Marinette, WI www.ansul.com.
3) Buckeye Fire Equipment, Kings Mountain, NC www.buckeyef.com.
4) Extinguishers private-labeled by manufacturers approved above are approved, with appropriate documentation.

2. Cabinets And Brackets:
   a. Acceptable Manufacturers:
      1) J L Industries, Bloomington, MN www.jlindustries.com.
      2) Larsen's Manufacturing Co, Minneapolis, MN www.larsensmfg.com.
      3) Modern Metal Products / Technico, Owatonna, MN www.modern-metal.com.
      4) National Fire Equipment Ltd, Scarborough, ON www.nationalfire.com.
      5) Potter-Roemer, Cerritos, CA www.potterroemer.com.
      6) Samson Products Inc, City of Commerce, CA www.samsonproducts.com.
      7) Seton Inc, Richmond Hill, ON (905) 764-1122.
      8) Equal as approved by Architect before bidding. See Section 01 6200.

B. Acceptable Distributors:
   1. W.W. Grainger, Inc., Lake Forest, IL www.grainger.com.
   2. Equal as approved by Architect before bidding. See Section 01 6200.

C. Fire Extinguishers:
   1. Design Criteria:
      a. Ten pound dry chemical ABC stored pressurized type equipped with pressure gauge and which does not need recharging except after use.
      b. Instructions for repairs, maintenance, and recharging shall be attached.
      c. Unit shall be tested and approved by UL and have minimum 4A:60-B:C UL rating. UL rating shall appear on extinguisher labels and be attached to and a part of fire extinguisher units.

D. Fire Extinguisher Cabinets:
   1. Design Criteria:
      a. Two-piece, semi-recessed or flush type depending on wall thickness, and have white baked enameled steel tubs with white baked enamel return trim and doors, clear acrylic glazing, ‘Safe-T-Lock,’ and cylinder locks.
      b. Supply each cabinet with one specified fire extinguisher.
   2. Acceptable Manufacturers:
      a. Basis of Design Product: Ambassador 1017 G10 by J L Industries.
      b. Equal as approved by Architect before bidding from Acceptable Manufacturer’s equivalent product. See Section 01 6200.

E. Wall-Mounted Brackets:
   1. Design Criteria:
      a. Heavy duty with minimum of double strap/bracket.
   2. Approved Bracket. See Section 01 6200:
      a. Basis of Design Product: No. 846 by Larsen’s.
      b. Equal as approved by Architect before bidding from Approved Manufacturer’s equivalent product.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Special Techniques:
   1. Securely mount cabinets and hangers plumb with wall surfaces.
   2. Trim for cabinets shall be neat in appearance.

END OF SECTION

DIVISION 11: EQUIPMENT

SECTION 116000

ANIMAL EQUIPMENT

PART 1 - GENERAL

1.1 DEFINITIONS DESCRIPTION OF WORK

A. Types of equipment required include the following:
1. Dog Kenneling – UltraBase (AE-1)
2. Dog Kennel Guillotine Doors (AE-2)
3. Cat Cages – Comfort Suite (AE-3)
4. Intake Holding Cages (AE-4)
5. Grooming Tub (AE-5)
6. Grooming Table (AE-6)
7. Exam and Treatment Table (AE-7)
8. Scales (AE-8)
9. Pressure Washing System (AE-9)

B. Basis of Design: The Contractor's bid shall be based on the manufacturer and model identified as the Basis of Design. Other manufacturer and models may be considered as equal if approved by the Architect as a substitute. Refer to other sections of Project Manual for requirements.

C. The General Contractor is advised that the products in this section cannot be obtained from one single vendor and they will have to solicit bids for the various separate manufacturers listed.

1.2 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.3 QUALITY ASSURANCE

A. Qualifications: Engage manufacturing firms specializing in the manufacturing and installation of animal equipment. Manufacturer must have a minimum of five (5) years of production and installation experience of similar works and requirements of this Section. Installation must be done by factory-trained and approved personnel for the specific item they are installing.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for all equipment. Submit operating and maintenance instructions.

B. Shop Drawings: Prepare Floor Plans, Elevations, sections and details as necessary to convey the proper understanding of the scope of the work for each item.

1.5 DELIVERY AND STORAGE

A. Deliver products to project site in manufacturer's undamaged protective containers. Deliver products for interior spaces after spaces to receive them have been fully enclosed.

1.6 SPECIFIED PRODUCT WARRANTY

A. Submit manufacturer's standard written warranty. The length of warranty varies per product, but in no case less than 1 year.

PART 2 - PRODUCTS

2.1 DOG KENNELING - ULTRABASE (EQUIPMENT ITEM #AE-1)

A. Dog Kenneling – UltraBase Above Floor Kennels
1. Manufacturer
a. Midmark (formerly Mason Company) (804) 335-7235, themings@midmark.com (Basis of Design)

b. Direct Animal Products. 940-433-5468
c. LGL Animal Products, Inc. 979-690-3434

2. Materials
   a. Stainless Steel
3. Kennel Fronts and Gates
   a. Kennel Front: Height 6'-8" wide per width of kennel.
   b. Kennel Gate: Height 6'-0" min and width varies but 2'-0" minimum.
   c. Swing Gates and Fixed Panel (Base Bid):
      1) For Gates and Fixed Panels at the Staff Side provide perimeter frame and internal bracing shall consist of 1" x 18 gauge (.049" wall) square 304 A-554 welded stainless steel tubing with 180 grit polish. Each corner of the frame shall be TIG welded. For the top portion provide wire grids that shall be constructed of 304 stainless steel wire 3/16" in diameter in the vertical direction with 15/16" spacing between wires, and 304 stainless steel wire 3/16" in diameter in the horizontal direction with 3-5/8" or less spacing between wires. Horizontal and vertical wires shall be resistance welded at each juncture and each wire shall insert into the framework. Provide weep holes in the bottom of stainless steel tubes. At bottom portion of the Gates and Fixed Panels provide an isolation panel 4'-0" tall in an outer framework of 6063 T52 aluminum U Channel 3/4"x 3/4"x 1/8" thick consisting of a .400 HDPE substrate bonded with FRP sheets of .030 FRP on the outside of the enclosure and stainless steel sheets of #24 gauge (18-8 type 304-2B) with #22 gauge stainless steel on the inside of the enclosure. Solid panels to be perimeter sealed to the aluminum framework. The isolation channel shall be extruded 6063 T5 aluminum.
      2) For Gates and Fixed Panels at the Public Side provide perimeter frame and internal bracing shall consist of 1" x 18 gauge (.049" wall) square 304 A-554 welded stainless steel tubing with 180 grit polish. Each corner of the frame shall be TIG welded. At the top portion of the Gates and Fixed Panels provide glass panels that shall be constructed of 1/4" tempered glass held in place by a semi-rigid PVC extrusion inset into the aluminum framework of 6063-T52 aluminum U -channel 3/4" x 3/4" x 1/8" thick and shall be secured to the frame by means of stainless steel fasteners. At the bottom portion of the Gates provide wire grids at 4'-0" tall that shall be constructed of 304 stainless steel wire 3/16" in diameter in the vertical direction with 15/16" spacing between wires, and 304 stainless steel wire 3/16" in diameter in the horizontal direction with 3-5/8" or less spacing between wires. Horizontal and vertical wires shall be resistance welded at each juncture and each wire shall insert into the framework. Provide weep holes in the bottom of stainless steel tubes. At bottom portion of the Fixed Panels provide an isolation panel 4'-0" tall in an outer framework of 6063 T52 aluminum U Channel 3/4"x 3/4"x 1/8" thick consisting of a .400 HDPE substrate bonded with FRP sheets of .030 FRP on the outside of the enclosure and stainless steel sheets of #24 gauge (18-8 type 304-2B) with #22 gauge stainless steel on the inside of the enclosure. Solid panels to be perimeter sealed to the aluminum framework. The isolation channel shall be extruded 6063 T5 aluminum.
      3) Gate Hinges shall consist of two 3/8" diameter stainless steel hex head screws which shall be threaded into stainless steel tapped plugs inserted into the top and bottom of the door frame. Each plug shall contain a nylon pivot bushing for smooth precision rotation.
      4) Patented stainless steel two-way latch shall open both outward and inward. The latch shall secure automatically when gate is closed from the outward position and from the inward position it shall be able to latch and open from the inside of kennel. It shall be designed to accept a padlock. The two-way latch bar, the latch catch, and the swing pendant shall be made from 304 stainless steel.
      5) Gate Shall be designed and installed so the gates will swing both into the run and swing out of the run.
      6) Fixed panels on the Public Side shall be designed to include Built-in (Double Bowl Bracket: 2-1/2 Quart, 1 Quart) (Rotary Double Bowl Insert 2-1 quart.)

4. Side Walls
   a. The Kenneling Manufacturer to provide Isolation Panels of kennel material to go on top of the molded fiberglass Ultrabase floor system and extend up to 6'-8". The top of the isolation panel to align with the top of the Kennel front. Bottom portion of isolation panel shall be 48"

high, shall be installed with 3/4" wide keyhole clamps spaced on 8" center shall be the following materials: 24 gauge (.024") 304 stainless steel sheets bonded on each side of a .400" HDPE substrate in an outer framework of 6063-T52 aluminum U-channel 3/4" x 3/4" x1/8" thick. Solid panels to be perimeter sealed to the aluminum framework. Isolation channel shall be extruded 6063-T5 aluminum. Two panel hangers shall be provided for channels up to 10' long. Three panel hangers are used for panels over 10' long. Channels shall be secured and sealed to the top of the concrete curb with the "Silvis Seal". Patent pending Silvis Seals shall be a co-extrusion consisting of a rigid vinyl base and two flexible polyvinyl chloride (PVC) sealing ribs. Adhered to the top of the co-extrusion shall be two strips of 3M VHB double sided tape. Each seal shall have an additional end blocker consisting of a strip of closed cell neoprene foam with VHB double sided tape on one side. The upper portion of the isolation panel shall be Kennel material all of stainless-steel. Perimeter frame and internal bracing shall consist of 1" x 18 gauge (.049" wall) square 304 A-554 welded stainless steel tubing with 180 grit polish. Each corner of the frame shall be TIG welded. Wire grids shall be constructed of 304 stainless steel wire 3/16" in diameter in the vertical direction with 15/16" spacing between wires, and 304 stainless steel wire 3/16" in diameter in the horizontal direction with 3-5/8" or less spacing between wires. Horizontal and vertical wires shall be resistance welded at each juncture and each wire shall insert into the framework. Provide weep holes in bottom of stainless steel tube frames.

b. At Medical/Quarantine and Dog Holding runs the Kenneling Manufacturer to provide isolation opaque panels to go on top of the molded fiberglass Ultrabase floor system and extend up to 6'-8" at side walls of these runs. The isolation panel shall be installed with 3/4" wide keyhole clamps spaced on 8" center shall be the following materials: 24 gauge (.024") 304 stainless steel sheets bonded on each side of a .400" HDPE substrate in an outer framework of 6063-T52 aluminum U-channel 3/4" x 3/4" x1/8" thick. Solid panels to be perimeter sealed to the aluminum framework. Isolation channel shall be extruded 6063-T5 aluminum. Two panel hangers shall be provided for channels up to 10' long. Three panel hangers are used for panels over 10' long. Channels shall be secured and sealed to the top of the concrete curb with the "Silvis Seal". Patent pending Silvis Seals shall be a co-extrusion consisting of a rigid vinyl base and two flexible polyvinyl chloride (PVC) sealing ribs. Adhered to the top of the co-extrusion shall be two strips of 3M VHB double sided tape. Each seal shall have an additional end blocker consisting of a strip of closed cell neoprene foam with VHB double sided tape on one side.

5. Back walls
   a. The Kenneling Manufacturer to provide Isolation Panels of kennel material to go on top of the molded fiberglass Ultrabase floor system and extend up to 6'-8". The top of the isolation panel to align with the top of the Kennel back. The isolation panel shall be installed with 3/4" wide keyhole clamps spaced on 8" center shall be the following materials: 24 gauge (.024") 304 stainless steel sheets bonded on each side of a .400" HDPE substrate in an outer framework of 6063-T52 aluminum U-channel 3/4" x 3/4" x1/8" thick. Solid panels to be perimeter sealed to the aluminum framework. Isolation channel shall be extruded 6063-T5 aluminum. Two panel hangers shall be provided for channels up to 10' long. Three panel hangers are used for panels over 10' long. Channels shall be secured and sealed to the top of the concrete curb with the "Silvis Seal". Patent pending Silvis Seals shall be a co-extrusion consisting of a rigid vinyl base and two flexible polyvinyl chloride (PVC) sealing ribs. Adhered to the top of the co-extrusion shall be two strips of 3M VHB double sided tape. Each seal shall have an additional end blocker consisting of a strip of closed cell neoprene foam with VHB double sided tape on one side.

6. UltraBase Above Floor System
   a. Dimensions:
      1) Widths: 36" or 48".
      2) Depths: 48"or 72"
      3) Dimensional tolerances: ± 1/8".
   b. Materials:
      1) Molded, solid surface fiberglass-reinforced plastic.
      2) Honeycomb core: (1/2" for 3' units or 3/4" for 4' units) in the main floor area
      3) Features: Lightweight, and chemical-resistant.
   c. Surface Overlay:
      1) Steel Grey or Aurora granite flake polyester gelcoat

2) Final layer is filled polyester resin

d. Features:
1) 2” PVC drain with removable snap-in hair guard.
2) 3/ 4” plywood pads covered by fiberglass-reinforced plastic molded into each corner of the underside of the base unit.
3) Adjustable leveling legs:
a) ASTM A500 structural steel tubing, threaded at one with a threaded insert at the opposite end.
b) Four stainless steel bolts with lock nuts and adjustable flood pads for leveling

e. Resting Bench
1) 9.39 FRP bonded to a .400 HDPP fluted core.
2) Framework: 6063-T6 aluminum extrusions with aluminum angles and stainless steel flat head screws.
3) Debris guard: 1” grid polyethylene structural foam, 7/16” thick, running the width of the bench.
4) Pivot design: Bench pivots up into the upright position until manually lowered.

f. Panel Finish
1) 304 stainless steel overlay for high contact areas
2) FRP for non-exposed, lower-contact zones.

7. Cage Tops
a. Provide cage top covers where shown on the Animal Equipment Drawings drawing. Provide cage top covers at all Quarantine runs, Medical Isolation runs, Dog Intake Holding runs, Dangerous Dog runs, and Nursing Mother runs both Indoor and Outdoor runs. Also, provide cage top covers on end runs in each of the Adoption Wings, Stray Wings, and Transfer to provide a limited number of dog housing units to prevent “climbers” from climbing out (both indoor and outdoor runs). Provide 4 sets for indoor/outdoor runs. These locations are noted on the Animal Equipment drawings. Stainless steel top covers shall be perimeter frame and internal bracing shall consist of 1” x 16 gauge (.065” wall) square 304 A-554 welded stainless steel tubing with 180 grit polish. Each corner of the frame shall be TIG welded. Wire grids shall be constructed of 304 stainless steel wire 1/8” in diameter in both directions with 3” spacing between wire centerlines. All wires shall be resistance welded at each juncture. Wire grid shall be TIG welded securely to the square tubing framework. Provide weep holes in bottom of steel tube frame.

2.2 DOG KENNEL GUILLOTINE DOORS (EQUIPMENT ITEM #AE-2)

A. Transfer Doors (Guillotine)
1. Manufacturers- Midmark (formerly Mason Company) (804) 335-7235, themings@midmark.com (Basis of Design)
2. Materials: Vertical sliding doors shall be one of the following materials:
a. 1/4” thick Polymetal
b. Channels shall be sold extruded aluminum 6063-T6. Doors are raised or lowered by pulling or releasing a 3/32” stainless steel wire cable that is secured to the top of the door. Transfer doors come equipped with cable, “S” hooks, stainless steel adjustable direction pulleys, screw-eyes, and all necessary hardware for easy installation.
3. Size:
a. Standard Kennels (Large) - For openings up to 29” high x 17” wide.
b. Jumbo Kennels (Extra Large) – For openings up to 34” high x 17” wide. Provide at Jumbo kennels and any additional kennels noted on Animal Equipment plans. Verify locations with Owner.

Optional cable guards shall be made of 0.100” Aluminum sheet and shall be fastened to the channels with stainless steel screws.
4. Schedule
a. Provide one transfer door at each indoor/indoor set of dog kennels and any additional locations as noted on the Animal Equipment drawings. (Verify)

B. Dog-Bone Counterweight
1. Manufacturers – Midmark (formerly Mason Company) (804) 335-7235, themings@midmark.com (MS) (Basis of Design)
2. Outer shell shall be made if high-density polyethylene. Each counterweight shall have a threaded steel insert molded into the upper end to accommodate a supplied 3/8" galvanized steel eyebolt. Shot shall be securely contained inside the outer shell to reach the desired weight.
3. Schedule
   a. Provide one dog-bone counterweight at each dog run to be installed at indoor side of kennel and any additional locations as noted on the Animal Equipment drawings. (Verify)

C. Multi-Directional Multi-Application (MDMA) Pulley Hardware
1. Manufacturers – Midmark (formerly Mason Company) (804) 335-7235, themings@midmark.com (MS) (Basis of Design)
2. Pulley Hardware shall be made of type 403 stainless steel with the pulley sheave being made from polyoxymethylene. Mounting bracket to have multiple holes for use in multiple mounting applications including installation to:
   a. Building Walls
   b. Kennel Entry Gates
   c. Division Panels
3. Pulley Frame to attach to mounting bracket using a weld stud which allows for pulley sheave to pivot 360 and placed in a set position to allow smooth cable motion. Multiple mounting holes allow for up to (2) pulleys to be attached to one bracket allowing for counter-balanced applications. Pulley sheave shall have tapered edges to keep cable centered over sheave. Pulley frame to have sheave cover when placed in an upward position to prevent cable from derailing off of pulley system.
4. Schedule
   Provide one multi-directional multi-application (MDMA) pulley hardware at each dog run to be installed at indoor side of kennel and any additional locations as noted on the Animal Equipment drawings. (Verify)

2.3 CAT CAGES (EQUIPMENT ITEM #AE-3)

A. Cat Cages for Lobby cats, Adoption cats, stray cats, and medical cats.
1. Manufacturer- Midmark (formerly Shor-Line Company) (804) 335-7235, themings@midmark.com
   a. Model Number: 929.0039.12/ 929.0039.15 – 48" Comfort Suite w/ 30"W Main Space and 18" litter compartment, Stainless Steel
2. Materials:
   a. Each unit is made from an extruded PVC and a unique fine-celled foam board.
   b. Doors shall be all polycarbonate with diagonal vents on the litter space side. The door at the main living quarters side shall be stainless steel cage material on top portion and bottom portion, the middle portion shall be clear polycarbonate.
   c. Quiet time latches are made of stainless steel and Polyethylene and helps eliminate noise and added stress for patients.
   d. Patented Hinge Design is constructed of 14-gauge austenitic stainless steel that is encapsulated by an injected molded, fiberglass reinforced nylon 6/6 thermoplastic polymer.
   e. Horizontal portals can be closed/opened from the outside, as to not disturb the animal inside.
   f. Provide active (vertical) ventilation at each litter box unit for connection with .
   g. Additional options include; resting shelf, cat cave, additional condo vents, vertical port & optional storage doors/drawers.
3. Provide one (1) "kat kave" for each cage.
4. Size: 48" overall width (includes 18" litter space).
5. Installation
   a. Provide casters and mobile base for these cages (2 high).

2.4 INTAKE CAGES (EQUIPMENT ITEM #AE-4)

A. Manufacturers
1. Midmark (formerly Shor-line Company) (804) 335-7235, themings@midmark.com (Basis of Design)

B. Features

1. Cage constructed from Type 304 heavy-gauge stainless steel material. All seams shall be finished with precision heliarc seam welds.
2. Cages shall have fully-rounded inner corners.
3. A stainless steel front-to-rear support bar shall be included for the cages.
4. Outer door frame constructed of 3/8” diameter rod.
5. Door bars constructed with 1/4" horizontal rods and 3/16” vertical rods.
6. Hinge shall be constructed with 3/8” diameter rod.
7. Double latch shall be constructed from an 11 gauge latch bar.
8. Provide stainless steel trim strips and plates. Tight seal should be provided to all adjacent surfaces.

C. Model and Size
1. Model – 902.2424.70
2. Size – 24” x 24”
3. Configuration
   a. 3 cages wide x 2 cages high for a total of 6 at Animal Receiving

D. Installation
   a. Provide casters and mobile base for these cages (2 high).

2.5 GROOMING TUB (EQUIPMENT ITEM #AE-5)

A. Manufacturer: Midmark (formerly Shor-Line Company) (804) 335-7235, themings@midmark.com

B. Model No. Elite Grooming Tub, No. 904.0702.40 (RH) Drain (verify)

C. Materials – Stainless Steel

D. Features:
1. Dimensions: 60” H x 55.25” W x 24” D
2. Constructed with radiused corners along all the corners of the tub.
3. 45” angles on the front edges add an element of safety and aesthetic appeal.
4. Featuring our innovative STAMP (STeprAMP) system that collapses steps into a ramp. The STAMP system provides two functions in one and conveniently folds away under the shower for storage while not in use.
5. Slide in and slide out steps/ramp can be operated without bending down. No hands required.
6. Slip resistant tread on steps/ramp.
7. PVC Coated Tub Floors have the option of a floor panel set upon the rails to raise the showering platform to an ergonomic showering level.
8. Door is completely removable and features the hinges that are used on our cages.
9. Door latch is easy to use and constructed of the same long-lasting material as our hinges.
10. Sliding restraint ring design allows dogs to be turned around in the tub without detaching the safety lead.
11. Supply Caddy can be completely removed and 2 plugs are provided to close the mounting holes.
12. Includes: Supply Caddy, 2 PVC Coated Tub Floor Panels, Hair Trap Drain Insert and Restraint Ring.

E. Wall Mount Faucet with Coil Hose
1. Model No. 804.0006.72, 8 lbs.

F. Spill Resistant Vacuum Breaker
1. Model No. 804.0015.00, 2 lbs.

2.6 GROOMING TABLE (EQUIPMENT ITEM #AE-6)

A. Manufacturer: Midmark (formerly Shor-Line Company) (804) 335-7235, themings@midmark.com (Basis of Design)

B. Model Number: 903.3220 Hydraulic Lift. Color Selected by Owner

C. Features:
1. The only CSA/UL listed grooming table on the market
2. Pivoting grooming arms travels 180 degrees around the end of the table.
3. The arm locks into five positions horizontally, any position between 22” and 39” vertically. The loop hook has six position choices. All features allow the groomer to operate the table efficiently and comfortably.
4. Proprietary polyurethane coated table top provides a secure and comfortable surface for the pets. Plus, it’s durable and easy to clean.

5. You can operate our smooth and quite lifting system from both sides of the table.
6. Bright color lasts because of the powder coated, heavy-gauge steel construction.
7. The actuator lifts up to 200lbs. from 20” to 41” high.
8. Specs: Super- sized 40” L x 26” table top.

2.7 EXAM AND TREATMENT TABLE (EQUIPMENT ITEM #AE-7)

A. Manufacturers: Midmark (804) 335-7235, themings@midmark.com

B. Model No.: DT7.C791.AN Right Hand Table (Verify)
1. 60” Long table, Frost (verify color with Owner)
2. Overall Dimension: Exam Top is 60” L x 25” W

2.8 SCALES (EQUIPMENT ITEM #AE-8)

A. Manufacturer: Midmark (formerly Shor-Line Company) (804) 335-7235, themings@midmark.com (Basis of Design)

B. Model Number: 110-3110-00 Platform Scale, Post Mount

C. Features:
1. Stainless steel drip edge
2. The stainless steel top provides long-lasting durability and easy wipe-down cleaning.
3. HOLD key on the remote display allows the animal’s weight to be retained after leaving the platform.
4. Large 44” Lx22” W size with 300 lb capacity is ideal for weighing medium to large animals.
5. AC or battery power with low battery indicator and auto-off feature to extend battery life.
6. Adjustable feet for easy leveling.
7. Tare feature for weighing using baskets or crates.

2.9 PRESSURE WAHING SYSTEM (EQUIPMENT ITEM #AE-9)

A. Refer to Section 11 60 10 for more information.

PART 3 – EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer’s instructions and recommendations. Installation to be completed by factory-trained and approved personnel and the final installation on each item warrantied by the Manufacturer.

3.2 ADJUST AND CLEAN

A. Testing: Test each item to verify proper operation. Make necessary adjustments.

B. Accessories: Verify that accessory items required have been furnished and installed.

C. Safety: Ensure there are no sharp edges or protrusions that would be harmful to animals or people.

D. Cleaning: Remove packing material from equipment items and leave units in clean condition, ready for operation.

E. Provide training to Owners as needed, and provide Owner’s Manuals as well as, Cleaning and Care Instructions for all equipment.

END OF SECTION

SECTION 11 60 10

PRESSURE WASHING SYSTEM EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install equipment described in the Drawings and described in this Section.

B. Manufacturer shall include, but not be limited to the following equipment. Manufacturer shall engineer, fabricate and install pressure washing systems.
   1. Manufacturer shall provide engineering and services as required to provide a fully engineered, operational and component assembled system.
   2. Design of all piping and other accessories within the system boundaries.
   3. Arrangement of all piping and equipment on the system to allow for proper equipment access.
   4. Creation of preliminary and final I/O list.
   5. Assembly of a complete erection package, including the necessary requirements and specifications for field piping, and wiring, as well as for installing the equipment.
   6. Design of all wiring systems and supply of wiring interconnecting diagrams, schematics, and loop diagrams for all electrical equipment.
   7. Creation of O&M Manuals for the equipment.
   8. Purchasing, quality control, project management, scheduling services, transportation support, shop supervision, shop safety personnel, and all other project management services required to support the project.
   9. Manufacturer shall expedite the delivery of all equipment purchased in order to meet the schedule requirements; this includes continued correspondence with sub-manufacturers.
   10. Manufacturer shall include the following travel in their quote: as a minimum, one (1) trip to the site is required for equipment operation, safety, and maintenance training.
   11. Manufacturer is responsible for providing the correct specifications for materials of construction, relevant operating conditions including noise requirements and warranty requirements to all sub-manufacturers for all material and equipment purchased by Manufacturer.

1.2 RELATED WORK

A. Coordinate work of this Section with work of other Sections as required to properly execute the Work and as necessary to maintain satisfactory progress of the work of other Sections.

1.3 QUALITY ASSURANCE

A. Submit catalog cut sheets to the Owner for approval of the type, model, and finish of equipment and appliances.

B. Furnish items in proper operating condition and without any defects or damages to the finish.

C. Check and make necessary adjustments to insure that installed items operate faultlessly.

D. Manufacturer shall submit the following to the A/E for system approval, and shall not begin construction until the materials have been approved by the customer and A/E.
   1. Layout Drawing of central units and remote stations.
   2. Connections List
   3. Detailed Operation Manual

E. Manufacturer must demonstrate the system to the Owner and set up a local service firm.

1.4 REFERENCES

A. The Kennel Cleaning System covered by this specification shall meet the relevant portions of the following codes:
   1. AFBMA Anti-Friction Bearings Manufacturers Association
   2. ANSI American National Standards Institute
   3. ASME American Society of Mechanical Engineers
   4. ASTM American Society for Testing and Materials
   5. NEC National Electrical Code
   6. NEMA National Electrical Manufacturers Association
   7. NFPA National Fire Protection Association

8. OSHA Occupational Safety and Health Act
9. SDI Steel Deck Institute
10. UL Underwriters Laboratory

1.5 SUBMITTALS

A. Provide manufacturer's literature for Owner's approval before ordering.

B. Manufacturer shall supply with the quote a schedule of fabrication and delivery (including delivery of documentation) that meets the stated job requirements.

C. 2 sets of O&M Manuals shall be submitted with the system, and an electronic copy shall be provided.

1.6 WARRANTY

A. Turn over to the Owner guaranty or warranty certificates for the furnished equipment and appliances.

B. Equipment to be free from manufacturing defects for one (1) year from date to be determined as part of quoting process (warranty will begin after system startup and acceptance).

C. Repair or replace parts or materials found to be defective, provided written or verbal notice of the alleged defect is provided within one (1) year from date of the start of the warranty.

D. The warranty is not intended to include:
1. Ordinary wear and tear, erosion, corrosion.
2. Warranty labor at the customer site
3. Unintended use, misuse, abuse or improper handling, operation or storage by any third party.
4. Inability of Manufacturer or its subcontractors to make timely delivery on account of Acts of God, labor troubles, intervention or any civil or military authority, material shortages, delays by suppliers or any other cause reasonably beyond its control.

E. Equipment parts of accessories manufactured by others will carry the warranty (if any) of the manufacturer, or will be warranted by the system manufacturer, whichever warranty is longer.

F. Manufacturer is to provide diagnostic technical services (usually within the first 8 hours of notification of a problem).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. SMT Spray Master Technologies, Rogers AR., Phone 800-548-3373 (Basis of Design)

2.2 EQUIPMENT

A. Manufacturer shall include, but not be limited to the following equipment: Manufacturer shall engineer and fabricate a self-contained, ventilated Alkaline Hydrolysis System which shall contain the following major pieces of equipment, which are supplied by Manufacturer unless otherwise noted.

B. Central Units: 300-5131 PowerClean 2.0C, wall or rack mounted units both with Post Pump Chemical Injection for use with Rescue disinfectant.
1. 2 HP Motor
2. Dual Chemical Injection System post pump.
3. Master Control Panel with 24 V Lead
4. Thermal Limit Switch
5. Water Level Float Switch Assembly
6. Automatic Line Pressure Relief Manifold with SS Bleeder Valve
7. Manifold Hose
8. 6’ Water Inlet Supply Hose
9. Maintenance Kit: Water filter, replacement filter and one hydraulic oil with 5.7 GPH metering chemical pump & hour meter.
10. 10. 2.2 GPM, @ 1100 PSI, 115V
11. Two chemical delivery system.
12. Provide hanging stainless steel chemical bracket that holds up to 5 gallons.

C. Remote Stations: quick connect remote stations to be located at various locations of all animal housing areas, as needed to clean all animal housing areas.
1. 300-1267 Recessed Remote for wall, Top Entry, SS Tubing and Rotary Switch.

2. 300-1620- ½" Stainless Steel Tubing and Installation Supply Kit (100' each) OR adequate High Pressure Hose Installation Kits.
3. 300-2545 Winterize Valve Kit (Outdoor Remote Locations).
4. 042-0014 1/2" SS Compression Tee (tube to tube).
5. 300-1358 Deluxe Animal Care Package with "Shorty" Vari Nozzle Low Pressure Chemical Application and High-Pressure Rinse Gun, Trap Shooter, Wall and Tile Brush and Stainless-Steel Accessory Rack.
6. 300-5258 Portable Hose Reel without Hose or 300-5240 Wall Mounted Hose Reel or 300-0679 Retractable Hose Reel with 50' High Pressure Hose.
7. 300-…. High Pressure Hose up to 100' Long.

D. Each remote station requires a 2" PVC conduit chase within the wall from the location of the remote station to the space above an accessible ceiling. The material and labor for the PVC chase is not supplied by SMT and will need to be supplied and installed by the contractor, prior to the installation of the SMT system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accordance with layout shown on Drawings and in strict conformity with the manufacturer's recommendations.

B. Furnish necessary blocking, filler pieces, angles, moldings, and other finish items for complete installation and faultless operation of the equipment.

C. Installation: The entire system shall be installed by the Manufacturer's trained staff all in strict accordance with the Manufacturer's instructions and requirements.

3.2 QUALITY ASSURANCE AND CONTROL

A. The Manufacturer shall provide qualified personnel to assist in the equipment start-up and to provide operational and maintenance training to customer personnel if the customer selects that option.

3.3 DELIVERY AND STORAGE

A. The System shall be protected against water, dust and damage to the equipment during shipment.

B. The System shall be shipped directly to the Customer at the address listed in the purchase order. Freight shall be estimated and added to the price of the project.

3.4 START-UP AND ACCEPTANCE

A. Submit Operation Manual to the customer

B. Provide telephone technical coaching during startup and operation as required by the customer at no additional cost (standard with the system)

C. Verify system operating performance.

END OF SECTION

DIVISION 12: FURNISHINGS

SECTION 12 3661

QUARTZ COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Products Furnished But Not Installed Under This Section:
1. Quartz countertops.
2. Setting materials and accessories.

B. Related Sections:
1. Division 01: Administrative, procedural, and temporary work requirements.
2. Section 06 – Rough Carpentry for blocking
3. Section 07 – Joint Sealants.

1.2 REFERENCES

A. American National Standards Institute (ANSI):
1. A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
2. A118.4 - Latex-Portland Cement Mortar.

B. ASTM International (ASTM:
1. C97 - Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.
2. C99 - Standard Test Method for Modulus of Rupture of Dimension Stone.
3. C170 - Standard Test Method for Compressive Strength of Dimension Stone.
4. C241 - Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.
5. C482 - Standard Test Method for Bond Strength of Ceramic Tile to Portland Cement.
6. C484 - Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile.
7. C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.
8. C648 - Standard Test Method for Breaking Strength of Ceramic Tile.
9. C650 - Standard Test Method for Resistance of Ceramic Tile to Chemical Substances.
10. C672/C672M - Standard Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
11. C880 - Standard Test Method for Flexural Strength of Dimension Stone.
12. C1026 - Standard Test Method for Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling.
13. C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
14. E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Shop Drawings: Include countertop layout, dimensions, materials, finishes, cutouts, and attachments.

B. Samples:
1. 3 x 3 inch quartz samples in specified colors.
2. Joint sealer samples – full range of colors for selection.

1.4 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Minimum [2] years documented experience in work of this Section.

B. Mockup:
   1. Construct countertop mockup, [1]] foot wide, full depth, with splash.
   2. Larger sample as Approved mockup may remain as part of the Work.

1.5 WARRANTY

A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Design Standard - Zodiac Dupont Quartz
   1. Color - Antique Pearl
B. Equal as approved by architect prior to bidding.

2.2 MATERIALS

A. Quartz Sheet:
   1. Product: Zodiac Dupont Quartz
   2. Composition: Quartz aggregate, resin, and color pigments formed into flat slabs.
   3. Anti-microbial protection: Microban by Microban International, Inc., integral to sheet.
   4. Thickness: ½" minimum with turned down edges.
   5. Physical characteristics:
      a. Static coefficient of friction: 1.02 dry, 0.51 wet, tested to ASTM C1028.
      b. Water absorption: Maximum 0.03 percent, tested to ASTM C97.
      c. Compressive strength: Minimum 29,000 psi, tested to ASTM C170.
      d. Bond strength: Minimum 210 psi, tested to ASTM C482.
      e. Modulus of rupture: Minimum 6300 psi, tested to ASTM C99.
      f. Flexural strength: Minimum 5800 psi, tested to ASTM C880.
      g. Breaking strength: Minimum 480 lbf, tested to ASTM C648.
      h. Stain resistance: Not affected by 10 percent hydrochloric acid or 10 percent KOH, tested to ASTM C650.
      i. Thermal shock resistance: Pass 5 cycles, tested to ASTM C484.
      j. Abrasive index: 65-Ha = 25, tested to ASTM C241.
      k. Thermal expansion: 1.670 x 10^{-5} in/in/deg F, tested to ASTM C531.
      l. Deicing resistance: Rating of 0, tested to ASTM C672/C672M.
      m. Freeze/thaw resistance: 0 tiles at 15 cycles, tested to ASTM C1026.
      n. Flame spread rating: Class 1, tested to ASTM E84.

2.3 ACCESSORIES

A. Adhesive: Type recommended by quartz manufacturer.

B. Joint Sealer:
   1. Latisil Tile and Stone Sealant by Laticrete International, Inc.
   2. Color: To be selected from manufacturer's full color range.

2.4 FABRICATION

A. Cut quartz panels accurately to required shapes and dimensions.

B. Radius exposed edges.

C. Fabricate with hairline joints.

D. Cut holes for sinks, faucets and toilet accessories as needed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive countertops; remove loose and foreign matter than could interfere with adhesion.

3.2 INSTALLATION

A. Install countertops in accordance with manufacturer’s instructions and approved Shop Drawings.

B. Adhere countertops to supports with continuous beads of adhesive.

C. Set plumb and level. Align adjacent pieces in same plane.

D. Install with hairline joints.

E. Fill joints between countertops and adjacent construction with joint sealer; finish smooth and flush.

3.3 INSTALLATION TOLERANCES

A. Maximum variation from level and plumb: 1/8 inch in 10 feet, noncumulative.

B. Maximum variation in plane between adjacent pieces at joint: Plus or minus 1/16 inch.

3.4 CLEANING

A. Clean countertops in accordance with manufacturer's instructions.

3.5 PROTECTION

A. Protect installed countertops with non-staining sheet coverings.

END OF SECTION

SECTION 12 9313

BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Products Furnished But Not Installed Under This Section:
   1. Exterior mounted Bicycle Racks.

B. Related Requirements:
   1. Section 03 3053: 'Miscellaneous Cast-In-Place Concrete' for installation.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A53/A53M-12, ‘Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless’.
      b. ASTM A123 /A123M-12, ‘Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products’.
      c. ASTM A500/A500M-10a, ‘Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes’.

1.3 SUBMITTALS

A. Informational Submittals:
   1. Manufacturers' Instruction:
      a. Provide installation instruction including mounting and tolerances.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery And Acceptance Requirements:
   1. Materials shall be delivered in original, unopened packages with labels intact.

B. Storage And Handling Requirements:
   1. Protect materials and finish from damage during handling and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Columbia Cascade, Portland, OR www.timberform.com.
   2. Creative Pipe Inc, Hermosa Beach, CA www.creativepipe.com.
   3. Huntco Supply LLC, Portland, OR www.huntco.com.
   4. Madrax, Wannakee, WI www.madrax.com.

5. Bike Room Solutions, wwwbikeroomsolutions.com/
6. Equal as approved by Architect before bidding. See Section 01 6200.

2.2 MANUFACTURED UNITS

A. Exterior Bike Rack
   1. Serpentine Style.
   2. Mounting: In-Ground.
   3. Bicycle Capacity: As determined by Architect to conform to project requirements.
   4. Cast-in-place model fabricated from 2-3/8 inch (60 mm) outside diameter, 0.154 inch (3.912 mm) wall, Schedule 40 steel pipe.
   5. Finish:
      a. Powder coated after complete fabrication:
      b. Preparation:
         1) Steel must be free of any scale, paint, varnish, grease, or rust.
         2) Chemical wash and rinse.
         3) Apply corrosion-inhibiting iron phosphate treatment.
      c. Apply powder coating.
   6. Color: As selected by Owner from Manufacturers standard colors.

B. Acceptable Products:
   1. CycLoops by Columbia Cascade.
   2. Thunderbolt Series by Creative Pipe.
   3. BR Series by Huntco Supply.
   4. Heavy Duty Winder by Madrax.

PART 3 - EXECUTION: Not Used

END OF SECTION

DIVISION 22: PLUMBING

22 0500 COMMON WORK RESULTS FOR PLUMBING

22 0500 COMMON WORK RESULTS FOR PLUMBING

22 1000 PLUMBING PIPES AND PUMPS

22 3000 PLUMBING EQUIPMENT

22 4000 PLUMBING FIXTURES

END OF TABLE OF CONTENTS

SECTION 22 05 00

BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. CCR California Code of Regulation

B. CBC California Building Code

C. CFC California Fire Code

D. CEC California Electric Code

E. CMC California Mechanical Code

F. CPC California Plumbing Code

G. California Title 24 - Building Energy Efficiency Standards

H. SCAQMD South Coast Air Quality Management District

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Scope of Work:

1. Plumbing Work shall include, but is not necessarily limited to:

    a. Furnish and install all items listed in the Plumbing Material List.
    b. Extend existing domestic water piping system including cold, hot, and hot water circulating piping within the building. Insulate all piping as specified.
    c. Revise and/or replace water heaters.

d. Furnish and install condensate drain piping from plumbing related equipment such as ice machines.
e. Extend existing sanitary sewer and vent system.
f. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
g. Complete all applicable tests, certifications, forms, and matrices.

2. Air Conditioning and Ventilating Work: Refer to Section 23 05 00 "Basic HVAC Requirements".

1.4 OWNER FURNISHED PRODUCTS

A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.

B. This Contractor shall make all plumbing system connections shown on the drawings or as required for fully functional units.

C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Itemize all work and list associated hours and pay scale for each item.

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

a. Plumbing Contractor.
b. Air Conditioning and Ventilating Contractor.
c. Temperature Control Contractor.
d. Fire Protection Contractor.
e. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.

5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.
4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Electrical Code Article 725.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.

g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

a. Makeup Air Units.
b. Packaged Rooftop Units.
c. Water Heaters.
d. Hot Water Circulation Pumps.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control Subcontractor when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.
5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.7 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.

c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.
e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

a. Scale of drawings:

1) General plans: 1/4 Inch = 1 '-0" (minimum).
2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).

5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.8 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Ontario Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
22 05 00	Owner Training Agenda
22 05 05	Plumbing Demolition for Remodeling
22 05 29	Hangers and Supports
22 05 30	Roof Support
22 05 53	Plumbing Identification
22 05 93	Plumbing Testing, Adjusting and Balancing
22 07 19	Plumbing Pipe Insulation
22 10 00	Plumbing Piping Systems and Valves
22 10 30	Plumbing Specialties
22 11 23	Domestic Water Pumps
22 30 00	Plumbing Equipment
22 40 00	Plumbing Fixtures

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.

c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 22 XX XX.description.YYYYMMDD
    b. Transmittal file name: 22 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.10 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.11 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Motor windings and ventilation openings.
2. Bearings.
3. Equipment Pipe and Accessories connection openings. (e.g. boiler connections, coil connections, etc.)
4. Starter and control cabinets.
5. Heat transfer coils.
6. Pump Seals.
7. Combustion burner and blower equipment (e.g. combustion air intake, combustion vent/flue, etc.)

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.12 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.13 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone or flowable fill to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe wall penetrations are sealed.
c. Pipe identification and valve tags are installed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up or reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div22.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.
16. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Maintenance of equipment.
3. Start-up procedures for all major equipment.
4. Explanation of seasonal system changes.
5. Explanation of Owner’s Responsibilities to operate, maintain, and flush domestic water system (i.e., ASHRAE Standard 188).

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Domestic Hot Water System - 1 hours
2. All Domestic Water Systems operation, maintenance and flushing of all fixtures and dead legs - 1 hours

G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of two weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

H. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 PAINTING

A. This Contractor shall paint the following items:

1. All piping in mechanical room

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

H. Paint all outdoor exposed existing natural gas piping the color selected by Owner or Architect/Engineer.

I. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
3. Color of paint shall be as follows:

a. All piping in mechanical room:

1) Domestic Cold Water: Blue pipe/white letters
2) Domestic Hot Water: Red pipe/white letters
3) Sanitary Waste: Green pipe/black letters
4) Natural Gas: Yellow pipe/black letters

3.9 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All pumps operating and balanced.
3. All plumbing fixtures installed and caulked.
4. Pipe insulation complete, pipes labeled and valves tagged.
5. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 22 05 00

SECTION 22 05 05

PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical Demolition.

B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Existing Plumbing System: Maintain service to all plumbing fixtures until new piping is installed. Obtain permission from Owner at least 48 hours before shutting down system for any reason. Make changeover to new piping with minimum outage. Do not disconnect any roof drainage piping until new piping is in place and operational.

B. Demolish and extend existing plumbing work under provisions of Division 2 and this Section.

C. Remove, relocate, and extend existing installations to accommodate new construction.

D. Remove abandoned piping to source of supply and/or main lines.

E. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

F. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

G. Repair adjacent construction and finishes damaged during demolition and extension work.

H. Extend existing installations using materials and methods compatible with existing installations, or as specified.

I. Remove unused sections of domestic water piping back to mains and cap. Capped pipe shall be less than 2 feet from main to prevent "dead legs".

J. Temporarily cap all openings to the sanitary and vent system to prevent odor from entering the work area and building.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 22 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. Floor slab on grade is a structural slab. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid rebar or utilities encased in floor construction. Provide rebar dowels to replace damaged rebar and pin existing slab with patched slab. Refer to [**discipline**][**structural**] plans for additional information.

F. Floor slab is post-tensioned. All penetrations shall be X-rayed prior to cutting and/or drilling to avoid any tension cables or utilities encased in floor construction.

G. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes X-ray or similar non-destructive means.

H. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.

C. PLUMBING ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction. This Contractor shall complete any cleaning required for existing systems which are affected by construction dust and debris.

B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Architect/Engineer before proceeding.

END OF SECTION 22 05 05

SECTION 22 05 29

PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Equipment Bases and Supports.

C. Sleeves and Seals.

D. Flashing and Sealing of Equipment and Pipe Stacks.

E. Cutting of Openings.

F. Escutcheon Plates and Trim.

1.2 REFERENCES

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices

D. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 22 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:
   1. Steel and Cast Iron Pipe:

      a. Hanger Rod Diameter:

         1) 2-1/2" and smaller: 3/8"
         2) 3" through 3-5/8": 3/8"

3) 4" through 6": 1/2"

2. Copper Pipe:

a. Hanger Rod Diameter:

1) 2-1/2" and smaller: 3/8"

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

D. All hanger rods, nuts, washers, clevises, etc., in damp areas shall have ASTM A123 hot-dip galvanized finish applied after fabrication. This applies to the following areas:

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

3. Copper piping located in an exposed area, including indirect waste piping in janitor's closets, shall use split ring standoff hangers for copper tubing. Support shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp. Use electro-galvanized or more corrosion resistant and threaded rod for floor applications. Use anchors applicable to the wall type with corrosion resistant threaded rod for wall applications.

a. Products:

1) nVent/M-Co Model #456
2) Eaton Fig. 3198HCT
3) Anvil Fig. CT138R

B. Vertical Supports:

1. Support and laterally brace vertical pipes unless otherwise noted by applicable codes, but never at intervals over 15 feet Support vertical pipes with riser clamps installed below hubs, couplings, or lugs. Provide sufficient flexibility to accommodate expansion and contraction to avoid compromising fire barrier penetrations or stressing piping at fixed takeoff locations.

a. Products:

1) Eaton Fig B3373 Series
2) nVent 510 Series
3) Anvil Fig. 90

2. Cold Pipe: Place restrained neoprene mounts beneath vertical pipe riser clamps to prevent sweating of cold pipes. Select neoprene mounts based on the weight of the pipe to be supported. Insulate over mounts.

    a. Products:

        1) Mason RBA, RCA or RDA
        2) Mason BR

3. Cold Pipe Alternative: Insulated pipe riser clamp with no thermal bridging between clamp and pipe; water repellant calcium silicate insulation material adhered inside the clamp; ASTM A653 galvanized steel clamp.

    a. Products:

        1) Pipeshields E100

4. Wall supports shall be used where vertical height of structure exceeds minimum spacing requirements. Install wall supports at same spacing as hangers or strut supports along vertical length of pipe runs. Wall supports shall be coordinated with the Structural Engineer.
5. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

C. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp within their temperature limits of -65°F to +275°F.
3. Vertical cold pipe drops and rough-ins to fixtures shall be supported by insulated pipe clamps to prevent thermal bridging and condensation.
4. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
5. Unless otherwise indicated, hangers shall be as follows:

    a. Clevis Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches & Smaller

        1) Products: Bare Steel Plastic or Insulated Pipe:

            a) Anvil Fig. 260
            b) Eaton Fig. 3100
            c) nVent Model 400

        2) Products: Bare Copper Pipe Felt or PVC Coated:

            a) Eaton Fig. B3104F or B3100CTC
            b) Anvil Fig. CT65
            c) nVent Fig. 402

b. Continuous Channel with Clevis Type: Service: Plastic Tubing, Flexible Hose, Soft Copper Tubing:

1) Products:

a) Eaton Fig. B3106, with Fig. B3106V
b) nVent Model 104, with Model 104V
c) Anvil Fig. 1V

c. Adjustable Swivel Ring Type: Bare Metal Pipe - 4 inches and Smaller

1) Products: Bare Steel Pipe:

a) Anvil Fig. 69
b) Eaton Fig. B3170NF
c) nVent Model 115

2) Products: Bare Copper Pipe:

a) Eaton Fig. B3170CTC
b) nVent 102A0 Series
c) Anvil Fig. CT-69

6. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

7. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller

1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
3) Products: Bare Steel, Plastic or Insulated Pipe:

a) Unistrut Fig. P1100 or P2500
b) Eaton Fig. B2000 or B2400
c) Anvil Fig. AS1200
d) nVent USC

4) Products: Bare Copper Pipe:

a) Eaton Fig. BVT
b) nVent CADDY Cushion Clamp

D. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.

1) Minimum allowable tension loads for Douglass Fir/Southern Pine:

a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".

2) Limitations:

a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer's approval.
b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
d) Spacing: Refer to wood structure spacing of hangers.

3) Products:

a) Simpson RWV
b) DeWALT
c) ITI Sammys GT25

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 22 05 50 for additional requirements for concrete bases in seismic applications.
2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days.

5. Equipment requiring bases is as follows:

    a. Expansion Tank
    b. Water Heater

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

2.5 ROOF PENETRATIONS

A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe penetrations. Refer to drawings for details.

B. Conical Pipe Boot: Seal pipes with surface temperature below 150°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: By architect shall match roofing membrane.

C. Break insulation only at the clamp for pipes between 60°F and 150°F. Seal outdoor insulation edges watertight.

2.6 SLEEVES AND LINTELS

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Fabricate all lintels for masonry walls from structural steel shapes or as indicated on the drawings. Have all lintels approved by the Architect or Structural Engineer.

D. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.

E. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Architect/Engineer's design.

F. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

G. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

H. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

I. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

J. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, pipes passing through walls, ceilings, or floors shall have their annular space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing elements consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve. If piping carries only fluids below 120°F, sleeves may be thermoplastic with integral water seal and textured surface.
3. Sleeves shall be at least 2 pipe sizes larger than the pipes.
4. Pressure shall be maintained by stainless steel bolts and other parts. Pressure plates may be of composite material for Models S and OS.

5. Sealing element shall be as follows:

		Element	
Model	Service	Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	High/Low Temperature (Steam)	Silicone	-67°F to 400°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant/Stainless	Nitrile	-40°F to 210°F

6. Manufacturers:

   a. Thunderline Corporation "Link-Seals"
   b. O-Z/Gedney Company
   c. Calpico, Inc.
   d. Innerlynx
   e. Metraflex Company (cold service only)
   f. Polywater PHSD

2.7 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.8 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.9 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.10 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.

2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Steel (Std. Weight or Heavier - Liquid Service):

    a. Maximum Spacing:

        1) 1-1/4" & under: 7'-0"
        2) 1-1/2": 9'-0"
        3) 2": 10'-0"
        4) 2-1/2": 11'-0"
        5) 3": 12'-0"
        6) 4" through 6": 12'-0"

2. Hard Drawn Copper & Brass (Liquid Service):

    a. Maximum Spacing:

        1) 3/4" & under: 5'-0"
        2) 1": 6'-0"
        3) 1-1/4": 6'-0"
        4) 1-1/2": 6'-0"
        5) 2": 8'-0"

3. Plastic Pipe:

    a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

4. Ultra-Flexible Pipe, Flexible Hose, and Soft Copper Tubing:

   a. Continuous channel with hangers maximum 8'-0" OC.

I. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

END OF SECTION 22 05 29

SECTION 22 05 30

ROOF SUPPORT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rooftop Pipe Support

1.2 QUALITY ASSURANCE

A. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this section.

B. Installer: Installed by Contractor.

1.3 REFERENCES

A. International Building Code 2021

B. California Building Code (CBC)

1.4 SUBMITTALS

A. Submit under provisions of Section 22 05 00.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 COORDINATION

A. Coordinate layout and installation of anchoring with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

1.7 WARRANTY

A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 ROOF PIPING SUPPORTS

A. Non-Penetrating Pillow Block Supports:

1. Provide pre-fabricated non-penetrating pillow block roof pipe supports for all piping installed on the roof.
2. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. Acceptable Products:

    a. Anvil International HBS-Base Series
    b. Cooper B-Line Dura-Blok
    c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load)
    d. Miro Industries 1.5, 3-R, 4-R or 5-R (to match pipe)

PART 3 - EXECUTION

3.1 GENERAL

A. Install all items per manufacturer's instructions.

B. Piping crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the pipe, equipment connections, or support connections. Pipe offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent piping.

C. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

D. Supports shall extend directly to building structure.

E. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the drawings as being by others.

F. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

3.2 ROOF PIPING SUPPORTS

A. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.

B. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.

C. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

D. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories, to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.

E. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.

F. Support piping at equipment and valves so it can be disconnected and removed without further supporting the piping.

G. Piping shall not introduce strains or distortion to connected equipment.

H. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, and at equipment connections and heavy fittings.

I. Spacing: Refer to Supports and Anchors section for pipe spacing requirements.

END OF SECTION 22 05 30

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 22.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM B-1, B-3, and B-8 for copper conductors.

C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 “ 2kV Cables.

D. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00. Include list of items identified, wording, letter sizes, and color coding.

B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. 3M
2. Bunting
3. Calpico
4. Craftmark
5. Emedco
6. Kolbi Industries
7. Seton
8. W.H. Brady
9. Marking Services

2.2 MATERIALS

A. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"

2-1/2" to 6"	12"	1-1/4"

Plastic tags may be used for outside diameters under 3/4"

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

D. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

E. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

F. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem.
6. Number all tags and show the service of the pipe.
7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Apply markers and arrows in the following locations where clearly visible:

    a. At each valve.

b. On both sides of walls that pipes penetrate.
c. At least every 20 feet along all pipes.
d. On each riser and each leg of each "T" joint.
e. At least once in every room and each story traversed.

4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. CONDENSATE DRAIN: White lettering; green background
2. DOMESTIC COLD WATER: White lettering; green background
3. DOMESTIC HOT WATER - 115°F: White lettering; green background
4. DOMESTIC HOT WATER - 140°F: White lettering; green background
5. DOMESTIC HOT WATER CIRCULATING - 115°F: White lettering; green background
6. DOMESTIC HOT WATER CIRCULATING - 140°F: White lettering; green background
7. SANITARY SEWER: Black lettering; yellow background
8. VENT: Black lettering; yellow background
9. STORM SEWER (PRIMARY AND SECONDARY): White lettering; green background
10. NATURAL GAS: Black lettering; yellow background
11. All Underground Pipes: Varies

END OF SECTION 22 05 53

SECTION 22 05 93

PLUMBING TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjusting, and balancing of plumbing systems.

1.2 QUALITY ASSURANCE

A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer.

B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance, 2002.

B. ASHRAE - 2003 HVAC Applications Handbook; Chapter 37, Testing, Adjusting and Balancing.

1.4 SUBMITTALS

A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.

B. Electronic Copies:

1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.5 REPORT FORMS

A. Submit reports on AABC forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

B. Warranty/Guarantee must meet AABC National Project Performance Guarantee.

1.7 SCHEDULING

A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g., submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.

C. Recorded data shall represent actual measured or observed conditions.

D. Cut insulation, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.

E. Permanently mark setting of valves and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

F. Leave systems in proper working order, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.

G. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

A. Before beginning work, verify that systems are complete and operable. Ensure the following:

1. General Equipment Requirements:

a. Equipment is safe to operate and in normal condition.
b. Equipment with moving parts is properly lubricated.
c. Temperature control systems are complete and operable.
d. Proper thermal overload protection is in place for electrical equipment.
e. Direction of rotation of all pumps is correct.
f. Access doors are closed and end caps are in place.

2. Pipe System Requirements:

a. Strainer screens are clean and in place.
b. Shutoff, throttling and balancing valves are open.

B. Report any defects or deficiencies to Architect/Engineer.

C. Promptly report items that are abnormal or prevent proper balancing.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.

B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

A. ± 10% of scheduled values:

1. Adjust piping systems to ±10% of design values.

3.5 ADJUSTING

A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

B. Once balancing of systems is complete, at least one valve must be 100% open.

C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.

D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

A. Fill in test results on appropriate forms.

B. Complete all applicable tests, certifications, forms, and matrices listed in the Illinois Department of Public Health (IDPH) Final Occupancy Checklist Certifications for Request of Inspection.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.
2. Project location.
3. Project Architect.
4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.2 PLUMBING SYSTEMS

A. Pump Data:

1. Drawing symbol.
2. Service.
3. Manufacturer, size, and model.
4. Impeller size: specified, actual, and final (if trimmed).
5. Flow Rate (gpm): specified and actual.
6. Pump Head: specified, operating and shutoff.

7. Suction Pressure: operating and shutoff.
8. Discharge Pressure: operating and shutoff.

B. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, model, frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps for each phase.

C. Balancing Valve:

1. Drawing symbol.
2. Service.
3. Location.
4. Size.
5. Manufacturer and model.
6. Flow rate (gpm): specified and actual.
7. Pressure drop: specified and actual.

END OF SECTION 22 05 93

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping Insulation.

B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.

B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM C1729 - Standard Specification for Aluminum Jacketing for Insulation.

C. ASTM E84 - Surface Burning Characteristics of Building Materials.

D. NFPA 255 - Surface Burning Characteristics of Building Materials.

E. UL 723 - Surface Burning Characteristics of Building Materials.

F. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

G. California Title 24 - Building Energy Efficiency Standards.

1.4 SUBMITTALS

A. Submit shop drawings per Section 22 05 00. Include product description, list of materials and thickness for each service, and locations.

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

B. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75°F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations, use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.

2.2 VAPOR BARRIER JACKETS

A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

2.3 JACKET COVERINGS

A. Aluminum Jackets: ASTM C1729; 0.016" thick (thicker where required by ASTM C1729); stucco embossed finish with Z edge seams and aluminum bands for outdoor use. Where colored jacket covers are called for, provide factory-applied hard film acrylic paint in color selected by Architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.

B. Insulated Piping Operating Below 60°F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.
2. All balance valves with fluid operating below 60°F shall be insulated with a removable plug wrapped with vapor barrier tape to allow reading and adjusting of the valve.

C. Insulated Piping Operating Between 60°F and 140°F:

1. Do not insulate flanges and unions, but bevel and seal ends of insulation at such locations. Insulate all fittings, valves and strainers.

D. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, and strainers.
2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.

E. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

3.3 SUPPORT PROTECTION

A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.

B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:

1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:

   a. Cellular glass (Type C) (for all temperature ranges) with a minimum compressive strength of 90 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
   b. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.

1) Products:

a) Buckaroo CoolDry
b) Cooper/B-Line Fig. B3380 through B3384
c) Pipe Shields A1000, A2000

c. Insulation Couplings:

1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
2) PET thermoplastic foam load bearing core with elastomeric foam ends and lap-seal jacket.
3) Horizontal Strut Mounted Insulated Pipe Manufacturers:

a) Klo-Shure or equal
b) Armafix Ecolight

4) Vertical:

a) Manufacturers: Klo-Shure Titan or equal

d. Rectangular blocks, plugs, or wood material are not acceptable.
e. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size
1/2" to 3-1/2"	12" long x 18 gauge

F. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

3.4 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.

2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F seal fitting covers with vapor retarder mastic in addition to tape.

B. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

3.5 JACKET COVER INSTALLATION

A. Metal Covering:

1. Provide vapor barrier as specified for insulation type. Cover with aluminum jacket covering with seams located on the bottom of horizontal piping. Include fittings, joints and valves.
2. Seal all interior and exterior butt joints with metal draw bands and sealant. Seal all exterior joints watertight.
3. Interior joints do not need to be sealed.
4. Use metal covering on the following pipes:

    a. All exposed piping in finished spaces unless noted otherwise on the drawings.
    b. All exposed piping adjacent to cloud ceilings.
    c. All exposed piping in unfinished areas as noted on drawings (e.g., storage rooms, janitor's closets, utility rooms, etc.).
    d. All exposed piping in mechanical or equipment rooms below 8'-0" above floor.
    e. All exposed piping in mechanical rooms that is subject to damage from normal operations. (Example: Piping that must be stepped over routinely.)

5. Use colored aluminum jacket covers on the following pipes:

    a. All exterior piping.

3.6 SCHEDULE

A. Refer to drawings for insulation schedule.

END OF SECTION 22 07 19

SECTION 22 10 30

PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleanouts.

B. Traps.

C. Trap Primers.

D. Floor Drains and Sinks

E. Strainers.

F. Unions.

G. Balancing Valves.

H. Water Hammer Arresters.

I. Dielectric Fittings (Connections Between Dissimilar Metals).

J. Drain Valves.

K. Relief Valves.

1.2 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.

C. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

D. Valves for potable water systems shall comply with California Assembly Bill AB1953 limiting lead content. Also described in 2022 CPC: 604.2 Lead Content.

1.3 REFERENCES

A. ANSI A112.21.1 - Floor Drains.

B. ASSE 1010 - Water Hammer Arresters.

C. ANSI A112.6.3 - Floor and Trench Drains; The American Society of Mechanical Engineers.

D. ANSI 1011 - Hose Connection Vacuum Breakers; American Society of Sanitary Engineering.

E. ASSE 1019 - Vacuum Breaker Wall Hydrants, Freeze Resistant Automatic Draining Type; American Society of Sanitary Engineering.

F. PDI WH-201 - Water Hammer Arresters.

1.4 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Include sizes, rough-in requirements, service sizes, and finishes.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Provide cleanouts as shown and specified on the drawings as well as required by code.

B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.

C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.

D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 YARD CLEANOUTS

A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.

B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

2.3 TRAPS

A. Provide all individual connections to the sanitary system with P-traps, except where such drains discharge directly into a properly trapped collection basin or sump. Unless otherwise specified or shown, traps shall be:

1. Chromium plated cast brass when used with plumbing fixtures or when installed exposed in finished spaces.
2. Insulated at accessible lavatories.
3. Cast iron, deep-seal pattern where concealed above ceiling, below grade or in unfinished areas.
4. Deep-seal pattern of the same material and/or coating where drainage lines are of special materials or coatings such as polypropylene, PVDF, CPVC, etc.

B. All traps shall have accessible, removable cleanouts, except where installed on floor drains with removable strainers.

C. Each trap shall be completely filled with water at the end of construction but before building turnover to the Owner. All floor drains, floor sinks, trench drains, etc. shall be filled with water.

2.4 TRAP PRIMERS

A. Provide trap primers as shown and specified on the drawings.

B. Where trap primers are shown on drawings, coordinate with corresponding floor drains to ensure they include a side inlet connection for the trap primer line.

2.5 FLOOR DRAINS AND SINKS

A. Floor drains and sinks shall be in the form of a receptor with grate/strainer set flush with the surrounding floor.

B. Provide floor drains and sinks as shown and specified on the drawings as well as required by code.

2.6 STRAINERS

A. Unless otherwise indicated, strainers shall be Y-pattern and have stainless steel screens with perforations as follows:

1. Water:

a. 1/4" - 2": 3/64" perforations

B. Furnish pipe nipple with shutoff valve to blow down all strainer screens.

C. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

2.7 UNIONS

A. Copper pipe - wrought copper fitting - ground joint.

2.8 BALANCING VALVE WITH FLOW INDICATION

A. Balancing valve with built-in visual flow meter, adjustable flow control with memory stop feature, external temperature gauge, and tight shutoff.

B. Maximum working pressure: 150 psi. Maximum Temperature 230°F. Maximum differential pressure: 15 psi. Maximum inlet temperature: 195°F.

C. Low-lead brass valve, stainless steel springs, EPDM seals.

D. Manufacturer shall size balancing valves for the scheduled flow rate. Flow rate shall be measurable on the self-contained visual flow meter.

E. Acceptable Manufacturers:

1. Calieffi 132 Series
2. Watts CSD (provide with separate external temperature gauge)

2.9 WATER HAMMER ARRESTERS

A. Provide water hammer arresters as shown and specified on the drawings as well as required by code.

B. ANSI A112.26.1; sized and located in accordance with PDI WH-201, precharged for operation between -100°F and 300°F and maximum 250 psig working pressure.

2.10 DIELECTRIC FITTINGS (CONNECTIONS BETWEEN DISSIMILAR METALS)

A. Connections between dissimilar metals shall be insulating dielectric types that provide a water gap between the connected metals, and that either allow no metal path for electron transfer or that provide a wide water gap lined with a non-conductive material to impede electron transfer through the water path.

B. Joints shall be rated for the temperature, pressure, and other characteristics of the service in which they are used, including testing procedure.

C. Aluminum, iron, steel, brass, copper, bronze, and stainless steel are commonly used and require isolation from each other with the following exceptions:

1. Iron, steel, and stainless steel connected to each other.
2. Brass, copper, and bronze connected to each other.
3. Brass or bronze valves and specialties connected in closed systems with steel, iron, or stainless steel on both sides of the brass or bronze valves and specialties. Where two or more brass or bronze items occur together, they shall be connected with brass nipples. Brass or bronze valves and specialties cannot be used as a dielectric separation between pipe materials.

D. Dielectric protection is required at connections to equipment of a material different than the piping.

E. Screwed Joints (acceptable up to 2" size):

1. Dielectric waterway rated for 300 psi CWP and 225°F.
2. Acceptable Manufacturers: Elster Group ClearFlow fittings, Victaulic Series 47, Grinnell Series 407, Matco-Norca.

F. Flanged Joints (any size):

1. Use 1/8" minimum thickness, non-conductive, full-face gaskets.
2. Employ one-piece molded sleeve-washer combinations to break the electrical path through the bolts.
3. Sleeve-washers are required on one side only, with sleeves minimum 1/32" thick and washers minimum 1/8" thick.
4. Install steel washers on both sides of flanges to prevent damage to the sleeve-washer.
5. Separate sleeves and washers may be used only if the sleeves are manufactured to exact lengths and installed carefully so the sleeves must extend partially past each steel washer when tightened.
6. Acceptable Manufacturers: EPCO, Central Plastics, Pipeline Seal and Insulator, F. H. Maloney, or Calpico.

2.11 DRAIN VALVES

A. Drain valves shall be shutoff valves as specified for the intended service with added 3/4" male hose thread outlet and cap.

2.12 RELIEF VALVES

A. RV-4: (Domestic Hot Water) Pressure and Temperature relief, cast bronze body and internal parts, stainless steel spring, test lever, threaded inlet and outlet. Maximum setting of 150 psi and 210°F temperature. Capacities ASME certified and labeled. Acceptable Manufacturers: Cash Series FV, Watts #40, #120, #N240, #340.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Coordinate construction to receive drains at required invert elevations.

B. Install all items per manufacturer's instructions.

C. Water Hammer Arresters:

1. Install water hammer arresters in accessible locations. Provide access doors as required. Coordinate type with Architect/Engineer/Owner.
2. Water hammer arrestors shall be installed in cold and hot water lines upstream of all plumbing fixtures or equipment, with a quick acting valve or multiple quick acting valves. Quick acting valves shall be defined as solenoid actuated valves, manual flush valves, sensor activated faucets and flush valves, squeeze handle spray faucets, and other similar type valves.
3. Install multiple water hammer arrestors in toilet group branch piping greater than 20 feet in developed length from the cold and hot water mains.

D. Cleanouts:
1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 100 feet. Provide cleanouts at bases of all sanitary and storm risers as shown on the drawings and as required by code.
2. Provide a cleanout at the upstream end of a horizontal waste pipe in a plumbing chase serving multiple plumbing fixtures; for example a bank of water closets or lavatories.
3. Provide cleanouts on the branch line connected to individual plumbing fixtures as required by code; for example just below a sink, lavatory or urinal.
4. Extend underfloor cleanouts up to the floor with long sweep elbows.
5. Install a full size, two-way cleanout within 5 feet of the foundation inside or outsideof building.
6. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
7. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

E. Yard Cleanouts:

1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.

F. Floor Drains and Floor Sinks:

1. Use alternate sealing method when installing drains in existing floor slabs.
2. Coordinate sloping requirements with the architectural plans and specifications.
3. Top of floor drain and sinks grate/strainer shall not extend above the finished floor elevation.
4. Top of floor drain and sink grate/strainer shall not extend above the finished floor elevation. Grate/strainer shall be installed flush with surrounding finished floor. Should the Plumbing Contractor believe this presents a conflict with code, the issue should be evaluated before installation of the floor drain or sink begins. Proceeding with installing a floor drain or sink raised above the finished floor without prior approval will result in the Contractor being required to remove the drain or sink in question and reinstall it at the approved elevation.

G. Balancing Valves:

1. Install balancing valves with straight, unobstructed pipe section both upstream and downstream as required, per manufacturer's installation instructions.

END OF SECTION 22 10 30

SECTION 22 11 23

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Domestic Water In-Line Circulators.

1.2 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Submit certified pump performance curves with pump and system operating point plotted. Include NPSH curve when applicable.

C. Pumps with motors operating above the RPM the pump curves are based on shall have impellers trimmed to deliver GPM and head scheduled.

PART 2 - PRODUCTS

2.1 GENERAL

A. Statically and dynamically balance rotating parts.

B. Construction shall permit complete servicing without breaking piping or motor connections.

C. Pumps shall operate at 1750 rpm unless specified otherwise.

D. Pump connections shall be flanged, whenever available.

E. Domestic hot water pumps shall be suitable for 225°F water.

F. Motors shall comply with Section 22 05 13.

G. Submitted pump selections must have a diameter impeller that meets or exceeds the scheduled pump. The inlet and discharge pipe sizes shall also meet or exceed the scheduled pump.

2.2 DOMESTIC WATER IN-LINE CIRCULATORS

A. Provide pumps as specified on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install all products per manufacturer's recommendations.

2. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.

B. In-Line Pump:

1. Support in-line pumps individually so there is no strain on the piping. Support pump so no weight is carried on pump casings. Install with a minimum of five diameters of straight pipe on pump suction and discharge.
2. Ensure pumps operate at specified fluid temperatures without vapor binding or cavitation, are non-overloading in parallel or individual operation, and operate within 25% of midpoint of published maximum efficiency curve.
3. Pumps shall be factory aligned. If alignment is not satisfactory, as determined by the Architect/Engineer, manufacturer shall provide a factory trained representative to field align the shafts.

END OF SECTION 22 11 23

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Water Heaters.

1.2 QUALITY ASSURANCE

A. Products and installation of specified products shall conform to recommendations and requirements of the following organizations:

1. National Sanitation Foundation (NSF).
2. American Society of Mechanical Engineers (ASME).
3. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
4. National Electrical Manufacturers' Association (NEMA).
5. Underwriters' Laboratories (UL).

B. Perform work in accordance with State of California Plumbing Codes and municipality of local area standards.

C. Water Heater Performance Requirements: Equipment efficiency not less than prescribed by ASHRAE 90.1 when tested in accordance with DOE 10 CFR, ANSI Z21.10.1 and ANSI Z21.10.3.

D. Conform to ASME Section VIII for construction of water heaters and heat exchangers. Provide boilers registered with National Board of Boiler and Pressure Vessel Inspectors.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASME Section 8D - Pressure Vessels.

C. ANSI/NFPA 70 - National Electrical Code.

D. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water Heaters.

E. ASSE 1005 - Water Heater Drain Valves, 3/4" Iron Pipe Size.

F. UL 174 - Household Electric Storage Tank Water Heaters.

1.4 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

C. Include heat exchanger dimensions, size of tappings, and performance data.

D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

E. For equipment connected to an electric power source, submit short circuit rating (SCCR) of integrated unit.

F. Submit manufacturer's installation instructions including control and electrical power/controls wiring diagrams.

G. Submit manufacturer's certificate that pressure vessels meet or exceed specified requirements.

H. Submit operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.6 REGULATORY REQUIREMENTS

A. Water heaters shall conform to AGA, ANSI/NFPA 54, ANSI/NFPA 70, ANSI/UL 1453 as applicable.

B. Conform to ANSI/ASME Section 8 Division 1 for fabrication of steel pressure vessels.

C. Conform to ANSI/ASME Section 10 for manufacture of fiber-reinforced plastic pressure vessels.

PART 2 - PRODUCTS

2.1 WATER HEATERS

A. All water heaters shall be as scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all items in accordance with manufacturer's instructions.

3.2 WATER HEATER INSTALLATION

A. Install water heaters on concrete bases. Coordinate sizes and locations of concrete bases. Refer to Section 22 05 29.

B. Install water heaters level and plumb, according to drawings, manufacturer's instructions, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend drain piping full size from relief valve and discharge by positive air gap onto closest floor drain. Discharge pipe material shall be same as domestic water piping.

END OF SECTION 22 30 00

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All plumbing fixtures.

1.2 REFERENCES

A. ANSI A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use.

B. ANSI A112.18.1 - Finished and Rough Brass Plumbing Fixture Fittings.

C. ANSI A112.19.1M - Enameled Cast Iron Plumbing Fixtures.

D. ANSI A112.19.2M - Vitreous China Plumbing Fixtures.

E. ANSI A112.19.3 - Stainless Steel Plumbing Fixtures (Designed for Residential Use).

F. ASME A112.19.4 - Porcelain Enameled Formed Steel Plumbing Fixtures.

G. ANSI A112.19.5 - Trim for Water-Closet Bowls, Tanks, and Urinals.

H. AHRI 1010 - Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.

I. ASSE 1002 - Water Closet Flush Tank Ball Cocks.

J. Americans with Disabilities Act (ADA), Title III.

K. The Energy Policy Act (EPAct) of 2005.

1.3 SUBMITTALS

A. Submit product data under provisions of Section 22 05 00. Submittals shall include fixture carriers for record purposes only. Architect/Engineer does not review or approve carriers except for manufacturer.

B. Include fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. For fixtures and trim requiring electrical connections, submit product data indicating general assembly, components, electrical power/controls wiring diagrams, and service connections.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All fixtures shall be as shown on the drawings and as scheduled in the plumbing material list. Additional requirements below:

B. All vitreous china fixtures shall be from the same manufacturer where possible.

C. All lavatory and sink trim shall be from the same manufacturer where possible.

D. All fixtures shall be lead free. Faucets, traps, stops, and other fixture accessories shall not contain more lead than allowed per the latest State or Federal Act.

E. P-Traps and Tailpieces:

1. Lavatories:

a. Accessible Type: 1-1/4" chrome plated 17-gauge cast brass offset tailpiece and p-trap with cleanout on bottom of trap.
b. Non-Accessible Type: Offset not required for tailpiece, otherwise same.

2. Sinks:

a. Accessible Type: 1-1/2" chrome plated 17-gauge cast brass offset tailpiece and p-trap with cleanout on bottom of trap.
b. Non-Accessible Type: Offset not required for tailpiece, otherwise same.

3. Acceptable Manufacturers:

a. McGuire
b. Keeney
c. Dearborn Brass
d. Zurn
e. Chicago Faucet

F. Insulation Covers and Enclosures for Accessible Lavatories and Sinks:

1. Premanufactured cover for P-trap, stop valves, and supply lines.

a. 1/8" thick vinyl construction, paintable, tool free installation,
b. Acceptable Manufacturers:

1) Truebro (Lav Guard 2)
2) Plumberex (Pro-Extreme)
3) McGuire (Prowrap)
4) Buckaroos Inc.
5) Zurn

2. Premanufactured rigid enclosure for concealing lavatory P-trap, stop valves, and supply lines,

a. Rigid, high impact PVC, paintable, stainless steel fasteners for anchoring and removal.
b. Acceptable Manufacturers:

1) Truebro (Lav Shield #2018)
2) Zurn (Z6900-VG)
3) Approved equal

3. Premanufactured rigid enclosure for concealing sink P-trap, stop valves, supply lines, garbage disposal, etc.

a. Rigid, high impact PVC, white or beige (Color by architect), paintable, 36" or 42" widths, stainless steel fasteners for anchoring and removal.
b. Acceptable Manufacturers:

1) Truebro (Basin Guard)
2) Approved equal

G. Angle Stops and Supplies:

1. Lavatories, Sinks and Tank Type Water Closets:

a. Lead-free, 3/8" chrome plated brass, quarter turn ball valve type with loose key stops, solder or compressionor threaded connection type.
b. Lead-free, 3/8" chrome plated soft copper risers .
c. Acceptable Manufacturers:

1) McGuire
2) BrassCraft
3) Keeney
4) Zurn
5) Chicago Faucet

H. Wall Hung Fixture Carriers:

1. Material: All Metal, ASME/ANSI A112.6.1M.
2. Lavatory carrier shall be rated to support 250 lbs unless noted otherwise on the drawings.
3. Water closet carrier shall be rated to support 500 lbs unless noted otherwise on the drawings
4. Manufacturers:

a. Zurn
b. JR Smith
c. Wade
d. Josam
e. Watts
f. Mifab
g. Sun Drainage Products
h. Sioux Chief

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.
2. Install each fixture with trap easily removable for servicing and cleaning. Use screwed tailpiece couplings. Connect fixture waste to stack with slip fitting.
3. Provide fixtures with supply lines, stop valves, reducers, escutcheons, and any other items required for a complete and operational plumbing fixture assembly.
4. Install components level and plumb.

5. Caulk joint between finish floor and floor mounted fixtures and between finish walls and wall mounted fixtures with silicon caulk. Caulk the joint, between rim and fixture where a fixture builds into a counter top, with caulking compound. Refer to DIVISION 7 for "Caulking" requirements. Color to match fixture.
6. Where there is a possibility of water following pipe brackets, etc., into a wall; caulk escutcheons, space around brackets, etc., to exclude water. Refer to DIVISION 7 for "Caulking" requirements.
7. Refer to architectural drawings for fixture mounting heights.
8. All non-potable outlets shall be clearly marked with a permanently affixed laminated sign with 3/8" high lettering saying "Non-Potable Water Not for Human Consumption." Sign shall have black lettering on a yellow background.

B. Wall-Mounted Fixture Requirements:

1. All wall-mounted fixtures shall have compatible carriers designed for their intended service and suitable for the space available and configuration of fixtures. All carriers shall extend to the floor and be anchored to the slab as intended by the carrier manufacturer.

C. Floor-Mounted Fixture Requirements:

1. Where floor mounted fixtures are installed on a sloped floor, the open void below the fixture shall be grouted, leveled, and caulked to eliminate stress on the fixture and to prevent water migration to the floor below.

D. Exposed or Inside Accessible Cabinets Traps, Valve and Pipe Requirements:

1. All water or waste piping for plumbing fixtures that is exposed or inside cabinets shall be chrome plated.
2. All exposed flush valves for water closets and urinals shall have a chrome plated hanger to anchor the piping to the wall.
3. All exposed water supply piping and fittings in a finished space to a shower valve, hose bibb, or other water outlet shall be chrome plated.

E. ADA Accessible Exposed Sink and Lavatory Trim:

1. All exposed sink and lavatory traps, piping and angle stops installed at accessible sink and lavatory locations shall include offset style drain tailpiece, p-trap installed near and parallel with back wall, and insulation kit specially manufactured for this installation. Armaflex with duct tape is not acceptable.

F. ADA Accessible Water Closet Requirements:

1. Handicapped accessible water closet flush valve or flush tank handles shall be on the left hand or right hand side of the fixture, whichever is nearer to the center of the stall.
2. Coordinate flush valves in handicap accessible locations with grab bars installed by the General Contractor. Make modifications as necessary to flush valve piping to avoid conflict with grab bars. Common solutions include shortened or offset vacuum breaker tailpieces.

3.2 ADJUSTING AND CLEANING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion, clean plumbing fixtures, equipment, and faucet aerator screens.

3.3 FIXTURE ROUGH-IN SCHEDULE

A. Rough-in fixture piping connections in accordance with table on plumbing drawings of minimum sizes for particular fixtures.

END OF SECTION 22 40 00

DIVISION 23: HEATING, VENTILATING, AND AIR-CONDITIONING

END OF TABLE OF CONTENTS

SECTION 23 05 00

BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. CCR California Code of Regulation

B. CBC California Building Code

C. CFC California Fire Code

D. CEC California Electric Code

E. CMC California Mechanical Code

F. CPC California Plumbing Code

G. California Title 24 - Building Energy Efficiency Standards

H. SCAQMD South Coast Air Quality Management District

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

C. Separate contracts will be awarded for the following work:

D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.

F. Scope of Work:

1. Plumbing Work: Refer to Section 22 05 00 "Basic Plumbing Requirements".

2. Heating Work shall include, but is not necessarily limited to:

   a. Furnish and install refrigerant piping, accessories, and final charge of refrigerant.
   b. Furnish and install condensate drain piping from cooling related equipment such as air handlers and cooling coil drain pans.
   c. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
   d. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.
   e. Complete all applicable tests, certifications, forms, and matrices.

3. Air Conditioning and Ventilating Work shall include, but is not necessarily limited to:

   a. Furnish and install package air handling units complete with curbs.
   b. Furnish and install air-cooled condensing units and curbs.
   c. Furnish and install complete supply air ductwork systems including all fittings, insulation, and outlets.
   d. Furnish and install complete return air ductwork systems including all fittings, insulation, and inlets.
   e. Furnish and install complete exhaust ductwork systems including all fittings, insulation, inlets, and fans.
   f. Furnish and install all temperature control systems.
   g. Furnish and install seismic restraint and equipment designed for use in seismic conditions described in Section 23 05 50.
   h. Complete all applicable tests, certifications, forms, and matrices.

4. Testing, Adjusting, and Balancing Work shall include, but is not necessarily limited to:

   a. Furnish complete testing, adjusting, and balancing as specified in Section 23 05 93, including, but not limited to, air systems, plumbing systems, and verification of control systems.
   b. Complete all applicable tests, certifications, forms, and matrices

1.4 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours will be required.

B. Itemize all work and list associated hours and pay scale for each item.

1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL & CONTROL CONTRACTORS

A. Definitions:

1. "Mechanical Contractors" refers to the following:

   a. Plumbing Contractor.
   b. Heating Contractor.
   c. Air Conditioning and Ventilating Contractor.
   d. Temperature Control Contractor.
   e. Fire Protection Contractor.
   f. Testing, Adjusting, and Balancing Contractor.

2. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case the devices are usually single phase and are usually connected to the motor power wiring through a manual motor starter having "Manual-Off-Auto" provisions.
3. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
4. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. Generally, where the motor power wiring exceeds 120 volts, a control transformer is used to give a control voltage of 120 volts.
5. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring which directly powers or controls a motor used to drive equipment such as fans, pumps, etc.

    a. This wiring will be from a 120 volt source and may continue as 120 volt, or be reduced in voltage (24 volt) in which case a control transformer shall be furnished as part of the temperature control wiring.

6. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
7. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractor's responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors and the like. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals reviewed. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall provide complete electrical power/controls wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. All electrical work shall conform to the National Electrical Code. All provisions of the Electrical Specifications concerning wiring, protection, etc., apply to wiring provided by the Mechanical Contractor unless noted otherwise.

4. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Electrical Code Article 725.
5. All Contractors shall establish utility elevations prior to fabrication and shall coordinate their material and equipment with other trades. When a conflict arises, priority is as follows:

    a. Light fixtures.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical busduct.
    d. Sheet metal.
    e. Electrical cable trays, including access space.
    f. Sprinkler piping and other piping.
    g. Electrical conduits and wireway.

C. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment provided by the Mechanical Contractor, for example:

    a. Makeup Air Units.
    b. Package Air Handling Units.

2. Assumes all responsibility for the Temperature Control wiring, when the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
3. Shall verify all existing equipment sizes and capacities where units are to be modified, moved or replaced. Contractor shall notify Architect/Engineer of any discrepancies prior to ordering new units or replacement parts, including replacements of equipment motors.
4. Temperature Control **Subcontractor's** Responsibility:

    a. Wiring of all devices needed to make the Temperature Control System functional.
    b. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control **Subcontractor**.
    c. Coordinating equipment locations (such as relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

D. Electrical Contractor's Responsibility:

1. Provides all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor on the Mechanical Drawings or Specifications.
2. Installs and wires all remote control devices furnished by the Mechanical Contractor or Temperature Control **Subcontractor** when so noted on the Electrical Drawings.
3. Provides motor control and temperature control wiring, where so noted on the drawings.
4. Coordinate with the Mechanical Contractor for size of motors and/or other electrical devices involved with repair or replacement of existing equipment.

5. Furnishes, installs and connects all relays, etc., for automatic shutdown of certain fans upon actuation of the Fire Alarm System as indicated and specified in Division 28.
6. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" (40 mm) and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the **Mechanical Contractor**.

a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

a. Scale of drawings:

1) General plans: 1/4 Inch = 1'-0" (minimum).
2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the Ontario, California of 2022 Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.

4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Utility Company Requirements:

1. Secure from the appropriate private or public utility company all applicable requirements.
2. Comply with all utility company requirements.
3. Make application for and pay for service connections, such as gas.
4. Make application for and pay for all meters and metering systems required by the utility company.

F. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.

8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.8 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 00	Owner Training Agenda
23 05 05	HVAC Demolition for Remodeling
23 05 13	Motors
23 05 29	Hangers and Supports
23 05 30	Roof Support and Wind bracing
23 05 48	Vibration Isolation Equipment
23 05 53	HVAC Identification
23 05 93	Testing, Adjusting, and Balancing
23 07 13	Duct Insulation
23 31 00	Ductwork
23 33 00	Ductwork Accessories
23 34 23	Prefabricated Curbs
23 37 00	Grilles, Registers, and Diffusers
23 40 00	Filters and Filter Systems
23 74 16.15	Packaged Air Conditioning Units for Dedicated Outside Air
23 81 26	Split System Air Conditioning Units

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.

c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 23 XX XX.description.YYYYMMDD
    b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

D. Paper Copy Submittal Procedures:

1. Paper copies are acceptable where electronic copies are not provided.

2. The Contractor shall submit ten (10) paper copies of each shop drawing.
3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.10 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 01.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings (e.g., each air handling unit, pump, exhaust fan, etc.). Use the equipment nomenclature (AHU-1, P-1, EF-1, etc.) on the Schedule of Values.
    b. Each type of small unitary equipment (e.g., FCUs, UHs, CABs, etc.). Multiple units of the same type can be listed together, provided quantities are also listed so unit costs can be determined.
    c. Each piping system (chilled water, heating water, steam, condensate, etc.). In addition, for larger projects, break down the material and labor for each piping system based on geography (building, floor, and/or wing).
    d. Each duct system (supply, return, relief, outside air, etc.) listed separately for each unit they serve (AHU-1 supply air ductwork, AHU-1 return air ductwork, etc.).
    e. Pipe insulation with separate material and labor line items for each piping system listed above.
    f. Duct insulation with separate material and labor line items for each duct system listed above.
    g. Temperature controls broken down into material and labor for the following:

        1) Engineering
        2) Controllers, devices, sensors, etc.

3) Control valves
4) Control dampers
5) Conduit
6) Wiring
7) Programming
8) Commissioning

h. Site utilities (5' beyond building)
i. Seismic design
j. Air balancing
k. Water balancing
l. Commissioning
m. Record drawings
n. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.11 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.12 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

1. Air Cooled Condensers
2. Base Mounted Pumps
3. Boilers, Burners and Boiler Trim
4. Computer Room Units
5. Condensing Units
6. Cooling Towers
7. Gas Fired Makeup Air Units
8. Fire Seal Systems
9. Fluid Coolers
10. Seismic Restraints and Equipment Bracing
11. Water Chillers

B. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

C. Submit copies of start-up reports to the Architect/Engineer and include copies of Owner's Operation and Maintenance Manuals.

1.13 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Motor windings and ventilation openings.
2. Bearings.
3. Equipment Pipe and Accessories connections openings. (e.g. boiler connections, coil connections, etc.)
4. Equipment Duct and Accessories connections openings. (e.g. AHU/RTU duct connections; Terminal Air Boxes, etc.)
5. Starter and control cabinets.
6. Heat transfer coils.
7. Pump Seals.
8. Combustion burner and blower equipment (e.g. combustion air intake, combustion vent/flue, etc.)

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.14 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.15 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.16 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.17 CONTINGENCY

A. Include in the Base Bid a contingency of 10 percent to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.18 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe and duct wall penetrations are sealed.
c. Pipe identification and valve tags are installed.
d. Main, branch and flexible ducts are installed.
e. Diffusers, registers and grilles are installed and connected to ductwork.
f. Terminal air box reheat coil piping or wiring is complete.
g. Terminal air box control wiring is complete and all control boxes are closed.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

3.5 OPERATION AND MAINTENANCE MANUALS

A. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div23.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

B. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.

2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

E. The instructions shall include:

1. Explanation of all system flow diagrams.
2. Explanation of all air handling systems.
3. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
4. Maintenance of equipment.
5. Smoke control systems.
6. Stairwell pressurization systems.
7. Start-up procedures for all major equipment.
8. Explanation of seasonal system changes.
9. Description of emergency system operation.

F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

G. The Contractor shall prepare a detailed, written training agenda and submit it to the Architect/Engineer a minimum of **two** weeks prior to the formal training for approval. The written agenda shall include specific training points within the items described above. For example: how to adjust setpoints, troubleshooting, proper start-up, proper shut-down, seasonal changes, draining, venting, changing filters, changing belts, etc. Failure to provide and follow an approved training agenda may result in additional training required at the expense of the Contractor.

H. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. **Areas with mechanical cooling shall be maintained below 60% RH.**

D. Contractor shall adjust the mechanical systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. The following paragraphs supplement Division 01 requirements.

B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

D. Refer to Section 23 09 00 for additional requirements for Temperature Control documents.

E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

G. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

A. This Contractor shall paint the following items:

1. All piping in mechanical room
2. Piping exposed in kitchen

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor.

D. Equipment cabinets, casings, covers, metal jackets, etc., in equipment rooms or concealed spaces, shall be furnished in standard or prime finish, free from scratches, abrasions, chips, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chips, etc. If color option is specified or is standard to the unit, this Contractor shall, before ordering, verify with the Architect/Engineer the color preference and furnish this color.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, storage room, etc., furnished by this Contractor. Equipment furnished with a factory coat of paint and enamel need not be painted, provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. Paint all outdoor uninsulated steel piping the color selected by Owner or Architect/Engineer.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.
3. Color of paint shall be as follows:

a. All piping in mechanical room:

1) Natural Gas: Yellow pipe/black letters

3.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

2. South Coast Air Quality Management District Rule 1168: Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113: Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.12 IAQ MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
    d. Protect stored on-site and installed absorptive materials from moisture damage.

2. Request that the Owner designate an IAQ representative.
3. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
4. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
5. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
6. Request copies of and follow all of the Owner's IAQ and infection control policies.
7. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
8. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
9. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings Under Construction".
10. If permanently installed air handlers are used to serve both construction and occupied areas, all return grilles throughout construction areas shall be sealed to prevent air from construction areas being supplied to occupied areas.
11. If permanently installed air handlers are used during construction to serve only construction areas and do not supply air to adjacent occupied areas, MERV 8 filtration media shall be used to protect each return air grille or opening. The intent of this will be to prevent construction dust and debris from entering any return or supply air ductwork in the facility. All filtration media shall be replaced immediately prior to occupancy.
12. Construction areas shall be maintained at a negative pressure at all times during construction. When areas are under construction, HEPA filtered exhaust fan(s) shall be installed in sufficient quantities as required to maintain construction areas at sufficient negative pressure as called for in the Owner's Infection Control Risk Assessment (ICRA). HEPA filtered exhaust fan discharge shall be ducted either outdoors or back into designated hospital areas as called for in the Owner's ICRA.
13. For each area under construction, the Contractor shall install a negative pressure indicator equivalent to Lamiflow Model L-102F as manufactured by Lamiflow Technologies. Contractor shall regularly monitor and record the negative pressure condition of the construction areas as called for in the Owner's ICRA.

3.13 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.

B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.

C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.

D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.

E. The following steps shall be taken during testing, adjusting, and balancing of each air system:

1. All construction activities in all spaces served by the air system shall stop.
2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.

F. The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

3.14 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All fans shall be operating and balanced.
4. All pumps, boilers and chillers operating and balanced.
5. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
6. All temperature control systems operating, programmed and calibrated.
7. Pipe insulation complete, pipes labeled and valves tagged.
8. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 23 05 00

SECTION 23 05 05

HVAC DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE GENERAL SCOPE OF WORK AND DO NOT SHOW EVERY PIPE, DUCT, OR PIECE OF EQUIPMENT THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY CONDITIONS PRIOR TO SUBMITTING A BID.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

C. Existing Heating System: Maintain existing system in service until new system is complete and ready for service. Drain system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely draining system. Minimize outage duration.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Division 2 and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned ducts and piping to source of supply and/or main lines.

D. Remove exposed abandoned pipes and ducts, including abandoned pipes and ducts above accessible ceilings. Cut ducts flush with walls and floors, cap duct that remains, and patch surfaces. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.

H. Remove unused sections of supply and return air ductwork back to mains. Patch opening with sheet metal and seal airtight. Patch existing insulation to match existing. Where existing ductwork is to be capped and reused, locate the end cap within 6" of the last branch. End caps shall be 3" pressure class and seal class "A".

I. Extend existing installations using materials and methods compatible with existing installations, or as specified.

J. Properly reclaim and dispose of all refrigerant in demolished equipment and as required for extension of existing equipment.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 23 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Clean all systems adjacent to project which are affected by the dust and debris caused by this construction.

C. MECHANICAL ITEMS REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL DISPOSE OF MATERIAL THE OWNER DOES NOT WANT TO REUSE OR RETAIN FOR MAINTENANCE PURPOSES.

3.6 SPECIAL REQUIREMENTS

A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction. This Contractor shall complete any cleaning required for existing systems which are affected by construction dust and debris.

B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Architect/Engineer before proceeding.

END OF SECTION 23 05 05

SECTION 23 05 13

MOTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Single Phase and Three Phase Electric Motors.

1.2 REFERENCES

A. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ANSI/IEEE 112 - Test Procedure for Polyphase Induction Motors and Generators.

E. ANSI/NEMA MG 1 - Motors and Generators.

F. ANSI/NFPA 70 - National Electrical Code.

G. Energy Independence and Security Act of 2007.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00. Include nominal efficiency and power factor for all premium efficiency motors. Efficiencies must meet or exceed the nominal energy efficiency levels presented below.

B. Submit shop drawings for all three phase motors.

C. Submit motor data with equipment when motor is installed by the manufacturer at the factory.

D. Submit shaft grounding rings or brushes for all motors as required.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof coverings. For extended outdoor storage, follow manufacturer's recommendations for equipment and motor.

1.5 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data including assembly drawings, bearing data including replacement sizes, and lubrication instructions.

PART 2 - PRODUCTS

2.1 MOTORS - GENERAL CONSTRUCTION AND REQUIREMENTS

A. Refer to the drawings for required electrical characteristics. Voltage is generally specified and scheduled as distribution voltage. Motor submittals may be based on utilization voltage if it corresponds to the correct distribution voltage.

Distribution/Nominal Voltage	Utilization Voltage
120	115
208	200
240	230
277	265
480	460

B. Design motors for continuous operation in 40ºC environment, and for temperature rise in accordance with ANSI/NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating horsepower, voltage, phase, hertz, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, insulation class.

D. Electrical Connection: Boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

E. Unless otherwise indicated, motors 3/4 HP and smaller shall be single phase, 60 hertz, open drip-proof or totally enclosed fan-cooled type.

F. Unless otherwise indicated, motors 1 HP and larger shall be three phase, 60 hertz, squirrel cage type, NEMA Design Code B (low current in-rush, normal starting torque), open drip-proof or totally enclosed fan-cooled type.

G. Each contractor shall set all motors furnished by him.

H. All motors shall have a minimum service factor of 1.15.

I. All motors shall have ball or roller bearings with a minimum L-10 fatigue life of 150,000 hours in direct-coupled applications and 50,000 hours for belted applications. Belted rating shall be based on radial loads and pulley sizes called out in NEMA MG1-14.43.

J. Bearings shall be sealed type for 10 HP and smaller motors. Bearings shall be regreasable type for larger motors.

K. Motor Driven Equipment:

1. No equipment shall be selected or operate above 90% of its motor nameplate rating. Motor size may not be increased to compensate for equipment with efficiency lower than that specified.
2. If a larger motor than specified is required on equipment, the contractor supplying the equipment is responsible for all additional costs due to larger starters, wiring, etc.

L. Motors for fans and pumps 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70% when rated in accordance with DOE 10 CFR 431. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of varying motor speed.

2.2 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Motor shall be variable speed, constant torque, brushless DC motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall integral surge protection. Motor shall be pre-wired for specific voltage and phase.

B. Motor frame shall be NEMA 48; UL recognized components shall be provided for the motor construction.

C. All EC motors shall be a minimum of 85% efficient at all speeds.

D. Motors shall be permanently lubricated; utilize ball bearings to match with the connected driven equipment.

E. Provide motor with on-board motor control module. Motor speed shall be limited to provide electronic over current protection. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed.

F. Operational mode shall be as scheduled and shall be one of the following:

1. Constant Flow

2.3 PREMIUM EFFICIENCY MOTORS (INCLUDING MOST 3-PHASE GENERAL PURPOSE MOTORS)

A. All motors, unless exempted by EPAct legislation that became federal law on December 19, 2010, shall comply with the efficiencies listed in that standard, which are reprinted below. These match the 2010 NEMA premium efficiency ratings. All ratings listed are nominal full load efficiencies, verified in accordance with IEEE Standard 112, Test Method B. Average expected (not guaranteed minimum) power factors shall also be at least the following:

	Full-Load Efficiencies %					
	Open Drip-Proof			Totally Enclosed Fan Cooled		
HP	1200 rpm	1800 rpm	3600 rpm	1200 rpm	1800 rpm	3600 rpm
1.0	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2.0	87.5	86.5	85.5	88.5	86.5	85.5
3.0	88.5	89.5	85.5	89.5	89.5	86.5
5.0	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10.0	91.7	91.7	89.5	91.0	91.7	90.2
15.0	91.7	93.0	90.2	91.7	92.4	91.0
20.0	92.4	93.0	91.0	91.7	93.0	91.0
25.0	93.0	93.6	91.7	93.0	93.6	91.7
30.0	93.6	94.1	91.7	93.0	93.6	91.7
40.0	94.1	94.1	92.4	94.1	94.1	92.4
50.0	94.1	94.5	93.0	94.1	94.5	93.0
60.0	94.5	95.0	93.6	94.5	95.0	93.6

75.0	94.5	95.0	93.6	94.5	95.4	93.6
100.0	95.0	95.4	93.6	95.0	95.4	94.1
125.0	95.0	95.4	94.1	95.0	95.4	95.0
150.0	95.4	95.8	94.1	95.8	95.8	95.0
200.0	95.4	95.8	95.0	95.8	96.2	95.4
250.0	95.4	95.8	95.0	95.8	96.2	95.8
300.0	95.4	95.8	95.4	95.8	96.2	95.8
350.0	95.4	95.8	95.4	95.8	96.2	95.8
400.0	95.8	95.8	95.8	95.8	96.2	95.8
450.0	96.2	96.2	95.8	95.8	96.2	95.8
500.0	96.2	96.2	95.8	95.8	96.2	95.8

B. Motor nameplate shall be noted with the above ratings.

2.4 MOTORS ON VARIABLE FREQUENCY DRIVES

A. All motors driven by VFDs shall be premium efficiency type.

B. Motors shall be designed for use with VFDs in variable torque applications with 1.15 service factor. Motors shall not be equipped with auxiliary blowers.

C. Motors driven by VFDs shall have Class F or H insulation and be designated by the motor manufacturer to be suitable for inverter duty service in accordance with NEMA MG 1 Section IV, "Performance Standards Applying to All Machines," Part 31 "Definite-Purpose Inverter-Fed Polyphase Motors.

D. All 480 volt motors driven by VFDs shall be provided with shaft grounding rings or grounding brushes as a means to protect bearings from adverse shaft currents.

1. Providing grounding rings internal to the motor housing is an acceptable solution, provided the motor is affixed with a label clearly indicating the presence of a grounding assembly. The grounding ring shall be listed for 40,000 hours of motor service and shall be accessible via the drive endplate.
2. Motor shafts 2" and larger require shaft grounding on the drive end and the non-drive end. This Contractor shall ensure (via field observation and measurement) that the shaft is effectively grounded upon startup.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

B. For flexible coupled drive motors, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Align shafts to manufacturer's requirements or within 0.002 inch per inch diameter of coupling hub.

END OF SECTION 23 05 13

SECTION 23 05 29

HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Equipment Bases and Supports.

C. Sleeves and Seals.

D. Flashing and Sealing of Equipment and Pipe Stacks.

E. Cutting of Openings.

1.2 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

C. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

D. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

E. MSS SP-127 - Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00. Include plastic pipe manufacturers' support spacing requirements.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 SEISMIC RESTRAINTS

A. Refer to Section 23 05 50 for additional requirements for seismic restraints.

2.2 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:

1. Copper, Plastic and Fiberglass Reinforced Pipe:

a. Hanger Rod Diameter:

1) 2-1/2" and smaller: 3/8"
2) 3") through 3-5/8": 3/8"
3) 4") through 6": 1/2"
4) 8": 5/8"
5) 10": 3/4"
6) 12": 7/8"
7) 14" and 16": 1"
8) 18" and 24": 1-1/4"

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.3 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

B. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Hangers in direct contact with bare copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp within their temperature limits of -65°°F to +275°°F.
3. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
4. Ferrous hot piping 4 inches and larger shall have steel saddles tack welded to the pipe at each support with a depth not less than specified for the insulation. Factory fabricated inserts may be used.

a. Products:

1) Anvil Fig. 160, 161, 162, 163, 164, 165
2) Eaton Fig. 3160, 3161, 3162, 3163, 3164, 3165
3) nVent Model 630, 631, 632, 633, 634, 635

5. Unless otherwise indicated, hangers shall be as follows:

    a. Clevis Type: Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and Smaller:

        1) Products: Bare Steel, Plastic or Insulated Pipe:

            a) Anvil Fig. 260
            b) Eaton Fig. 3100
            c) nVent Model 400

        2) Products: Bare Copper Pipe:

            a) Eaton Fig. B3104F or B3100CTC
            b) Anvil Fig. CT65
            c) nVent Fig. 402

6. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

    a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
    b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

7. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

    a. Clamp Type: Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller:

        1) Clamps in direct contact with copper pipe shall include plastic pipe insert similar to Unistrut Cush-A-Clamp, Hydra-Zorb, nVent Cushion Clamp or Eaton Vibra-Clamp.
        2) Pipes subject to expansion and contraction shall have clamps oversized to allow limited pipe movement.
        3) Products: Bare Steel, Plastic or Insulated Pipe:

            a) Unistrut Fig. P1100 or P2500
            b) Eaton Fig. B2000 or B2400
            c) Anvil Fig. AS1200
            d) nVent USC

        4) Products: Bare Copper Pipe:

            a) Eaton Fig. BVT
            b) nVent CADDY Cushion Clamp

C. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Wood Anchors: Tension wood rod hanger for suspending 3/8" threaded rod. Zinc plated carbon steel.

1) Minimum allowable tension loads for Douglass Fir/Southern Pine:

a) 3/8" diameter rod; 2-1/2" shank: 600 lb/590 lb.
b) Load values are based on full shank penetration into wood member. Minimum edge distance 3/4". Minimum end distance 3-1/4".

2) Limitations:

a) Truss: Do not hang from wood trusses without truss manufacturer or Structural Engineer™™s approval.
b) Sheetrock/Gypsum Ceiling: When drilling through non-wood materials (e.g., sheet rock, gypsum, etc.), increase shank length by depth of non-wood materials.
c) Plywood Flooring/Roofing: Do not hang from plywood floor or roofing.
d) Spacing: Refer to wood structure spacing of hangers.

3) Products:

a) Simpson RWV
b) DeWALT
c) ITI Sammys GT25

2.4 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Concrete Bases (Housekeeping Pads):

1. Refer to Section 23 05 50 for additional requirements for concrete bases in seismic applications.
2. Unless shown otherwise on the drawings, concrete bases shall be nominal 4 inches thick and shall extend 3 inches on all sides of the equipment (6 inches larger than factory base), except where pad extension would interfere with working space at equipment control panels and electrical panels.
3. Where a base is less than 12 inches from a wall, extend the base to the wall to prevent a "dirt-trap".

4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6"x6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at 28 days (be 20 MPa strength).
5. Equipment requiring bases is as follows:

    a. Air Handling Unit

C. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

D. Grout:

1. Grout shall be non-shrinking premixed (Master Builders Company "Embecco"), unless otherwise indicated on the drawings or approved by the Architect/Engineer.
2. Use Mix No. 1 for clearances of 1" or less, and Mix No. 2 for all larger clearances.
3. Grout under equipment bases, around pipes, at pipe sleeves, etc., and where shown on the drawings.

2.5 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

F. Exposed Housing Penetrations: Seal pipes with surface temperature below 150°F, penetrating housings with conical stepped, white silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite.

2.6 ROOF PENETRATIONS

A. Roof Curb Enclosure: Provide weatherproof roof curb and enclosure for pipe and duct penetrations. Refer to drawings for details.

B. Conical Pipe Boot: Seal pipes with surface temperature below 150°°F penetrating single-ply roofs with conical stepped, UV-resistant silicone, EPDM or neoprene pipe flashings and stainless steel clamps equal to Portals Plus Pipe Boots or Pipetite. Color: Black shall match roofing material.

C. Break insulation only at the clamp for pipes between 60°°F and 150°°F. Seal outdoor insulation edges watertight.

2.7 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

PART 3 - EXECUTION

3.1 HVAC SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Set all concrete inserts in place before pouring concrete.
3. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
4. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
5. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.

b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

D. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

E. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

F. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

G. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

1) 3/4" and under: 5'-0"
2) 1": 6'-0"
3) 1-1/4": 7'-0"
4) 1-1/2" 8'-0"
5) 2": 8'-0"
6) 2-1/2": 9'-0"
7) 3": 10'-0"
8) 4": 12'-0"
9) 6": 12'-0"

2. Hard Drawn Copper & Brass (Vapor Service):

a. Maximum Spacing:

1) 3/4" & under: 7'-0"
2) 1": 8'-0"
3) 1-1/4": 9'-0"
4) 1-1/2": 10'-0"
5) 2": 11'-0"
6) 2-1/2" & larger: 12'-0"

H. Wood Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

1) 3/4" & under: 5'-0"
2) 1": 6'-0"
3) 1-1/4": 6'-0"
4) 1-1/2": 6'-0"
5) 2": 8'-0"
6) 2-1/2": 9'-0"
7) 3": 10'-0"
8) 4": 10'-0"
9) 6": 10'-0"

2. Hard Drawn Copper & Brass (Vapor Service):

a. Maximum Spacing:

1) 3/4" & under: 6'-0"
2) 1": 6'-0"
3) 1-1/4": 6'-0"
4) 1-1/2": 6'-0"
5) 2": 10'-0"
6) 2-1/2" & larger: 10'-0"

I. Installation of hangers shall conform to MSS SP-58, 69, and 89.

END OF SECTION 23 05 29

SECTION 23 05 30

ROOF SUPPORT AND WIND BRACING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wind Restraint of Rooftop Equipment

B. Rooftop Access and Service Platforms

C. Rooftop Duct Support

D. Rooftop Pipe Support

E. Rooftop Equipment Support

1.2 REFERENCES

A. California Building Code (CBC)

B. California Division of State Architect (DSA) Interpretation of Regulations

C. ASCE 7-10, Chapter 29

D. ASCE 7-16, Chapter 29

1.3 SUBMITTALS

A. Submit under provisions of Section 23 05 00.

B. Submittal to Code Official:

1. Contractor shall submit copies of the wind restraint shop drawings to the governing code authority for approval.

C. Shop Drawings:

1. Calculations, restraint selections, and installation details shall be designed and sealed by a Structural Engineer licensed in the state where the project is located and experienced in wind restraint design and installation.
2. Coordination Drawings: Plans and sections drawn to scale, coordinating wind restraint bracing of mechanical components with other systems and equipment in the vicinity, including other wind restraint restraints.
3. Manufacturer's Certifications: Structural Engineer licensed in the state where the project is located shall review and approve manufacturer's certifications of compliance.
4. System Supports/Restraints - Submit for each condition requiring wind restraint bracing:

    a. Calculations for each wind restraint brace and detail used on the project.
    b. Plan drawings showing locations and types of wind restraint braces on contractor fabrication/installation drawings.

c. Cross-reference between details and plan drawings to indicate exactly which brace is being installed at each location. Details provided are to clearly indicate attachments to structure, correctly representing the fastening requirements of bracing.
d. Clear indication of brace design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.

5. Equipment - Submit for each piece of equipment supplied:

a. Certification that the equipment supplied for the project meets or exceeds the wind restraint requirements specified.
b. Specific details of wind restraint design features of equipment and maximum wind restraint loads imparted to the structural support.
c. Engineering calculations and details for equipment anchorage and support structure.

1.4 TESTING AND INSPECTION

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 DESIGN REQUIREMENTS

A. This project is subject to the wind loading requirements of the International Building Code **2021** edition.

B. The total height of the structure and the height of the system to be restrained within the structure shall be determined in coordination with architectural plans and the General Contractor.

1.7 COORDINATION

A. Coordinate layout and installation of anchoring with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

1.8 WARRANTY

A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SUPPLIERS

A. Miro Industries

B. Or equal

2.2 DESIGN CRITERIA

A. The following design criteria applies to all equipment noted below.

B. General Information:

1. Adopted Building Code: CBC-2022

C. Seismic:

1. Refer to Section 23 05 50 "Seismic Requirements For Equipment And Supports" for additional seismic requirements.

2.3 ACCESS AND SERVICE STAIRS AND PLATFORMS

A. Provide prefabricated OSHA 1910 compliant structure over obstructions and access to equipment installed on the roof as shown on the drawings. Supports include stanchioned supports anchored to the roof structure. Refer to drawings for stairs and/or service platform size, layout, and roofing material.

B. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain access and service stair and platforms for uplift and lateral loading.

C. Frame and Railing: Support frame and platform shall be hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.

D. Acceptable Manufacturer:

1. Miro Industries Stanchioned Crossover Stairs

2.4 ROOF DUCT SUPPORTS

A. Roof duct support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop duct system for uplift and lateral loading.

B. Refer to drawings for duct size, layout, structural framing, roofing material, and wind and seismic loading information.

C. Provide adjustable pre-fabricated roof duct supports for all duct installed on the roof. Supports include a combination of non-penetrating pillow block duct supports and stanchioned supports anchored to the roof structure.

D. Supports shall be constructed from hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.

E. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.

F. Acceptable Manufacturer:

1. Miro Industries DS and Stanchioned DS

2.5 ROOF PIPING SUPPORTS

A. Non-Penetrating Pillow Block Supports:

1. Provide pre-fabricated non-penetrating pillow block roof pipe supports for all piping installed on the roof.
2. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. Acceptable Products:

    a. Anvil International HBS-Base Series
    b. Cooper B-Line Dura-Blok
    c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load)
    d. Miro Industries 1.5, 3-R, 4-R or 5-R (to match pipe)

B. Premanufactured Anchored Roof Pipe Supports:

1. Roof duct support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop piping system for uplift and lateral loading.
2. Refer to drawings for pipe size, layout, structural framing, roofing material, and wind and seismic loading information.
3. Provide adjustable pre-fabricated pipe supports for all pipe installed on the roof. Supports include a combination of non-penetrating pillow block pipe supports and stanchioned supports anchored to the roof structure.

    a. Supports shall be constructed from hot dipped galvanized steel minimum 12-gauge channel or tube steel. Manufacturer shall determine final design.

4. Pillow block base shall be UV resistant polycarbonate rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
5. Acceptable Manufacturer:

    a. Miro Industries DS and Stanchioned DS

2.6 ROOF EQUIPMENT SUPPORTS

A. Premanufactured Equipment Roof Support Frames:

1. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop equipment for uplift and lateral loading.
2. Refer to drawings for equipment size, layout, structural framing, roofing material, and wind speed.
3. Provide adjustable prefabricated roof equipment supports for all equipment installed on the roof. Supports include stanchioned supports anchored to the roof structure.
4. Frame: Support frame shall be hot dipped galvanized steel minimum 12 gauge channel or tube steel. Manufacturer shall determine final design.
5. Decking: Support decking shall be minimum 1" thick, non-slip hot dipped galvanized bar grating.
6. Equipment requiring support frames is as follows:

    a. Filter racks
    b. Split system outdoor units
    c.

7. Minimum clear height above roof shall be 24 inches.

8. Acceptable Manufacturer:

    a. Miro Industries LD/HD

B. Equipment Roof Curbs and Rails:

1. Equipment requiring curbs or rails with this section is as follows:

    a. Exhaust fans

2. Provide prefabricated curbs or rails as follows:

    a. Roof Mounting Curb: Minimum 12 inches, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.
    b. 14 or 18 gauge galvanized sheet metal, as required for the equipment weight.
    c. Internal reinforcing.
    d. Pressure treated wood nailer.
    e. 18 gauge counter flashing completely covering nailer.
    f. Factory insulated with rigid fiberglass.

3. Refer to drawings for curb and rail heights.
4. Match units to the building roof with either a raised cant to match roof insulation (for built-up roofs) or with no cant (for single-ply roofs).
5. Where legs of equipment rest on rails, provide 1/4" bent plates 18" long.
6. Manufacturers:

    a. Thy
    b. Pate
    c. United
    d. Roof Products Systems
    e. Portals Plus

C. Exhaust Fans, Roof Hoods, Etc.:

1. Curb provided with equipment. Rooftop equipment such as roof hoods and rooftop exhaust fans shall be provided with curbs by the unit manufacturer. Refer to individual equipment sections for curb description.
2. This section shall provide anchoring such as guy wires, tethers, or straps to limit wind disruption.
3. Roof equipment support manufacturer shall provide ASCE-7 code-compliant sealed submittal to support and restrain rooftop equipment for uplift and lateral loading.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all items per manufacturer's instructions.

B. All wind restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

C. Installation of wind restraints shall not cause any change in position of equipment, piping, or ductwork resulting in stresses or misalignment.

D. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

E. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast-in-place inserts.

F. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment, ductwork, piping, or conduit. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only. Do not install cables over sharp corners.

G. Provide reinforced clevis bolts when required.

H. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.

I. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.

J. Supports shall extend directly to building structure.

K. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.

L. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.

3.2 ROOF PIPING SUPPORTS

A. Roof Supports: Install per manufacturer's requirements. Coordinate with Roofing Contractor.

B. Install roof pipe supports to resist wind movement per manufacturer's recommendations. Method of securing base to roof shall be compatible with roofing materials.

C. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

D. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.

E. Support piping at equipment and valves so it can be disconnected and removed without further supporting the piping.

F. Piping shall not introduce strains or distortion to connected equipment.

G. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, and at equipment connections and heavy fittings.

H. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

I. Spacing: Refer to Supports and Anchors section for pipe spacing requirements.

3.3 INSPECTION

A. Special inspection and testing shall be done in accordance with Chapter 17 of the California Building Code.

B. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.

END OF SECTION 23 05 30

SECTION 23 05 48

HVAC VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Bases.

B. Vibration Isolation.

C. Flexible Connectors.

1.2 SUBMITTALS

A. Submit shop drawings per Section 23 05 00 and the Vibration Isolation Submittal Form at the end of this section.

B. Vibration isolation submittals may be included with equipment being isolated, but must comply with this section.

C. Base submittals shall include equipment served, construction, coatings, weights, and dimensions.

D. Isolator submittals shall include:

1. Equipment served
2. Type of Isolator
3. Load in Pounds per Isolator
4. Recommended Maximum Load for Isolator
5. Spring Constants of Isolators (for Spring Isolators)
6. Load vs. Deflection Curves (for Neoprene Isolators)
7. Specified Deflection
8. Deflection to Solid (at least 150% of calculated deflection)
9. Loaded (Operating) Deflection
10. Free Height
11. Loaded Height
12. Kx/Ky (horizontal to vertical stiffness ratio - for spring isolators)
13. Materials and Coatings
14. Spring Diameters

E. Make separate calculations for each isolator on equipment where the load is not equally distributed.

F. Flexible connector shop drawings shall include overall face-to-face length and all specified properties.

G. Submit certification that equipment, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

a. 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. 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."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

H. Contractor shall provide seismic bracing calculations stamped by a licensed California Structural Engineer for all suspended utilities.

1. Contractor to submit shop drawings showing the following:

a. All seismic bracing locations and type of restraint being used.
b. Maximum seismic loads shall be indicated on the shop drawings for each brace location.
c. Manufacturer's seismic restraint layout on contractor shop drawings to be stamped by a licensed California Structural Engineer for all suspended utilities.

PART 2 - PRODUCTS

2.1 BASIC CONSTRUCTION AND REQUIREMENT

A. Vibration isolation for this project is subject to seismic restraint requirements of Section 23 05 50.

B. Vibration isolators shall have either known undeflected heights or other markings so deflection under load can be verified.

C. All isolators shall operate in the linear portion of their load versus deflection curve. The linear portion of the deflection curve of all spring isolators shall extend 50% beyond the calculated operating deflection (e.g., 3" for 2" calculated deflection). The point of 50% additional deflection shall not exceed the recommended load rating of the isolator.

D. The lateral to vertical stiffness ratio (Kx/Ky) of spring isolators shall be between 0.8 and 2.0.

E. All neoprene shall have UV resistance sufficient for 20 years of outdoor service.

F. All isolators shall be designed or treated for corrosion resistance. Steel bases shall be cleaned of welding slag and primed for interior use, and hot dip galvanized after fabrication for exterior use. All bolts and washers over 3/8" diameter located outdoors shall be hot dip galvanized per ASTM A153. All other bolts, nuts and washers shall be zinc electroplated. All ferrous portions of isolators, other than springs, for exterior use shall be hot dip galvanized after fabrication. Outdoor springs shall be neoprene dipped or hot dip galvanized. All damage to coatings shall be field repaired with two coats of zinc rich coating.

G. Equip all mountings used with structural steel bases with height-saving brackets. Bottoms of the brackets shall be 1-1/2" to 2-1/2" above the floor or housekeeping pad, unless shown otherwise on the drawings. Steel bases shall have at least four points of support.

H. All isolators, except M1, shall have provision for leveling.

2.2 MOUNTINGS

A. Type M1:

1. 0.75" thick waffled neoprene pad with minimum static deflection of 0.07" at calculated load and 0.11" at maximum load. For loads less than 15 pounds, the deflection at calculated load requirement is waived, but the isolator must have a maximum stiffness of the ratio of 45#/0.35".
2. Units need not be bolted down unless called for or needed to prevent movement. If bolted down, prevent short circuiting with neoprene bushings and washers between bolts and isolators.
3. Manufacturers:

    a. Mason "Super W"
    b. Kinetics "NGS"
    c. VMC/Amber-Booth "SPNR"
    d. Vibration Eliminator Co. "400N"

B. Type M4:

1. Use restrained spring mountings for equipment with operating weight different from the installed weight such as chillers and boilers, and equipment exposed to the wind such as cooling towers.
2. Spring isolators shall be free-standing with 1/4" neoprene acoustical friction pads.
3. All units shall have bolt holes and be bolted down. Prevent short circuiting with neoprene bushings and washers between bolts and isolators.
4. All mountings shall have leveling bolts.
5. Housings with vertical resilient limit stops shall prevent spring extension when weight is removed. Housings shall serve as blocking during erection and the installed and operating heights shall be the same.
6. Maintain a minimum clearance of 1/2" around restraining bolts and between the housings and the springs so as not to interfere with the spring action.
7. Limit stops shall be out of contact during normal operation.
8. Select isolators for equipment subjected to wind loads in conformance with ASCE 7-02.
9. Manufacturers:

    a. Mason "SLRS"
    b. Kinetics "FLS"
    c. Aeroflex "AWRS"
    d. Vibration Eliminator Co. "KW"

2.3 FLEXIBLE CONNECTORS (NOISE AND VIBRATION ELIMINATORS)

A. Type FC1:

1. Spherical flexible connectors with multiple plies of nylon tire cord fabric and either EPDM or molded and cured neoprene. Outdoor units shall be EPDM.
2. Steel aircraft cables or threaded steel rods shall be used to prevent excess elongation.
3. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer.
4. Connectors up to 2" size may have threaded ends.
5. Connectors 2-1/2" and over shall have floating steel flanges recessed to lock raised face neoprene flanges.
6. All connectors shall be rated for a minimum working pressure of 150 psi at 200°°F.

7. Manufacturer:

   a. Metraflex "Double Cable-Sphere"
   b. Minnesota Flex Corp.
   c. Mercer "200 Series"
   d. Twin City Hose "MS2".

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Provide vibration isolation as indicated on the drawings and as described herein.

C. Clean the surface below all mountings that are not bolted down and apply adhesive cement equal to Mason Type WG between mounting and floor. If movement occurs, bolt mountings down. Isolate bolts from baseplates with neoprene washers and bushings.

D. All static deflections listed in the drawings and specifications are the minimum acceptable actual deflection of the isolator under the weight of the installed equipment - not the maximum rated deflection of the isolator.

E. Support equipment to be mounted on structural steel frames with isolators under the frames or under brackets welded to the frames. Where frames are not needed, fasten isolators directly to the equipment.

F. Where a specific quantity of hangers is noted in these specifications, it shall mean hanger pairs for support points that require multiple hangers, such as rectangular ducts or pipes supported on a strut rack.

3.2 PIPE ISOLATION

A. Install flexible connectors in all piping connected to vibration producing equipment. This includes all fans, base-mounted pumps, compressors, etc. Absence of flexible connectors on piping diagrams does not imply that they are not required.

B. Provide sufficient piping flexibility for vibrating refrigerant equipment, or furnish flexible connectors with appropriate temperature and pressure ratings.

C. Support piping to prevent extension of flexible connectors.

3.3 VIBRATION ISOLATION SCHEDULE

A. AHU Fans:

1. Base Type: B1 or B2 or B3
2. Isolator Type: M3 and/or TR1
3. Static Deflection: Refer to ASHRAE Table
4. Flexible Connections: Per Section 23 33 00

B. Packaged HVAC Unit (less than 10 HP):

1. Base Type: NA

2. Isolator Type: M3 or H2 or H3
3. Static Deflection: 0.75"
4. Flexible Connections: Per Section 23 33 00

END OF SECTION 23 05 48

SECTION 23 05 53

HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 23.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

B. ASTM B-1, B-3, and B-8 for copper conductors.

C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 - 2kV Cables.

D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.

E. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00. Include list of items identified, wording, letter sizes, and color coding.

B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 3M

B. Bunting

C. Calpico

D. Craftmark

E. Emedco

F. Kolbi Industries

G. Seton

H. W.H. Brady

I. Marking Services.

2.2 MATERIALS

A. General:

1. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
2. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
3. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
4. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

B. Ceiling Markers:

1. Label Style:

a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves. An arrow can be used to point to the tile needing removal.
b. The label tape shall be approximately 1/2" wide with all capitalized letters approximately 3/16□□ tall.
c. Ceiling grid labels shall be made with a label maker with durable adhesive labels having a clear background and black letters.
d. Equipment labels shall be as designated on the drawings (e.g., FCU-606B, etc.).
e. Valve labels shall be designated by the size, service, and the valve tag number (e.g., 1-1/4□□ CW #123, 2□□ HWS #234, etc.). A single longer label can be used to identify multiple valves using spaces between the descriptors if the valves are located close together and have the same service (e.g., HWS and HWR valves serving the same equipment or CW, HW, and HWC lines serving the same restroom, etc.).
f. Fire, fire/smoke and smoke dampers shall be labeled consistent with the type (e.g., Fire Damper, Fire/Smoke Damper, etc.).

2. "Dot" Style:

a. The intent is for the ceiling labels to be inconspicuous but easy to find and read while standing underneath. The labels shall be located on the grid T-bar nearest the ceiling tile that can be removed to provide the best access to the serviceable side of equipment or to valves.
b. The marker shall be a self-adhesive color dot approximately 1/2□□ in diameter.
c. The equipment and accessories to be marked and dot color shall be coordinated with the Architect/Engineer and Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem.
6. Number all tags and show the service of the pipe.
7. Provide one Plexiglas framed valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.
8. Provide one 36" x 24" minimum Plexiglas framed piping schematic showing valve locations with respective tag numbers. Mount directory in location chosen by the Architect/Engineer.
9. Provide two sets of laminated 8-1/2" x 11" (letter size) copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner and Architect/Engineer prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.

D. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

E. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.
2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

3.2 SCHEDULE

A. Ductwork and Fan Systems: All fans, filters housings, and access doors shall be labeled with text as follows:

1. SUPPLY AIR: White lettering; green background
2. RETURN AIR: White lettering; green background
3. GENERAL EXHAUST AIR: Black lettering; yellow background
4. VENTILATION AIR: White lettering; green background

END OF SECTION 23 05 53

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjusting, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, SMARTA Certified Air and Hydronic Balancer, or TABB Certified Supervisor.

B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance, Seventh Edition.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.

D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.

E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.

F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.

G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing (latest edition).

H. TABB - International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.

B. Electronic Copies:

1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

C. Paper Copies:

1. Submit certified copies of test reports to the Architect/Engineer for approval in soft cover, 3-hole binder manuals, with cover identification. Include index page and indexing tabs.

1.5 REPORT FORMS

A. Submit reports on AABC, SMACNA or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals, or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of **24** manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

B. Project will be constructed in phases. Provide balancing report after each phase is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.

C. Recorded data shall represent actual measured or observed conditions.

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.

E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.

G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 23 09 00 for additional information.

H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

A. Before beginning work, verify that systems are complete and operable. Ensure the following:

1. General Equipment Requirements:

    a. Equipment is safe to operate and in normal condition.
    b. Equipment with moving parts is properly lubricated.
    c. Temperature control systems are complete and operable.
    d. Proper thermal overload protection is in place for electrical equipment.
    e. Direction of rotation of all fans and pumps is correct.
    f. Access doors are closed and end caps are in place.

2. Duct System Requirements:

    a. All filters are clean and in place. If required, install temporary media.
    b. Duct systems are clean and free of debris.
    c. Fire/smoke and manual volume dampers are in place, functional and open.
    d. Air outlets are installed and connected.

e. Duct system leakage has been minimized.

3. Pipe System Requirements:

a. Coil fins have been cleaned and combed.
b. Hydronic systems have been cleaned, filled, and vented.
c. Strainer screens are clean and in place.
d. Shutoff, throttling and balancing valves are open.

B. Report any defects or deficiencies to Architect/Engineer.

C. Promptly report items that are abnormal or prevent proper balancing.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.

B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

A. ± 10% of scheduled values:

1. Adjust air inlets and outlets to ± 10% of scheduled values.
2. Adjust piping systems to **±10%** of design values.

B. ± 5% of sculed values:

1. Adjust fume exhaust systems to ± 5% of scheduled values.
2. Adjust supply and exhaust air-handling systems for space pressurization to ± 5% of scheduled values, and to provide proper pressurization.

C. + 5% ofeduled values

1. Adjust outdoor air intakes to within + 5% of scheduled values.
2. Adjust exhaust air through energy recovery equipment to within +5% of scheduled values.

D. Adjust supply, return, and exhaust air-handling systems to +10% / -5% of scheduled values.

3.5 ADJUSTING

A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

B. Once balancing of systems is complete, at least one damper or valve must be 100% open.

C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.

D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 Verification of existing systems.

A. Perform a pre-balance of systems serving the area of construction prior to the start of any other work. Do not make adjustments to the systems. If the systems are not operating at maximum capacity, temporarily drive system to maximum and take readings for the system. Return the system to its original state when measurements are complete.

1. Air Handling Unit:

a. General Requirements:

1) Existing Equipment Tag (if available).
2) Location.
3) Manufacturer, model, arrangement, class, discharge.
4) Fan RPM.

b. Flow Rate:

1) Supply flow rate (cfm)
2) Return flow rate (cfm)
3) Outside flow rate (cfm)
4) Exhaust flow rate (cfm)

c. Pressure Drop and Pressure:

1) Filter pressure drop.
2) Total static pressure. (Indicate if across fan or external to unit).
3) Inlet pressure.
4) Discharge pressure.

2. Exhaust Fan

a. Drawing symbol.
b. Location.
c. Manufacturer and model.
d. Flow rate (cfm).
e. Total static pressure. (Indicate measurement locations).
f. Inlet pressure.

g. Discharge pressure.
h. Fan RPM.

B. Report findings to Architect/Engineer on standard forms. Provide two (2) copies of report.

4.2 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.
2. Project location.
3. Project Architect.
4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.3 AIR SYSTEMS

A. Duct Leakage Test:

1. Air system and fan.
2. Leakage class.
3. Test pressure.
4. Construction pressure.
5. Flow rate (cfm): specified and actual.
6. Leakage (refer to Section 23 31 00 in the specifications): specified and actual.
7. Statement that fire dampers, reheat coils and other accessories were included in the test.
8. Pass or Fail.
9. Test performed by.
10. Test witnessed by.

B. Air Moving Equipment:

1. General Requirements:

a. Drawing symbol.
b. Location.
c. Manufacturer, model, arrangement, class, discharge.
d. Fan RPM.
e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
f. Final frequency of motor at maximum flow rate (on fans driven by VFD).

2. Flow Rate:

a. Supply flow rate (cfm): specified and actual.
b. Return flow rate (cfm): specified and actual.
c. Outside flow rate (cfm): specified and actual.
d. Exhaust flow rate (cfm): specified and actual.

3. Pressure Drop and Pressure:

a. Filter pressure drop: specified and actual.
b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
c. Inlet pressure.
d. Discharge pressure.

C. Fan Data:

1. Drawing symbol.
2. Location.
3. Manufacturer and model.
4. Flow rate (cfm): specified and actual.
5. Total static pressure: specified and actual. (Indicate measurement locations).
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

D. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

E. Duct Traverse:

1. System zone/branch/location.
2. Duct size.
3. Free area.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Duct static pressure.
7. Air temperature.
8. Air correction factor.

F. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.
3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

END OF SECTION 23 05 93

SECTION 23 07 13

DUCTWORK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork Insulation.

B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.

B. Materials:

1. Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
2. Fungal Resistance: No growth when tested in accordance with ASTM G21 (antifungal test).
3. Rated velocity on coated air side for air erosion in accordance with UL 181 at 5,000 fpm minimum.
4. UL listed in Category HNKT.

C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

D. ASTM E84 - Surface Burning Characteristics of Building Materials.

E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.

F. ASTM E814 - Fire Tests of Through Penetrations Firestops.

G. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

I. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

J. NFPA 96 - Standard for the Installation of Equipment for Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

K. NFPA 255 - Surface Burning Characteristics of Building Materials.

L. UL - XHEZ - Through Penetration Firestop Systems.

M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

N. UL 263 - Full Scale External Fire Tests with Hose Stream.

O. UL 723 - Surface Burning Characteristics of Building Materials.

P. UL 1479 - Fire Tests of Through Penetrations Firestops.

Q. California Title 24 - Building Energy Efficiency Standards

R. CMC California Mechanical Code

PART 2 - PRODUCTS

		R-VALUE PER THICKNESS							
	THICKNESS	0.5	1	1.5	2	2.5	3	4	5
TYPE	K-FACTOR	R-VALUE							
Flexible Fiberglass Outside Wrap	0.28			5.4	7.1	8.9	10.7	14.3	17.9
Semi-Rigid Fiberglass Board Wrap	0.25			6.0	8.0	10.0	12.0	16.0	20.0
Flexible Fiberglass Liner	0.28	1.8	3.6	5.4	7.1	8.9	10.7	14.3	17.9
Rigid fiberglass liner	0.23		4.3	6.5	8.7	10.9	13.0	17.4	21.7
Double Wall Ductwork	0.27		3.7	5.6	7.4	9.3	11.1	14.8	18.5
Flexible High Temp Rigid Preformed Fiberglass Acoustical Liner	0.23		4.3	6.5	8.7	10.9	13.0	17.4	21.7

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.

B. Install materials after ductwork has been tested.

C. Clean surfaces for adhesives.

D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.

E. Continue insulation with vapor barrier through penetrations unless code prohibits.

F. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

A. Refer to Section 23 31 00 for scheduling of insulation.

B. Unless noted otherwise, HVAC plenums and unit housings not pre-insulated at factory shall be insulated to geographical R-value requirements based on California Title 24, R-4.2, R-6 or R-8.

END OF SECTION 23 07 13

SECTION 23 31 00

DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized Ductwork

B. Aluminum Ductwork

C. Ductwork Sealants

D. Rectangular Ductwork

E. Round and Flat Oval Ductwork

F. Exposed Ductwork (Rectangular, Round, or Oval)

G. Flexible Duct

H. Leakage Testing

I. Ductwork Penetrations

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.

B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ANSI/AWS A5.11M (1997) - Specification for Nickel and Nickel Alloy Welding Electrodes for Shielded Metal Arc Welding.

D. ASHRAE - Handbook 2020 Systems and Equipment; Chapter 19 - Duct Construction.

E. ASHRAE - Handbook 2021 Fundamentals; Chapter 21 - Duct Design.

F. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.

G. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

H. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.

I. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

J. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

K. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

L. ASTM E413-87 - Classification for Rating Sound Insulation.

M. AWS A5.14M (1997) - Specification for Nickel and Nickel Alloy Bare Welding Electrodes and Rods.

N. AWS D9.1M/D9.1 - Sheet Metal Welding Code.

O. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1.

P. IECC - International Energy Conservation Code (latest published edition)

Q. NADCA ACR 2002 - Assessment, Cleaning, and Restoration of HVAC Systems.

R. NADCA Standard 05 1997 - Requirements for the Installation of Service Openings in HVAC Systems.

S. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.

T. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.

U. NFPA 96 - Ventilation Control and Fire Protection of Commercial Cooking Equipment.

V. SCAQMD Rule 1168 - South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications.

W. SMACNA - Air Duct Leakage Test Manual.

X. SMACNA - HVAC Duct Construction Standards.

Y. SMACNA - Phenolic Duct Construction Standard 022.

Z. SMACNA - Round Industrial Duct Construction Standards - 1999 Edition.

AA. UL 181 - Factory-Made Air Ducts and Air Connectors.

BB. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors

CC. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.

DD. CMC - California Mechanical Code

EE. CBC - California Building Code

1.3 SUBMITTALS

A. Submit shop drawings per Section 23 05 00.

B. Submit duct fabrication standards in compliance with SMACNA and these specifications. Clearly indicate metal gauges, reinforcement, and joining methods intended for use for each pressure classification. Furnish details of all common duct fittings and joint connections to be used on this project.

C. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.

D. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
3. Room names and numbers, ceiling types, and ceiling heights.
4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.

E. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

1.4 DEFINITIONS

A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.

B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.

C. Exterior Duct: Ductwork located outside the conditioned envelope including exposed ductwork above the roof, outside exterior walls, in attics above insulated ceilings, inside parking garages, and crawl spaces.

D. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 23 05 00 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

B. Duct drawings shall be at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
3. Location and size of all duct access doors.

4. Room names and numbers, ceiling types, and ceiling heights.
5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS AND SUPPORTS

A. Rectangular Duct - Single Wall:

1. General Requirements:

   a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
   b. Transitions shall not exceed the angles in Figure 4-7.

2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

   a. All ducts shall be cross-broken or beaded.
   b. Snap lock seams are not permitted.
   c. Turning vanes shall be used in all 90°° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:

      1) Type 1:

         a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
         b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.

      2) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
      3) Runners must be installed at a 45°° angle. Elbows with different size inlet and outlet must be radius type.
      4) Omitting every other vane is prohibited.

   d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.

e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45°° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
g. Round taps off rectangular unlined ducts shall be flanged conical or bellmouth type (equal to Buckley Bellmouth or Sheet Metal Connectors E-Z Tap), or 45°° rectangular with transition to round (equal to Sheet Metal Connectors Inc. High Efficiency Takeoff). Straight taps are acceptable if pressure class is 1" or less, round duct is 12" diameter or less, and the tap is not located between fans and TAB devices.
h. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30°° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30°° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
i. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
j. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
k. Slide-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

    1) Apply sealant to all inside corners. Holes at corners are not acceptable.
    2) Manufacturers:

        a) Ductmate Industries - 25/35/45
        b) Nexus
        c) Mez
        d) WDCI
        e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

l. Formed-on flanged transverse joint systems are acceptable provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

    1) Apply sealant to all inside corners. Holes at corners are not acceptable.
    2) Flanges shall be 24-gauge minimum (not 26 gauge).
    3) Manufacturers:

        a) Lockformer TDC
        b) TDF
        c) United McGill
        d) Sheet Metal Connectors
        e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

B. Round and Flat Oval Spiral Seam Ductwork - Single Wall:

1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.
2. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
3. 90°° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
4. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
5. Ductwork shall be suitable for velocities up to 5,000 fpm.
6. Divided flow fittings may be made as separate fittings or factory installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
9. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
10. Transverse Joint Connections:

    a. Crimped joints are not permitted.
    b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
    c. Ducts and fittings larger than 36" shall have flanged connections.
    d. Secure all joints with at least 3 sheet metal screws before sealing.
    e. Manufacturers, Slide-on Flanges:

        1) Ductmate Industries - SpiralMate
        2) Accuflange
        3) Sheet Metal Connectors are acceptable.

    f. Manufacturers, Self-Sealing Duct Systems:

        1) Lindab
        2) Ward "Keating Coupling"

C. Hangers and Supports General Requirements:

1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts with spacing as required by SMACNA.

3. Cable Hangers:

    a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
    b. Manufacturers; Supports:

        1) Gripple
        2) Ductmate
        3) Duro Dyne
        4) Architect/Engineer approved

    c. Aircraft cable with 2-point support in standard horseshoe arrangement. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. 8'-0" OC and as required by CMC/UMC and SMACNA guidelines.

4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer’s ratings and instructions.

2.2 MATERIAL AND APPLICATION SPECIFIC

A. Galvanized Steel:

1. General Requirements:

    a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
    b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
    c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
    d. Ductwork reinforcement shall be of galvanized steel.

2. Duct Hangers and Support Material:

    a. Ductwork hangers and supports shall be of galvanized or painted steel.
    b. All fasteners shall be galvanized or cadmium plated.

B. Aluminum Ductwork:

1. General Requirements:

    a. Material: ASTM B209; aluminum sheet, Alloy 3003-H14. Aluminum connectors and bar stock: Alloy 6061-T6. Aluminum or stainless steel fasteners are acceptable.
    b. All duct gauges and reinforcement shall be as called for in Tables 2-50, 2-51, 2-52, and 3-14 of the SMACNA HVAC Duct Construction Standards.
    c. Ductwork reinforcement shall be of aluminum.

2. Duct Hangers and Supports Material:

    a. Ductwork hangers and supports shall be of aluminum. Slip cable hangers are acceptable if constructed of aluminum.

b. All fasteners shall be aluminum.

C. Duct Hangers and Support Material:

1. Ductwork hangers and supports shall be of galvanized or painted steel.
2. All fasteners shall be galvanized or cadmium plated.

D. Exposed Ductwork (Rectangular, Round, and Flat Oval):

1. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:

a. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
b. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
c. Remove all identification stickers and thoroughly clean exterior of all ducts.
d. Locate fitting seams on least visible side of duct.
e. Provide exterior finish suitable for field painting without further oil removal.
f. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct.
g. Manufacturers, Slide-on Flanges:

1) Ductmate Industries
2) Accuflange
3) Sheet Metal Connectors

h. Manufacturers, Self-Sealing Duct System:

1) Lindab
2) Ward "Keating Koupling"

i. The system shall be free of visible dents and scratches when viewed from normal occupancy.
j. All insulation shall be internal, except at reheat coils.

2. In addition to the paragraphs above, this section applies to all ductwork specified or shown as "Architecturally Exposed":

a. All spiral ductwork fittings shall be carbon arc welded.
b. Grind all welds to remove irregularities.
c. Conical taps shall be one piece. Taps for grilles and takeoffs shall be factory installed with a continuous weld and ground smooth.
d. Welds shall be ground smooth and painted.
e. All architecturally exposed ducts shall be round or flat oval except where not possible (grilles, reheat coils, etc.).

3. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:

a. Metal gauge of duct and fittings.
b. Fitting type and construction.
c. Type and size of reinforcement.

4. Hangers for Exposed Ductwork:

    a. Round Ducts:

        1) Threaded rod with duct fixing bracket and metal strap. Provide single threaded rod centered on the duct. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel wrapping the circumference of the duct. Spacing as required by SMACNA guidelines.
        2) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Spacing and cable size as required by SMACNA guidelines.

            a) Manufacturers, Supports: Gripple, Ductmate, Duro Dyne, Architect/Engineer approved.

        3) Aircraft cable with 2-point support in standard horseshoe arrangement. Spacing and cable size as required by SMACNA guidelines.

    b. Rectangular Ducts:

        1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" in maximum dimension. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines.

            a) Manufacturers, Supports: Gripple, Ductmate, Duro Dyne, Architect/Engineer approved.

        2) Aircraft cable with 2-point support in standard horseshoe arrangement. Corner saddles are required when supporting rectangular ductwork. 8'-0" OC and as required by CMC/UMC and SMACNA guidelines.

    c. Strut-channel and all-thread rod is not acceptable for exposed ductwork.
    d. All fasteners shall be galvanized or cadmium plated.

E. Automotive Exhaust Duct:

1. Sheet Metal:

    a. Ductwork shall be spiral seam single wall type. Construct to requirements of SMACNA Class I Industrial Duct with a pressure rating of 7" negative.
    b. Do not penetrate fire rated partitions, unless protected as required by applicable codes.

2. Tubing/Flex Hoses:

    a. Flexible ducts shall be high temperature fiberglass with wire reinforcing.
    b. Provide hose reels, lifting elbows, support cables, winches, tailpipe adaptors, and all other required accessories.
    c. Manufacturers, Tubing:

        1) DSP Monoxivent
        2) Car-Mon Products, Inc.
        3) Engwald
        4) National

2.3 DUCTWORK REINFORCEMENT

A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.

1. Ducts must be over 18" wide.
2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
3. Tie rods must not exceed 1/2" diameter.
4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.4 DUCTWORK SEALANTS

A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Joint sealers for use on exterior weather exposed ductwork shall be rated for -30°F to +175°F and 2000-hour minimum UV resistance per ASTM G-53.

C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.

D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

E. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F.

1. Manufacturers, Pressure-Sensitive Tape:

a. Venture Tape 1581A

b. Compac #340
c. Scotch Foil Tape 3326
d. Polyken 339

2.5 FLEXIBLE DUCT

A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.

B. Flame Spread/Smoke Developed: Not over 25/50.

C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.

D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.

E. Standard:

1. Flexible duct shall have corrosion-resistant wire helix, bonded to an inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.
2. Usage:

    a. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
    b. Connections to air inlets and outlets. Do not exceed 5'-0" in length.

F. Acoustic:

1. Flexible duct shall be acoustic rated in accordance with ASTM E477 and ADC Test Code FD 72-RI by ETL. Insertion loss values noted below are for flow velocities less than 2,500 fpm. Submittals shall include insertion losses ratings per sizes and lengths listed below regardless of sizes shown on the drawings.
2. Flexible have corrosion-resistant wire helix, bonded to a nylon fabric core inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. Usage: All areas unless noted otherwise.
3. Inner liner shall be airtight and suitable for 6" WC static pressure through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft2*ºF*hr/Btuh. Temperature range of at least 0-180ºF. Maximum velocity of 4,000 fpm. "R" value shall not be less than 4.0 ft2*°F*hr/Btuh. Ducts in unconditioned spaces and ventilated attics: "R" value shall not be less than 6.0 ft2*°F*hr/Btuh.

4. Minimum Acoustic Insertion Losses per octave band:

a. Straight Duct:

	Length	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz
6" ø	6 ft	4.0	13	15	15	16	17	16
6" ø	3 ft	2.3	4.9	5.3	5.3	5.5	5.8	5.4
8" ø	6 ft	5.7	14	13	15	16	18	16
8" ø	3 ft	2.9	5.0	4.9	5.7	5.6	5.8	5.6
12" ø	6 ft	5.5	13	12	15	15	18	13
12" ø	3 ft	2.8	4.8	4.7	5.3	5.3	5.8	4.9

b. 90deg Elbow:

	Length	63hz	125hz	250hz	500hz	1000hz	2000hz	4000hz
6" ø	6 ft	10	15	16	17	18	17	18
6" ø	3 ft	3.8	5.4	5.5	5.7	5.9	5.8	5.9
8" ø	6 ft	10	15	16	17	16	18	18
8" ø	3 ft	2.4	5.3	5.6	5.8	5.6	5.9	6.0
12" ø	6 ft	11	14	15	16	15	16	15
12" ø	3 ft	4.4	5.1	5.3	5.5	5.4	5.6	5.3

5. Usage:

a. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
b. Connections to air inlets and outlets. Do not exceed 5'-0" in length.
c. Acceptable Manufacturers:

1) Flexmaster USA - Type 6
2) Thermaflex M-Ke

G. Radius Forming Elbows:

1. Flexible plastic radius forming elbow for use with flexible ducts to create 90deg elbow. One size for 6" to 16" diameter ducts. UL listed for return plenum spaces.
2. Usage: All supply air terminals with flexible ductwork connection.
3. Installation: Attach to flex duct and secure draw bands without crushing flex duct to form smooth radius elbow. Suspend radius forming elbow to structure. Install per manufacturer's instructions.
4. Acceptable Manufacturers:

a. Hart & Cooley - Smartflow
b. Thermaflex - Flexflow
c. Titus - Flexright

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide openings in ducts for thermometers and controllers.

B. Locate ducts with space around equipment for normal operation and maintenance.

C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.

D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.

E. Supply ductwork shall be free of construction debris, and shall comply with Level ""C" of the SMACNA Duct Cleanliness for New Construction Guidelines.

F. Repair all duct insulation and liner tears.

G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.

H. Insulate terminal air box reheat coils. Seal insulation tight to form a tight vapor barrier.

I. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.

J. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.

K. Install all exterior ductwork per SMACNA Fig. 6-3. Where drawings do not indicate otherwise, ductwork seams and joints shall be sealed watertight and pitched to shed water.

L. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.

M. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by California Building Codes.

N. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.

O. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.2 DUCTWORK APPLICATION SCHEDULE

A. Refer to Ductwork Application Schedule **below** for specific requirements for system, material, shape, pressure class, seal class and insulation application.

B. Example #12 Constant Volume from Fan to Outlet:

1. Shape:

a. Rectangular Duct - Single Wall
b. Round and Flat Oval Spiral Seam Ductwork - Single Wall
c. Round Snap-Lock Seam Ductwork - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:

a. ASHRAE 90.1-2022: 1-1/2" **thick Type A (R=8)**

6. Additional Requirements: None

C. Return Duct:

1. Material: Galvanized Steel
2. Pressure Class: -2"
3. Seal Class: A
4. Insulation:

a. ASHRAE 90.1-2022: None

5. Additional Requirements: None

D. Example #14 Exterior Return Duct:

1. Shape:

a. Rectangular Duct - Double Wall

2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:

a. ASHRAE 90.1-2022: 2" thick Type B (R=8)

6. Additional Requirements: None

E. Example #15 General Exhaust Duct:

1. Shape:

a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: -1"
4. Seal Class: A
5. Insulation: **None**
6. Additional Requirements: None

F. Example #17 AHU Exhaust Air Duct:

1. Shape:

    a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. ASHRAE 90.1-2022 and IECC-2021
6. Additional Requirements: None.

G. Example #18 Relief/Exhaust Air Duct from Fan to Exhaust Outlet:

1. Shape:

    a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:

    a. ASHRAE 90.1-2022: **None**

H. Example #23 Mixed/Make-up Air Duct:

1. Shape:

    a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:

    a. ASHRAE 90.1-2022: 1-1/2" thick Type A (R=8)

I. Example #24 **Makeup** Air Duct from Fan to Outlet:

1. Shape:

    a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:

    a. ASHRAE 90.1-2022: 1-1/2" **thick Type A (R=8)**

J. Example #30 Constant Volume from Fan to Outlet:

1. Material: Phenolic Non-Fibrous Closed Cell Ductwork - Indoor
2. Pressure Class: +3"

3. Seal Class: A
4. Insulation: None

K. Example #31 Return Duct:

1. Material: Phenolic Non-Fibrous Closed Cell Ductwork - Indoor
2. Pressure Class: -3"
3. Seal Class: A
4. Insulation: None

3.3 SPECIAL INSULATION REQUIREMENTS

A. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):

1. Insulation:

a. ASHRAE 90.1-2022: 1-1/2" thick Type A (R=8)

B. Linear Diffuser Supply Plenum:

1. Insulation:

a. ASHRAE 90.1-2022: 1-1/2" thick Type A (R=4.5)

3.4 DUCTWORK SEALING

A. General Requirements:

1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

D. Special Requirements for Dedicated Outside Air Systems (DOAS):

1. Apply aluminum-based adhesive sealant tape at non-flanged joints on ducts serving dedicated outside air supply (DOAS) and exhaust system in addition to Class A sealant.

2. Apply aluminum-based adhesive sealant tape on TAB boxes (all seams and joints of the box and duct connections) serving dedicated outside air supply (DOAS) system.

3.5 TESTING

A. Interior Duct - Less than 3" WG (positive or negative):

1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
3. Seal ducts to bring the air leakage into compliance.
4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

B. Interior Duct - 3" WG and Above (positive or negative):

1. A minimum of 25% of interior ductwork (inside the building envelope) shall be tested. The Owner or designated representative shall select the sections to be tested. If duct has outside wrap, testing shall be done before it is applied.
2. Duct system shall be completely pressure tested. If duct has outside wrap, testing shall be done before it is applied.
3. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
4. Seal ducts to bring the air leakage into compliance.
5. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

C. Exterior Duct - 1/2" WG and Above (positive or negative):

1. All exterior ductwork (outside the building envelope) shall be completely pressure tested. If duct has outside wrap, testing shall be done before it is applied.
2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
3. Seal ducts to bring the air leakage into compliance.
4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

D. Test Procedure:

1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:

    a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
    b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
    c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
    d. All joints shall be felt by hand, and all discernible leaks shall be sealed.

e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.6 DUCTWORK PENETRATIONS

A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.

B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.

C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

END OF SECTION 23 31 00

SECTION 23 33 00

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual Volume Dampers.

B. Fire Dampers.

C. Pressure Relief Doors.

D. Backdraft Dampers.

E. Fabric Connectors.

F. Drip Pans.

G. Duct Access Doors.

H. Duct Access Sleeve.

I. Duct Test Holes.

1.2 REFERENCES

A. AMCA Guide for Commissioning and Periodic Performance Testing of Fire, Smoke and Other Life Safety Related Dampers.

B. ASTM E477-20 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

C. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.1.

D. NFPA 72 - National Fire Alarm and Signaling Code

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

F. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.

G. NFPA 92 - Standard for Smoke Control Systems.

H. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives.

I. SCAQMD Rule 1168 - South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications.

J. SMACNA - HVAC Duct Construction Standards (latest edition).

K. UL 33 - Heat Responsive Links for Fire-Protection Service.

L. UL 555 - Fire Dampers and Ceiling Dampers.

M. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

N. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00.

B. Submit manufacturer's installation instructions.

C. Include UL ratings, California State Fire Marshal approval and NFPA 90A, dynamic ratings, leakage, pressure drop and maximum pressure data.

D. Submit certification that ductwork accessories will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.
    a. 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. 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."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.

B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.

C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.

E. Provide locking quadrant regulators on single and multi-blade dampers.

F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

H. Contractor assembled modular manual dampers are acceptable as long as it contains the components listed above.

2.2 BACKDRAFT DAMPERS

A. Gravity backdraft dampers, size 18 inches x 18 inches or smaller, furnished with air moving equipment, may be air moving equipment manufacturer's standard construction.

B. Fabricate multi-blade, parallel action gravity balanced backdraft dampers of extruded aluminum, with blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90°° stop, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

C. Models:

1. Ruskin CBD4
2. Arrow 655
3. Safe-Air/Dowco BRL
4. Greenheck EM.

2.3 FABRIC CONNECTORS

A. Fabric connectors shall be installed between all fans or fan units and metal ducts or casings to prevent transfer of fan or motor vibration.

B. The fabric connectors shall be completely flexible material which shall be in folds and not drawn tight.

C. Fabric connectors shall be of glass fabric double coated with neoprene, with UL approval. Weight = 30 oz. per square yard minimum. Fabric shall not be affected by mildew and shall be absolutely waterproof, airtight and resistant to acids, alkalis, grease and gasoline, and shall be noncombustible.

D. Fabric connections shall not exceed 6" in length on ductwork that has a positive pressure. On ductwork that has a negative pressure, the length shall not exceed 2" in length.

E. All corners shall be folded, sealed with mastic and stapled on 1" centers.

F. Fabric connectors shall not be painted.

G. Unless otherwise shown on the drawings, the fabric connection at the inlet to centrifugal fans shall be at least one duct diameter from the fan to prevent inlet turbulence.

H. Materials:

1. Durodyne MFN-4-100
2. Vent Fabrics, Inc.
3. "Ventglas"
4. Proflex PFC3NGA

I. Fabric connectors exposed to sunlight and weather shall be as described above, except the coating shall be Hypalon in lieu of neoprene.

J. Materials:

1. Durodyne "Duralon MFD-4-100"
2. Vent Fabrics, Inc.
3. "Ventlon"
4. Proflex PFC3HGA

2.4 DRIP PANS

A. Install drip pans under all rooftop exhaust fans, intake hoods, exhaust hoods and other roof penetrations that do not have ductwork below them to intercept dripping water.

B. Drip pans shall be 22 gauge minimum cross-broken or reinforced sheet metal with 2" welded upturned lips.

C. Pans shall extend 6" in all directions beyond the opening and shall have the top of the lip located 25% of the maximum throat dimension below the opening.

D. Insulate interior of drip pan with 1" thick elastomeric foam insulation. Adhere foam to drip pan with standard foam adhesive.

2.5 DUCT ACCESS DOORS

A. Fabricate per Fig. 7-2 and 7-3 of the SMACNA HVAC Duct Construction Standards and as indicated.

B. Review locations prior to fabrication. Install access doors at fire dampers, smoke dampers, motorized dampers, fan bearings, filters, automatic controls, humidifiers, louvers, duct coils and other equipment requiring service inside the duct.

C. Construction shall be suitable for the pressure class of the duct. Fabricate rigid, airtight, and close-fitting doors of materials identical to adjacent ductwork with sealing gaskets butt or piano hinges, and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover.

D. Access doors with sheet metal screw fasteners are not acceptable.

E. Minimum size for access doors shall be 24" x 16" or full duct size, whichever is less.

F. Provide duct access door in all horizontal return ductwork at 20 foot intervals per NFPA 90A.

2.6 DUCT TEST HOLES

A. Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.7 DUCTWORK ACCESSORY SEALANTS

A. Ductwork accessory sealants and adhesives shall conform to Section 23 31 00.

B. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install accessories in accordance with manufacturer's instructions.
2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
3. Coordinate and install access doors provided by others.
4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
5. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.
3. Grease duct volume dampers shall be continuously welded to duct and/or hoods so that system is liquidtight.

C. Drain Pan:

1. Drain pans shall be installed per ASHRAE 62.1.

    a. All drain pans shall be field tested under normal operating conditions to ensure proper drainage.
    b. Field testing of drain pans is not required if units with factory installed drain pans have been certified (attested in writing) by the manufacturer for proper operation when installed as recommended.

END OF SECTION 23 33 00

SECTION 23 34 23

POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Roof Exhaust Fan.

B. Rooftop Fan Curbs.

1.2 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. Fabrication: Conform to AMCA 99.

D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.0.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 208 - Calculation of the Fan Energy Index (FEI).

C. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

D. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

E. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

F. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

G. SMACNA - HVAC Duct Construction Standards (latest edition).

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).

B. Submit manufacturer's installation instructions.

C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

D. Submit motor data indicating compliance with Section 23 05 13.

E. Submit certification that power ventilators, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

a. 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. 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."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

PART 2 - PRODUCTS

2.1 ROOFTOP EXHAUST FAN - DIRECT DRIVEN

A. Fan Wheel: Centrifugal type, aluminum or composite with backward inclined or airfoil blades, statically and dynamically balanced.

B. Housing: Removable, spun aluminum dome or rectangular top, with square, one piece, aluminum base and curb cap with Venturi inlet cone.

C. Fan Shaft: Turned, ground and polished steel; keyed to wheel hub.

D. Any steel parts shall be galvanized or epoxy coated. Non-corrosive fasteners.

E. Direct drive, motor mounted outside of airstream and ventilated with outside air.

F. Aluminum or brass bird screen. Plastic mesh will not be allowed.

G. Mill aluminum finish.

H. SPECIFIER: Delete motorized damper paragraphs if specifying/scheduling motor-operated dampers in Section 23 09 00.

I. Dampers: Furnish normally closed, electric motorized damper. Provide step-down transformer if required. Install and wire damper to open when fan runs. Dampers shall be aluminum with brass bushings, blade seals and blade tie rods. Leakage shall not exceed 4 cfm/sq.ft @1" SP (or shall be AMCA Class 1 certified).

J. Motor (as scheduled on drawings):

1. Induction: Furnish permanently lubricated sealed ball type motor and drive shaft bearings. Motor and wheel supported by vibration isolators.

a. Disconnect as scheduled on drawings.

b. Provide non-fused, factory mounted and wired disconnect switch mounted inside fan housing.
c. Disconnect provided by Electrical Contractor, wired in the field.

2. Electronically Commutated Motor (ECM): Motor shall be variable speed, constant torque, brushless permanent magnet (PM) motor for direct-drive applications. Electronics shall be encapsulated for moisture protection and shall include integral surge protection. Motor and controller shall be pre-wired for specific voltage and phase. Motor frame shall be NEMA 48; All EC motors shall be a minimum of 85% efficient at all speeds. Provide motor with onboard motor control module. Motor speed shall be limited to provide electronic overcurrent protection. Provide non-fused, with thermal overload protection, factory mounted and wired disconnect switch mounted inside fan housing. Starter shall provide soft start to reduce inrush current and shall be controllable from 20% to 100% of full rated speed. Operational mode shall be as follows:

a. ECM set for constant CFM.
b. ECM modulating control using 0-10Vdc modulating signal.
c. ECM set for constant pressure.

K. Speed Controller: For single phase shaded pole or permanent split capacity motor fans, furnish solid-state dial speed controller factory mounted inside fan unless shown otherwise on the drawings. Provide permanent marking at balanced point.

L. Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.

M. Manufacturers:

1. Greenheck

2. Aerovent "FACX"
3. Cook "ACE-D"
4.
5. Twin City DCRU

2.2 ROOFTOP FAN CURBS

A. Furnish and install prefabricated roof curbs for all rooftop fans.

B. Size curb to match the curb cap of fan.

C. Roof Mounting Curb: Minimum 12 inches, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

D. Construction: Unitized construction, continuous arc welded corner seams. Insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board. Damper support angle. Pressure treated wood nailer. Curb with cant.

1. 18-gauge galvanized steel.
2. 14-gauge aluminum.

E. If called for in the drawings, curbs shall be of the sound attenuation type. Sound attenuation curbs shall reduce the fan sone rating by at least 40% and not decrease fan cfm more than 8% (which is accounted for in the scheduled fan cfm). Baffles shall be removable for access to the dampers.

F. Manufacturers:

1. Same manufacturer as the fan

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated lag screws to roof curb.

C. If manufacturer has no recommendations, secure roof exhaust fans to curbs with 1/4" lag bolts on 8" maximum centers.

D. MC shall install and wire factory provided damper to open when the fan runs if the manufacturer does not provide an option to pre-wire the damper.

END OF SECTION 23 34 23

SECTION 23 37 00

AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grilles And Registers.

B. Linear Diffusers.

C. Linear Diffuser Supply Plenum.

D. Roof Hoods.

E. Roof Curbs.

F. Goosenecks.

1.2 QUALITY ASSURANCE

A. Test and rate performance of air inlets and outlets per ASHRAE 70.

B. Test and rate performance of louvers per AMCA 500L-99.

C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.

B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.

C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.

E. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00.

B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.

C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.

D. Submit manufacturer's installation instructions.

E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.

B. Conform to ASHRAE 90.1.

1.6 EXTRA STOCK

A. Provide clean filters in all filter return grilles at time of installation.

B. Provide one additional set of replacement filters for all filter return grilles. Deliver to Owner at job site.

PART 2 - PRODUCTS

2.1 AIR TERMINALS - GRILLES AND REGISTERS

A. Reference to a grille means an air supply, exhaust or transfer device without a damper.

B. Reference to a register means an air supply, exhaust or transfer device with a damper.

C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.

D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.

E. The capacity and size of the unit shall be as shown on the drawings.

F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect.

G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.

H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.

I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.

J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.

K. Where specified to have filters, provide with filter rack suitable for 1" thick MERV-8 pleated media filters. Grille border shall be fabricated from minimum 22 gauge steel or minimum 0.040-inch thick for aluminum grilles. Provide removable grille face with metal knurled knob or quarter turn fastener to allow for filter media replacement.

L. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.

M. Manufacturers:

1. Tuttle & Bailey
2. Titus
3. Price
4. Nailor
5. Carnes
6. Metalaire
7. Krueger
8. Anemostat
9. Raymon Donco

2.2 AIR TERMINALS - LINEAR DIFFUSERS

A. Plenum Slot Diffusers (Lay-In):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect. .
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Linear diffusers and mounting frames shall be furnished as one piece up to 5' in length.
6. Diffusers shall be furnished with factory installed adjustable.
7. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
8. Number and width of slots shall be as shown on the drawings.
9. Provide integral insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
10. Manufacturers:

    a. Tuttle & Bailey ITPS
    b. Carnes DA
    c. Price TBD
    d. Krueger PTBS
    e. Nailor 5800
    f. Titus TBD
    g. Metalaire
    h. Anemostat API
    i. Raymon Donco SAT

11. Linear diffusers for fire-rated ceiling shall be UL labeled with a non-adjustable air pattern. Airflow direction shall be as shown on the drawings.
12. Manufacturers for fire-rated diffusers:

    a. Kees FRK-UL
    b. Titus TBD-FR
    c. Krueger PFTBS
    d. Price TBD2-FR
    e. Raymon Donco 2000FR
    f. Metalaire

B. Linear Slot Diffusers (Continuous):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors capable of providing 180°° pattern adjustment.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Manufacturers:

    a. Tuttle & Bailey 6000/7000
    b. Carnes CH
    c. Price SDS
    d. Krueger 1900
    e. Nailor 5000
    f. Titus ML
    g. Anemostat SLAD
    h. Raymon Donco HPL
    i. Metalaire

C. Linear Bar Grille Diffusers:

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect per ANSI/ASHRAE 70.

4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear bar diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each bar grille. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
8. Diffuser length and width, bar width, and spacing between bars shall be as shown on the drawings.
9. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum section for details.
10. Manufacturers:

    a. Tuttle & Bailey 4000
    b. Carnes CC;CT;CW
    c. Krueger 1500/1600
    d. Price LB
    e. Nailor 4900
    f. Titus CT
    g. Metalaire 2000
    h. Anemostat AL/TL
    i. Raymon Donco DGB

2.3 AIR TERMINALS - LINEAR DIFFUSER SUPPLY PLENUM

A. Linear diffusers shall be provided with field fabricated or prefabricated supply plenums. Plenum shall be a minimum of 2-1/2" wider than total slot width, minimum length of slot, and minimum height of 10". Plenums with end fed duct connections shall not exceed 8' in length. The cross sectional area of the plenum shall be designed for a maximum velocity of 500 fpm and the aspect ratio shall be limited to a width-to-height ratio of less than 1.5. Plenums with side outlets shall be designed for a maximum velocity of 600 fpm and inlet ducts to plenum shall be spaced 5' on center maximum. Inlet ducts to plenums shall have a maximum velocity of 900 fpm. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.

B. Plenum shall be constructed with 24 gauge galvanized steel and shall have side inlets unless shown otherwise on the drawings. Refer to Ductwork Application Schedule in Section 23 31 00 for insulation requirements.

C. End caps and required accessories shall be integral with the plenum or furnished and installed by the Mechanical Contractor.

D. A manual volume damper shall be furnished and installed by the Mechanical Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings

E. Prefabricated plenums shall be by the same manufacturer as the linear diffuser or Kees Inc.

2.4 ROOF HOODS

A. Hoods shall be constructed of roll formed, interlocking aluminum panels. Vertical end panels are fully locked into hood.

B. Top of curb to hood inlet shall be minimum of 5".

C. Curb cap shall be of 14 gauge formed aluminum with mitered corners continuously heliarc-welded. Hood shall be of the same material and cross-broken for added strength. Underside of hood shall be coated with insulating mastics.

D. Hoods shall be furnished with aluminum bird screen.

E. Hood and throat shall be reinforced with extruded aluminum angle and have a minimum snow load rating of 30 lbs. per square foot.

F. Size, cfm, finish and pressure drop for hoods shall be as scheduled on the drawings.

G. Inlet area shall be minimum 150% of throat area for intake hoods. Outlet area shall be minimum 125% of throat area for exhaust hoods and relief vents.

H. Hoods shall be furnished with 12" high curb (above top of roof) and be of the size and type as shown on the drawings.

I. Hood shall be furnished with motorized damper unless otherwise noted on the drawings.

J. Manufacturers:

1. Ammerman
2. Carnes
3. Cook
4. Greenheck
5. ILG
6. Jenco Fan
7. PennBarry
8. Twin City Fan & Blower
9. York
10. United Enertech GEV-GIV

2.5 ROOF CURBS

A. Furnish and install, where shown on the drawings, prefabricated roof curbs for all rooftop hood openings.

B. Roof Mounting Curb: Curb shall be sized to match curb cap of the hood. Minimum 12 inches, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood Nailer.

C. Curbs shall be unitized construction, 18 gauge galvanized steel, with continuous arc welded corner seams, insulated with 1-1/2" thick, 3 lb. density rigid fiberglass board and damper support angle.

D. Curb without cant - suitable for use with membrane type roof.

E. Curb with built-in cant with step for roof insulation.

F. Manufacturers:

1. Same manufacturer as the equipment it serves or Pate, RPS, or Thy.

2.6 GOOSENECKS

A. Fabricate in accordance with SMACNA Duct Construction Standards of minimum 18 gauge galvanized steel.

B. Mount on minimum 12 inch high curb base.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install items in accordance with manufacturers' instructions.
2. Install seismic restraints according to SMACNA's "Kitchen Equipment Fabrication Guidelines, Appendix 1, Guidelines for Seismic Restraints for Kitchen Equipment".
3. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
4. Install diffusers to ductwork with air tight connections.
5. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.
6. Supply air diffusers in operating rooms (Class B and C surgery) shall be opened and cleaned before the space is used.
7. Supply grille and register blades shall be aimed in the field to provide adequate air distribution in the space. All return grilles and registers blades shall be oriented to minimize sight distance beyond installed device.

B. Volume Damper:

1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

C. Maintaining Duct Cleanliness:

1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 05 00.

END OF SECTION 23 37 00

SECTION 23 40 00

AIR CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Filters and Filter Media.

B. Activated Carbon Filters.

C. Filter Frames.

D. Filter Gauges.

1.2 QUALITY ASSURANCE

A. Filter media shall be tested under ANSI/UL 900 and labeled.

B. Provide all filters and filter banks by one manufacturer.

C. Air filters shall be State Fire Marshal approved and of a listed type. Preformed filters having combustible framing shall be tested as a complete assembly. Air filters in all occupancies shall be Class 2 or better (as shown in the State Fire Marshal listing). Air filters shall be accessible for cleaning or replacement.

1.3 REFERENCES

A. ANSI/UL 586 - Test Performance of High Efficiency Particulate, Air Filter Units.

B. ANSI/UL 867 - Standard for Electrostatic Air Cleaners.

C. ANSI/UL 900 - Test Performance of Air Filter Units.

D. ANSI/UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.

E. ASHRAE 26 - Guideline for Field Testing of General Ventilation Devices and Systems for Removal Efficiency In-Situ by Particle Size and Resistance to Flow.

F. ASHRAE 52.2 - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

G. ANSI/NFPA 70 - National Electrical Code.

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include data on media, performance, assembly and frames.

B. Submit certification that all air cleaning devices, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

a. 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. 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."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 EXTRA STOCK

A. Provide a total of three (3) sets of filters for all units.

1. Provide clean filters in all units at time of installation.
2. Provide clean filters in all units at project final completion after all interior finishes are complete.
3. Provide one additional set of replacement filters for all units. Deliver to Owner at job site.

PART 2 - PRODUCTS

2.1 MERV 8 (MEDIUM EFFICIENCY) - DISPOSABLE - TYPE D

A. Pleated media, disposable type with welded wire grid support bonded to the filter media.

B. Heavy duty, paper board frame with diagonal support members bonded to inlet and exit sides of each pleat. Bond frame to media periphery to eliminate air bypass.

C. 2" thick media with at least 4.6 square feet of media per square foot of face area. Maximum initial resistance of 0.30" WGat 500 fpm face velocity.

D. 1" thick media with at least 2.3 square feet of media per square foot of face area. Maximum 0.25" WG initial resistance at 350 fpm face velocity.

E. MERV 8 per ASHRAE 52.2.

2.2 MERV 13 (85% EFFICIENT) RIGID FILTER - DISPOSABLE - TYPE F

A. Pleated, rigid, disposable type with high density, fine fiberglass laminated to non-woven synthetic backing. Welded wire grid media support bonded to the filter media. Galvanized steel enclosing frame bonded to media periphery to eliminate air bypass.

B. Maximum 12" thick cartridges with at least 14.5 square feet of media per square foot of face area.

C. MERV 13 per ASHRAE 52.2. Maximum 0.60" WG initial resistance at 500 fpm face velocity.

D. Manufacturers:

1. Camfil
2. American Air Filter

2.3 ACTIVATED CARBON FILTERS - TYPE L

A. Assembly: Galvanized steel unit with extruded aluminum tracks to hold filter servicing trays in deep V arrangement with disposable panel pre-filter.

B. Media: 34lb/ft3 pelletized or granular activated carbon. Minimum 60% carbon tetrachloride activity; in thin bed trays, nominal frame size 24" x 24" x 12"; 1.42 ft3 of carbon per 1,000 cfm nominal airflow capacity.

C. Maximum 0.45" WG initial resistance at 500 fpm face velocity.

D. Manufacturers:

1. Camfil
2. Purafil
3. American Air Filter

2.4 SIDE ACCESS FILTER HOUSING

A. 16 gauge welded and caulked galvanized steel construction with bracing and prepunched standing flanges on inlet and outlet.

B. Full size, hinged access doors on each end of housing with 16 gauge galvanized steel, reinforced, positive sealing heavy duty latches and resilient gasketing.

C. 16 gauge galvanized steel or extruded aluminum holding tracks. "U" shaped bearing channel. Replaceable woven pile seals for filters.

D. Holds nominal 24" x 24" or 24"x12" filters without alteration.

E. Filter channel suitable for 1" or 2" thick prefilter and bag or cartridge type.

F. Manufacturers:

1. Camfil
2. American Air Filter

2.5 FILTER GAUGES

A. Inclined Manometer: One-piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, 0-2" WG range, 3% of full scale accuracy.

B. Accessories: Static pressure tips with integral compression fittings, 1/4" plastic tubing, 2- or 3-way vent valves, indicating fluid.

C. Manufacturers:

1. Dwyer "Mark II"

2. Meriam Instrument.

D. Differential Pressure Gauge: Diaphragm actuated, nominal 3" round dial, glass filled nylon housing, polycarbonate lens, zero adjustment, 0-2" W.G. range, 5% of full scale accuracy.

E. Accessories: Static pressure tips with integral compression fittings and 1/8" NPT plastic tubing.

F. Manufacturers:

1. Dwyer "Minihelic II" 2-5000
2. Marshalltown Instrument "Series 85C"

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturers' instructions.

B. Seal filter media to prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan systems without filters.

D. Install static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and calibrate. Every filter bank, including packaged units, shall have a filter gauge.

E. Install four (4) high efficiency filter test holes, two upstream and two downstream, at all high efficiency filter banks in air handling units and ductwork (85% efficiency and higher). Coordinate location of test holes with Owner.

END OF SECTION 23 40 00

SECTION 23 74 16.15

PACKAGED AIR CONDITIONING UNITS FOR DEDICATED OUTSIDE AIR

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Unit.

B. Unit Controls.

1.2 QUALITY ASSURANCE

A. All insulation inside the unit and in the air stream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).

B. All units must be UL or ETL listed and must contain UL labeled components.

C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.

D. Conform to ASHRAE 90.1 California Energy Code Title 24.

E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

A. AHRI 210 - Unitary Air Conditioning Equipment.

B. AHRI 240 - Air Source Unitary Heat Pump Equipment.

C. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

D. AHRI 920 - (I-P) and 921 (SI): Performance Rating of Direct Expansion-dedicated Outdoor Air System Units (with Addendum 1)

E. ASHRAE 37 - Methods of Testing for Rating Unitary Air Conditioning and Heat Pump Equipment.

F. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

G. NFPA 70 - National Electrical Code.

H. NFPA 90A - Installation of Air Conditioning and Ventilating System.

I. UL - Underwriters' Laboratory.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00.

B. Indicate electrical service and duct connections on shop drawings or product data.

C. Submit manufacturer's installation instructions.

D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

E. Submit fan curves, including minimum and maximum fan speed, with specified operating points clearly plotted.

F. Provide 8 octave maximum sound power levels at unit discharge and exhaust connection.

G. Submit certification that the packaged rooftop air conditioning units, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

    a. 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. 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."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

A. Provide five (5) year manufacturer's warranty for compressors.

B. Provide **standard** year manufacturer's warranty for heat exchanger.

C. Provide **standard** year manufacturer's warranty for controls and electrical components (thermostats, VFD, etc.).

1.8 MAINTENANCE SERVICE

A. Contractor shall furnish complete service and maintenance of packaged units for one year from Date of Substantial Completion.

B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of four (quarterly) filter replacements, minimum of one fan belt replacement, and controls checkout, seasonal adjustments, and recalibrations.

D. Submit copy of service call work order or report and include description of work performed to Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 23 05 00 for additional information.

B. Aaon

C. Trane

D. York

E. Daikin

F. Carrier

G. Captive Aire

2.2 MANUFACTURED UNITS

A. Provide units having electric heating elements, and electric refrigeration.

B. Unit shall be self-contained, packaged, factory assembled, pre-wired and tested, consisting of cabinet and frame, supply fan, , electric heating elements, controls, air filters, refrigerant cooling coil and compressor, condenser coil, condenser fan, and a full refrigerant charge.

C. Unit shall be furnished with non-fused disconnect switch, short fuse protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection.

D. AHRI rated for direct expansion use with R-32 or R-454B.

2.3 FABRICATION

A. Cabinet: Galvanized steel with baked enamel finish, access doors with locking door handle with piano hinges. Access doors shall be provided at each section (e.g., filter section, supply fan section, etc.). All exterior access must be permanently labeled on the outside indicating what is behind the panel. Structural members shall be minimum 18 gauge, with access doors minimum 20 gauge.

B. Outside Air Intakes: The outside air intakes shall be located a minimum of 15 inches above the mounting curb to minimize the effect of heat pickup from the roof during the natural cooling cycle and the effects of snow on the roof during winter operation. Each air intake shall be furnished with rain eliminators.

C. Insulation: All sections shall be double wall, foam injected casings.

D. Air Filters: Two inch thick glass fiber disposable media in metal frames with 4" pleated MERV 13 filter.

2.4 FANS/MOTORS

A. Fans:

1. Supply Fans: centrifugal; SWSI plenum or vane axial fan.
2. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
3. Fan and motor assemblies shall be resiliently mounted.
4. Direct drive motor.
5. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
6. All fans must be statically and dynamically balanced.

B. Motors:

1. Motors shall be open drip-proof with grease lubricated bearings.
2. Motors shall be "variable frequency drive rated" when controlled by VFDs. Refer to Section 23 05 13.
3. No equipment shall be selected or operate above 90% of its motor nameplate rating.
4. Motor shall have 1.15 service factor.
5. ECM motors may be provided.

2.5 ELECTRIC HEATING COIL

A. Helical nickel-chrome resistance wire coil heating elements with refractory ceramic support bushings easily accessible with automatic reset thermal cut-out, built-in magnetic contactors, galvanized steel frame, control circuit transformer and fuse, manual reset thermal cut-out, airflow proving device, toggle switch (pilot duty) unfused disconnect.

B. Controls shall start supply fan before electric elements are energized and continue operating until air temperature reaches minimum setting, with switch for continuous fan operation.

C. Heating shall have four stages of modulating SCR control.

2.6 EVAPORATOR COIL

A. Provide copper tube with aluminum fin coil assembly.

B. Install a drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. The drain pans shall extend the entire width of each coil, including piping and header if in the air stream. The length shall be as necessary to limit water droplet carryover beyond the drain pan to 0.0044oz per ft2 of face area per hour under peak sensible and peak dew point design conditions, considering both latent load and coil face velocity. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.

C. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

D. Provide insulation on liquid refrigerant and suction piping between compressor and evaporator coil where not protected by drain pans. Insulation shall be elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.27 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

E. Drain Pan Condensate Overflow Switch: Float with integral magnet overflow switch conforming to UL508. Factory installed in drain pan and wired to shut the rooftop unit down with a fault alarm. No standby power required.

2.7 HOT GAS REHEAT COIL

A. Provide copper tube with aluminum fin coil assembly.

B. Valves to reroute hot refrigerant gas from the discharge line of the compressor through the reheat coil.

2.8 COMPRESSOR

A. Provide hermetic or semi-hermetic compressors (quantity as scheduled on drawings), 3600 rev/min maximum, resiliently mounted with positive lubrication high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

B. Provide capacity control by staging multiple compressors, digital scrolls.

C. Five minute timed off circuit shall delay compressor start.

D. For heat pump units, provide reversing valve, suction line accumulator, flow control check valve, and solid-state defrost control utilizing thermistors.

E. The use of hydrochlorofluorocarbon (HCFC) or chlorofluorocarbon (CFC) based refrigerants is prohibited.

2.9 CONDENSER

A. Condenser shall provide design capacity between the minimum and maximum ambient conditions scheduled on the drawings.

B. Condenser Coil:

1. Round Copper Tube and Aluminum Fins: Construct condenser coils of aluminum fins mechanically bonded to seamless copper tubing. Air test under water to 450 psig (3100 kPa gauge).
2. Microchannel: All aluminum brazed fin construction. The maximum allowable working pressure of the condenser is 450 psig (3100 kPa gauge). Air test under water to 450 psig (3100 kPa gauge).

C. Condenser Fans: Provide direct drive low noise blade design propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Fan blade shall be aluminum or composite material.

D. Condenser Motors: Fan motors shall be an ECM type motor for proportional control. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

E. Entire fan assembly shall be statically and dynamically balanced.

F. Provide outdoor thermostat to cycle condenser fans.

G. Provide hail guards on all condenser coils.

H. Liquid and discharge isolation valves with staged and digital scrolls.

2.10 ELECTRICAL

A. Provide with single point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet.All units must be so constructed that when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120 volt duplex convenience outlet) is disconnected by means of a single disconnect.

B. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.

C. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.

D. All units shall include a transformer for controls and convenience outlet.

E. Only one power cable connection to the unit shall be necessary.

F. Motor shall include phase failure protection and prevent the motor from operation in the event of phase loss.

2.11 OPERATING CONTROLS - CONSTANT VOLUME DOAS UNITS

A. When ECMs are applied:

1. Constant Volume: The unit controller shall proportionally control the ECM motors on each fan based on inital airflow settings. The unit controller shall increase/decrease the speed of the supply fan in order to maintain the constant volume airflow. The unit controller shall provide discharge air temperature control with the compressor modulation.

B. When variable speed drives are applied:

1. Constant Volume: An electronic variable frequency drive shall be provided to balance each fan. Each drive shall be factory installed out of the airstream in a conditioned cabinet. Drives shall meet UL Standard 95-5V. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly. Mounting arrangements that expose drives to high temperature unfiltered ambient air are not acceptable.

C. Room thermostat shall incorporate:

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from setpoint.
3. Set-up for four separate temperatures per day.
4. Instant override of setpoint for continuous or timed period from one hour to 31 days.
5. Short cycle protection.
6. Programming based on weekdays, Saturday and Sunday.
7. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

D. Controller display shall include:

1. Time of day.
2. Supply duct temperature.
3. Programmed temperature.
4. Programmed time.
5. Duration of timed override.
6. Day of week.
7. System model indication: heating, cooling, auto, off, fan auto, fan on.
8. Stage (heating or cooling) operation.

E. Provide low limit sequence to close outside air dampers and stop fans.

F. Dehumidification Controls: Maintain the relative humidity setpoint with the hot refrigerant gas reheat coil.

2.12 DDC TEMPERATURE CONTROLS

A. Install standalone control module providing communication between unit controls and packaged DDC temperature control system.

ACOUSTICS

B. Manufacturer shall submit calculated sound power levels.

2.13 REMOVABLE FILTER SCREEN

A. Description: Removable, washable cottonwood airborne matter screen compatible with equipment intake.

B. Submittal: Filter screen shall be included by equipment manufacturer to ensure equipment airflow capacity is coordinated with screen.

C. Filter Material: Flexible, UV resistant fine polyester screen.

D. Fasteners: Commercial plastic/polyester twist lock fasteners fastened to equipment using self-tapping screws w/ bonded washer.

E. Approved Manufacturers:
1. By Equipment Manufacturer
2. Air Solution Company

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that area is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.

C. All field wiring shall be in accordance with the National Electrical Code.

D. P-traps must be provided for all drain pans.

E. Comb all coils to repair bent fins.

F. Contractor shall coordinate unit access stair and walkway placement to ensure compliance with OSHA requirements.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide initial start-up and shutdown during first year of operation.

END OF SECTION 23 74 16.15

SECTION 23 81 26

SPLIT SYSTEM AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Split system air conditioning wall units.

1.2 REFERENCES

A. ARI 210 - Unitary Air Conditioning Equipment

B. ARI 240 - Air Source Unitary Heat Pump Equipment

C. ANSI NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

D. ANSI/ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.

E. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

F. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

G. ASHRAE 52 - Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

H. ASTM B1003 - Standard Specification for Seamless Copper Tube for Linesets.

I. FS TT-C-490 - Cleaning Method and Pretreatment of Ferrous Surfaces for Organic Coatings.

J. UL - Underwriters' Laboratories.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00.

B. Indicate drain, electrical, and refrigeration rough-in connections on shop drawings or product data.

C. Submit manufacturer's installation instructions.

D. Submit certification that split system air conditioning equipment, accessories, and components will withstand seismic forces defined in Section 23 05 50. Include the following:

1. Basis for Certification: Indicate whether certification is based on actual test of assembled components or on calculation.

a. 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. 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."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Manufacturer shall provide special seismic certification per HCAI CAN 2-1708a.5 with submittal. Submittals without certification will be returned and not reviewed.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept units and components on site in factory protective containers, with factory shipping skids and lifting lugs. Inspect for damage.

B. Comply with manufacturer's installation instruction for rigging, unloading, and transporting units.

C. Protect units from weather and construction traffic by storing in dry, roofed location until units are ready for immediate installation.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A for the installation of computer room air conditioning units.

B. Conform to ASHRAE 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.

1.7 WARRANTY

A. Provide five (5) year manufacturer's warranty on all compressors.

PART 2 - PRODUCTS

2.1 SPLIT SYSTEM WALL AND CEILING-MOUNTED UNITS

A. Manufacturers:

1. LG

2. Carrier/Toshiba
3.
4. Panasonic/Sanyo
5. Samsung
6. Daikin Applied
7. Trane/Mitsubishi

8. York/Hitachi

B. Manufactured Units:

1. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
2. Assemble unit for wall-mounted or ceiling installation with service access required.
3. Performance shall be as scheduled on the drawings.
4. Unit shall be rated per AHRI Standards 210/240 and listed in the AHRI directory as a matched system.
5. Provide unit with factory-supplied cleanable air filters.
6. The units shall be listed by Electrical Laboratories (ETL) in accordance with UL-1995 certification and bear the ETL label.
7. All wiring shall be in accordance with the National Electric Code (NEC).

C. Evaporator Cabinet and Frame:

1. Cabinet:

a. Refer to schedule on drawings for mounting type (wall-mounted]).
b. Exposed units shall have a finished appearance with concealed refrigerant piping, condensate drain piping, and wiring connections.

D. Evaporator Fans and Motors:

1. Fans:

a. The evaporator fan shall be direct drive with a single motor having permanently lubricated bearings.
b. The fan shall be statically and dynamically balanced.
c. The indoor fan shall have at least three speeds.

2. Motor:

a. Direct driven, digitally controlled with multiple speeds. Permanently lubricated with internal overload protection.

E. Evaporator Coils (Direct Expansion):

1. Direct expansion cooling coil of seamless copper tubes expanded into aluminum fins.
2. Single refrigeration circuit with externally equalized expansion valve.
3. Coils shall be pressure tested at the factory.
4. A sloped, corrosion-resistant condensate pan with drain shall be provided under the coil.

F. Electrical Panel:

1. Service Connections, Wiring, and Disconnect Requirements: Conform to the National Electrical Code and local electrical codes.

G. Control:

1. The unit shall have a hard-wired 7-day programmable remote controller to operate the system. Provide wall mounting bracket for controller.

2. Remote controller shall have "automatic", "dry" (dehumidification), and "fan only" operating modes.
3. The remote controller shall have the following features:

    a. On/Off power switch.
    b. Mode Selector to operate the system in auto, cool, heat, fan, or dehumidification (dry) operation.
    c. Fan Setting to provide multiple fan speeds.
    d. Swing Louver for adjusting supply louver discharge.
    e. On/Off Timer for automatically switching the unit off or on.
    f. Temperature Adjustment allows for the increase or decrease of the desired temperature.
    g. Powerful Operation to allow quick cool down or heating up in the desired space to achieve maximum desired temperature in the shortest allowable time.

4. The remote controller shall perform fault diagnostic functions that may be system related, indoor or outdoor unit related depending on the fault code.
5. Temperature range on the remote controller shall be 64°°F to 90°°F in cooling mode and 50°°F to 86°°F in heating mode.
6. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote controller.
7. Integration: Manufacturer shall provide a BACnet interface with the building automation system in accordance with ASHRAE/ANSI Standard 135. This may be accomplished through a system integration panel or "gateway". Integration panels shall be provided as part of the split system.

H. Outdoor Unit:

1. General:

    a. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.

2. Cabinet:

    a. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.

3. Fan:

    a. The fan shall be direct drive, propeller type fan with fan guard.
    b. Fan blades shall be statically and dynamically balanced.
    c. The fan shall have permanently lubricated type bearings.
    d. Motor shall be protected by internal thermal overload protection.
    e. Airflow shall be horizontal discharge.

4. Coil:

    a. The outdoor coil shall be nonferrous construction with corrugated fin tube.
    b. The coil shall be protected with an internal guard.
    c. Refrigerant flow from the condenser shall be controlled via a metering device.

5. Compressor:

    a. Hermetic or scroll refrigerant compressors with resilient suspension system, [inverter driven, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.
    b. The outdoor unit shall have an accumulator and four-way reversing valve.

6. Refrigerant:

    a. Unit shall use R-32 or R-454B.
    b. The use of chlorofluorocarbon (CFC)-based refrigerants is prohibited.

I. Condensate Pump: Provide third party condensate pump.

2.2 PIPING

A. Design Pressure: 450 psig; Maximum Design Temperature: 250°°F

B. Type ACR Seamless Copper Tube Linesets; Brazed Joints:

1. 3/4" and under.
2. Tubing: Type ACR seamless copper tube linesets, ASTM B1003. Sizes indicated are nominal designation.
3. Joints: Brazed with silver solder.
4. Fittings: Wrought copper solder joint, ANSI B16.22.
5. Special Requirements: All tubing shall be cleaned, dehydrated, pressurized with dry nitrogen, plugged, and tagged by manufacturer "for refrigeration service". During brazing operations, continuously purge the interior of the pipe with nitrogen to prevent oxide formation.
6. Limitations:

    a. Only between refrigerant splitter box and indoor terminal unit.
    b. For use above ceiling only. Do not use in exposed areas.

C. Refrigerant linesets are not permitted.

1. Provide manufacturer-packaged refrigerant linesets and accessories of sizes needed for installation. Verify lengths of piping required for installation.

2.3 INSULATION

A. EPDM (NBR/PVC Blend is not permitted) elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.25 maximum 'K' value at 75°°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Minimum 1/2" thick for pipe sizes less than 1-1/4" and 3/4" thick for pipe sizes 1-1/4" and above.

2.4 ROOF MOUNTING CURB

A. Minimum 12 inches, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood Nailer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that proper power supply is available.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
2. Install units in accordance with manufacturer's instructions. Install all units level and plumb. Indoor units shall be installed using manufacturer's standard mounting hardware securely fastened to building structure.
3. Refer to Section 23 05 29 for **roof support rails** for outdoor unit.
4. Coordinate the exact mounting location of all indoor and outdoor units with architectural and electrical work. Coordinate installation of ceiling-mounted units with ceiling grid layout. Provide additional ceiling grid reinforcement or modification as required and coordinate the work with the GC. Locate the indoor unit where it is readily accessible for maintenance and filter changes. Where outdoor units are located on the roof, locate at least 10' from the roof edge.
5. Verify locations of wall-mounted remote controllers with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Height above finished floor shall not exceed 48".
6. Maintain minimum clearances to all equipment. Maintain manufacturer's minimum maintenance, and airflow clearances, and maintain minimum spaces about electrical equipment, whichever is greater.

    a. 208V: 42" deep x 30" wide or the width of the panel whichever is wider.

B. Condensate Removal:

1. Install condensate piping with trap and route from drain pan to nearest drain. Discharge to nearest code-approved receptor or to a properly vented indirect waste fitting. Flush all piping before making final connections to units.

C. Comb all coils to repair bent fins.

D. Install new filters in the unit at Substantial Completion.

E. A factory-authorized service agent shall assist in commissioning the unit and inspecting the installation prior to startup. Submit startup report with O&M manuals.

3.3 REFRIGERANT PIPING

A. Install refrigerant piping from the indoor unit(s) to the condensing unit. Refrigerant pipe sizes, lengths, specialties and configurations shall be as recommended by the manufacturer. Evacuate refrigerant piping and fully charge system with refrigerant per manufacturer's requirements.

B. Provide weather-tight insulated roof curb to accommodate refrigerant piping and conduit roof penetrations.

C. Insulate all refrigerant piping. Both liquid and suction lines shall be insulated between the indoor and outdoor units.

D. Joining of Piping:

1. Brazed Joints:

a. Make up joints with brazing filler metal conforming to ANSI/AWS A5.8. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to brazing. Apply flux evenly, but sparingly, to all surfaces to be joined. Brazing filler metal with a flux coating may also be used. Heat joints uniformly to proper brazing temperature so braze filler metal flows to all mated surfaces. Wipe excess braze filler metal, leaving a uniform fillet around cup of fitting.
b. Flux shall conform to ANSI/AWS A5.31.
c. Remove composition discs and all seals during brazing if not suitable for a minimum of 840°°For greater than the melting temperature of the brazing filler metal, whichever is greater.

E. Insulation:

1. California Title 24 - 2016:

a. Refrigerant Suction (40°°F & Below):

1) Up to 1": 1"
2) 1" and up: 1-1/2"

b. Refrigerant Liquid:

1) Up to 1": 1"
2) 1" and up: 1-1/2"

END OF SECTION 23 81 26

DIVISION 26: ELECTRICAL

26 0000 COMMON WORK RESULTS FOR ELECTRICAL

END OF TABLE OF CONTENTS

SECTION 26 05 00

BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. . This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. CEC California Electrical Code

C. CCR California Code of Regulation

D. CBC California Building Code

E. CFC California Fire Code

F. CMC California Mechanical Code

G. CPC California Plumbing Code

H. California Title 24 - Building Energy Efficiency Standards

I. SCAQMD South Coast Air Quality Management District

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

C. Separate contracts will be awarded for the following work.

D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.

F. Description of Systems shall be as follows:

1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
3. Grounding system.
4. Fire alarm system.
5. Wiring of equipment furnished by others.
6. Removal work and/or relocation and reuse of existing systems and equipment.
7. Telecommunications rough-in, as shown on drawings, for installation of telecommunications equipment by others under separate contract.
8. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

G. Work Not Included:

1. Telecommunications cabling will be by others, in raceways and conduits furnished and installed as part of the Electrical work.
2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.4 OWNER FURNISHED PRODUCTS

A. The Owner will supply manufacturer's installation data for Owner-purchased equipment for this project.

B. This Contractor shall make all electrical system connections shown on the drawings **or** required for fully functional units.

C. This Contractor is responsible for all damage to Owner furnished equipment caused during installation.

1.5 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

1.6 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, and CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.

3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Electrical Code Article 725.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Luminaires.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical bus duct.
    d. Sheet metal.

e. Cable trays, including access space.
f. Other piping.
g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".
2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.

3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

1.7 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.

5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.8 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.

2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of California Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.

6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing AutoCAD MEP.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 00	Basic Electrical Requirements	
26 05 03	Through Penetration Firestopping	
26 05 05	Electrical Demolition for Remodeling	
26 05 13	Wire and Cable	
26 05 23	Manufactured Wiring Systems	
26 05 27	Supporting Devices	
26 05 33	Conduit and Boxes	+> 1.5"

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 35	Surface Raceways	
26 05 48	Seismic Requirements for Equipment and Supports	
26 05 53	Electrical Identification	
26 05 73	Power System Study	
26 09 33	Lighting Control System	
26 22 00	Dry Type Transformers	Yes
26 24 16	Panelboards	Yes
26 24 19	Motor Control	
26 27 26	Wiring Devices	Ceiling mount
26 28 13	Fuses	
26 28 16	Disconnect Switches	Yes
26 43 00	Surge Protection Devices	
26 51 19	LED Lighting	Yes

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors' names and addresses
   e. Supplier and manufacturer's names and addresses
   f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.

12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect™™s/Engineer's review and processing of each submittal, excluding mailing.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer™™s opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.
17. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
18. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
19. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
20. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD

21. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.10 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
    b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.
    c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
    d. Fire alarm broken down into material and labor for the following:

        1) Engineering
        2) Controllers, devices, sensors, etc.
        3) Conduit
        4) Wiring
        5) Programming
        6) Commissioning

    e. Site utilities (5' beyond building)
    f. Seismic design
    g. Testing
    h. Commissioning
    i. Record drawings
    j. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.11 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Keep all materials clean, dry and free from damaging environments.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

B. The following network connected equipment shall be equipped with restricted access protocols:

1. Adjustable trip overcurrent protection devices
2. Electrical controls
3. Lighting control system
4. Fire alarm and automatic detection

1.14 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.15 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.

12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
   b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
   c. Luminaire whips are supported above the ceiling.
   d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
   e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
   f. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.

2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 7248 hours prior to installation of ceilings or lay-in ceiling tiles.

C. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to and place in location as directed and submit receipt to Architect/Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

D. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div26.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

E. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.

F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

H. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

C. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

D. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect the color preference before ordering.

E. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

F. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.

G. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.

H. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.

1. Elevator machine rooms and hoistways.
2. Exit enclosures.
3. Other areas restricted by code.
4. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
5. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

E. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.11 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the Architect/Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 26 05 26, the following shall be done to obtain the value given:

    a. Verify that all connections in the service ground system are secure.
    b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
    c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
    d. Review results with the Architect/Engineer.

4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:

    a. Date of test.
    b. Number of hours since the last rain.
    c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
    d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
    e. Make, model, and calibration date of test equipment.
    f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:

   a. Service disconnects
   b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
   c. Fusible switches with ground fault relay protection.
   d. Outside branch circuits and feeders.
   e. Code required.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

D. Arc Energy Reduction Equipment Performance Testing:

1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:

   a. All arc energy reduction systems installed.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

E. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.

H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.13 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Per Section 26 05 00, cable insulation test results have been submitted.
4. Per Section 26 05 00, ground resistance test results have been submitted.
5. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
6. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
7. Report of instruction of Owner's representative has been submitted as per Section 26 05 00.
8. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
9. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 26 05 00

SECTION 26 05 03

THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. NFPA 5000 - Building Construction Safety Code

K. CBC California Building Code

1.4 SUBMITTALS

A. Submit under provisions of Section 26 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.

3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

D. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

E. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 CFM/sq.ft. at both ambient temperature and 400°°F.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.7 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall/Floor Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999

Penetrating Item	UL System No.
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION 26 05 03

SECTION 26 05 05

ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. THE DRAWINGS ARE INTENDED TO INDICATE THE SCOPE OF WORK REQUIRED AND DO NOT INDICATE EVERY BOX, CONDUIT, OR WIRE THAT MUST BE REMOVED. THE CONTRACTOR SHALL VISIT THE SITE PRIOR TO SUBMITTING A BID AND VERIFY EXISTING CONDITIONS.

B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.

C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.

D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.

E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.

F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.

G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.

B. Coordinate utility service outages with Utility Company.

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. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.

D. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.

E. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Service changeover shall be completed on an overtime basis.

F. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.

D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.

E. Disconnect and remove outlets and devices that are to be demolished. Remove outlet or devices' associated back box, supports, and conduit and conductors back to source. Patch opening created from removal of device to match surrounding finishes.

F. Disconnect and remove abandoned panelboards and distribution equipment.

G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.

I. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.

J. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.

K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.

L. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.

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

N. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes X-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.

O. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that 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.

C. Luminaires: Remove existing luminaires for cleaning as indicated on the drawings. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical parts. Replacement parts shall match specified components for new luminaires of same type when applicable. Reinstall luminaire and connect to circuiting as indicated on drawings.

D. ELECTRICAL ITEMS (E.G., LIGHTING FIXTURES, RECEPTACLES, SWITCHES, CONDUIT, WIRE, ETC.) REMOVED AND NOT RELOCATED REMAIN THE PROPERTY OF THE OWNER. CONTRACTOR SHALL PLACE ITEMS RETAINED BY THE OWNER IN A LOCATION COORDINATED WITH THE OWNER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DISPOSAL OF MATERIAL THE OWNER DOES NOT WANT.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION 26 05 05

SECTION 26 05 13

WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy

B. NFPA 70 - National Electrical Code (NEC)

C. CEC California Electrical Code

D. UL 44 - Thermoset-Insulated Wires and Cables

E. UL 83 - Thermoplastic-Insulated Wires and Cables

F. UL 854 - Service-Entrance Cables

G. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

H. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or.

C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.

D. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

E. Aluminum conductors are not to be used.

F. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in raceway.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type "THHN".

D. Underground or In Slab: All conductors shall be type "THWN".

3.2 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.2(7) (2011 - 2017 edition Table B310.15(B)(2)(7); 2008 or later edition B.301.7) or calculated in accordance with Annex B Application Information for Ampacity Calculation.

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.

D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

E. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:

1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.

2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.5 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

a. Left to Right - A-B-C
b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. Inspect wire and cable for physical damage and proper connection.

D. Torque test conductor connections and terminations to manufacturer's recommended values.

E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

F. Protection of wire and cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

G. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 26 05 13

SECTION 26 05 23

MANUFACTURED WIRING SYSTEMS

PART 1 - GENERAL

1.1 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. CEC California Electrical Code

C. Electrical Code Article 604

D. UL 183 - Modular Wiring Systems

1.2 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Submit product data for all components being utilized for system, showing ratings, including manufacturer specific voltage drop data; scaled floor plan drawings indicating layout of modular wiring and components, including cable lengths; and record location of connection to permanent wiring system.

1.3 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record field location of all components and cable routing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - LIGHTING SYSTEMS

A. Metalux, Model MWS

B. Lithonia, Model RELOC

C. Day-Brite, Model ELECTROCONNECT

D. American Cable Systems, Model FLEX

2.2 SYSTEM REQUIREMENTS

A. Voltage to be 277 volts. Rated 20 amps.

B. All components in system must be safety keyed to prevent mismatching of voltages.

C. Components in a multiple circuit application must be provided with a mechanism to prevent joining of components of two different phases.

D. System must be capable of handling up to five conductors to accommodate possible switching arrangement.

E. System shall use minimum of #12 AWG copper THHN conductors rated 90°°C. Increase conductor size for runs where the voltage drop exceeds 3%.

F. A copper ground conductor shall be used throughout the system for connecting to the permanently wired ground system.

G. All mating components shall be made of galvanized steel.

H. System shall not share neutrals.

I. Modular wiring system shall be provided by the fixture manufacturer, if available.

2.3 COMMON SYSTEM COMPONENTS

2.4 COMPONENTS - MODULAR POWER SYSTEM

A. Homerun Cables:

1. Quantity of homerun cables shall be based on quantity of distribution boxes and system structure.

B. Main Distribution Boxes:

1. Construction: Cold-rolled steel enclosure with four (4) leg mounting supports to elevate box off concrete floor. The box shall contain factory installed wiring blocks on a terminal strip for field use.
2. Provide knock-out(s) for hardwired input connection to homerun conductors. Box shall either accept feeders from two panels, or two separate boxes shall be provided.
3. Boxes shall have multiple modular output connections (simplex or duplex) for branch circuit cables connection.
4. A primary/secondary distribution box layout is acceptable.
5. Provide permanent label on top of box indicating panel source(s) and circuit number.

C. Branch Circuit Cables:

1. Provide a locking, modular pin and socket connection on both ends of cables serving access floor boxes.
2. Cables shall be able to be connected together to provide additional length for future remodeling.
3. Length: Suitable to reach device served. All cables serving floor boxes shall have a 10 foot slack loop to allow for quick relocation.
4. Maximum combined cable length from distribution box shall not exceed 50 feet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install per manufacturer's instruction and reviewed approved layout shop drawings.

B. Wire size shown on drawings to be used for permanent wiring attachment to initial lighting feed adapter.

C. Install in accordance with NEC Section 604.

D. Support all modular wiring cables at 5'-0" intervals. Modular lighting cables or cords shall not rest on the ceiling tile. Support from ceiling system a minimum of 3" above the ceiling tile.

E. Support modular lighting cables and cords in open areas directly from structural joists. In no case shall wiring "loop" below the joists.

F. Coordinate location of access floor boxes with furniture and equipment.

G. Coordinate power distribution cables with technology contractor to minimize running in parallel.

H. Install permanent circuit identification.

END OF SECTION 26 05 23

SECTION 26 05 27

SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and Equipment Supports

B. Fastening Hardware

C. Concrete Housekeeping Pads

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 REFERENCES

A. UL 62275 - Cable Management Systems - Cables Ties for Electrical Installations

1.4 COORDINATION

A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Allied Support Systems

B. Cooper B-Line

C. Erico, Inc.

D. Hilti

E. Power Fasteners

F. Orbit Industries

2.2 MATERIAL

A. Support Channel: Hot-dip galvanized; painted steel.

B. Hardware: Corrosion resistant.

C. Concrete Housekeeping Pads:

1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floor, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by the Contractor. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6" x 6", W1.4-W1.4 welded wire fabric. Concrete shall withstand 3,000 pounds compression per square inch at twenty-eight days.

D. Rooftop Support System:

1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
4. Products:

    a. Anvil International HBS-Base Series
    b. Cooper B-Line Dura-Blok
    c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

E. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

E. Do not use powder-actuated anchors without specific permission.

F. Do not drill structural steel members.

G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting.

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

L. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION 26 05 27

SECTION 26 05 33

CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)

B. Intermediate metallic conduit and fittings (IMC)

C. Electrical metallic tubing and fittings (EMT)

D. Flexible metallic conduit and fittings (FMC)

E. Liquidtight flexible metallic conduit and fittings (LFMC)

F. Rigid polyvinyl chloride conduit and fittings (PVC)

G. Wall and ceiling outlet boxes

H. Pull and junction boxes

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

B. Federal Specifications (FS):

1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
2. A-A-55810 - Specification for Flexible Metal Conduit

C. NECA "Standards of Installation"

D. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit

3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

G. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 - Flexible Metal Conduit
2. UL 6 - Rigid Metal Conduit
3. UL 360 - Liquid Tight Flexible Steel Conduit
4. UL514-B - Conduit Tubing and Cable Fittings
5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
6. UL651-B - Continuous Length HDPE Conduit
7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
8. UL797 - Electrical Metal Tubing
9. UL1242 - Intermediate Metal Conduit

H. American Standard of Testing and Materials (ASTM):

1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

I. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.4 SUBMITTALS

A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 05 00 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Calbond Calpipe
5. Wheatland Tube Co
6. O-Z Gedney
7. or approved equal.

B. Manufacturers of RMC Conduit Fittings:

1. Appleton Electric
2. O-Z/Gedney Co.
3. Electroline
4. Raco
5. Bridgeport
6. Midwest
7. Regal
8. Thomas & Betts
9. Crouse-Hinds
10. Killark
11. Orbit Industries
12. or approved equal.

C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

D. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.

1. Acceptable Manufacturers:

a. Calbond Calpipe
b. Robroy
c. T&B Ocal
d. or approved equal.

2.2 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

B. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Wheatland Tube Co
5. O-Z Gedney
6. or approved equal.

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Manufacturers of EMT Conduit:

1. Allied
2. Calbond Calpipe
3. LTV
4. Steelduct
5. Wheatland Tube Co
6. or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:

    a. Appleton Electric
    b. O-Z/Gedney Co.
    c. Electroline
    d. Raco
    e. Bridgeport
    f. Midwest
    g. Regal
    h. Thomas & Betts
    i. Orbit Industries
    j. or approved equal.

2.4 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.

B. Manufacturers:

1. American Flex
2. Alflex
3. Electri-Flex Co
4. or approved equal.

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

    a. O-Z/Gedney Co.
    b. Thomas & Betts
    c. Appleton Electric
    d. Electroline
    e. Bridgeport
    f. Midwest
    g. Regal
    h. Orbit Industries
    i. Wesco Regal
    j. or approved equal.

2.5 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Manufacturers:

1. Anaconda Type UA
2. Electri-Flex Type LA
3. Alflex
4. Carlon(Lamson & Sessions)
5. or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

   a. Appleton Electric
   b. O-Z/Gedney Co.
   c. Electroline
   d. Bridgeport
   e. Thomas & Betts
   f. Midwest
   g. Regal
   h. Carlon (Lamson & Sessions)
   i. Orbit Industries
   j. or approved equal.

2.6 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers:

1. Carlon (Lamson & Sessions) Type 40
2. Cantex, J.M. Mfg.
3. or approved equal.

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.7 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.

B. Cast Boxes: Nema FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.

C. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

D. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

E. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.

F. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.8 ECONN; ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.9 JB; PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

E. Flanged type boxes shall be used where installed flush in wall.

2.10 ROUGH-IN

A. Provide with one (1) flush mount double gang box with single gang plaster ring and appropriate cover plate,

B. Conduit stubbed to above the lay-in ceiling routed to the corridor cable tray.

1. Rough-in shall have one (1) 1" conduit.

2. Mount on wall +54" or as noted in plans. Rough-in shall have one (1) 1" conduit.

2.11 FOUNDATION - UNDERGROUND SLEEVES AND SEALS

A. Wall Seals ("Link-Seals"):

1. Where shown on the drawings, raceways passing through foundation walls to an underground condition shall have their annual space (sleeve or drilled hole - not tapered hole made with knockout plug) sealed by properly sized sealing element consisting of a synthetic rubber material compounded to resist aging, ozone, sunlight, water and chemical action.
2. Sleeves, if used, shall be standard weight steel with primed finish and waterstop/anchor continuously welded to sleeve.
3. Sleeves shall be at least 2 trade sizes larger than the penetrating raceway.
4. Pressure shall be maintained by stainless steel bolts and accessories. Pressure plates may be of composite materials for Models S and OS.
5. Sealing Elements shall be as follows:

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

6. Approved Manufacturers:

   a. Thunderline Corporation "Link-Seals"
   b. O-Z/Gedney Company
   c. Calpico, Inc
   d. Innerlynx
   e. Polywater PGKD Series

2.12 RACEWAY SEALS AND SEALANT

A. Duct Sealant: Field applied expandable duct sealant, closed cell field cured, water tight, air tight. Identified for use with electrical cables, conductors, and raceways. Minimum liquid withstanding of 10-feet head of water (5 PSI). Compatible with conductors and raceways, UL94 Flammability Certified.

1. NOT ALLOWED. Duct seal putty, all-purpose construction sealant.
2. Manufacturers:

   a. Polywater FST / AFT Series
   b. Approved equal

B. Duct Seal Bushing: Custom mechanical seal, liquid tight, gas tight, stainless steel hardware. Minimum liquid withstanding of 10-feet head of water (5 PSI). Coordinate product with raceway size, cable quantities, and cable sizes.

1. Manufacturers:

   a. Polywater PHRD / PHSD Series Varia /PHSI Module Series
   b. Jackmoon Commscope DuctPlug Series
   c. CalAm Manufacturing WedgeSeal Series

C. Duct Seal Bushing Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSI).

1. Manufacturers:

a. Raychem Rayflate Duct Sealing Systems RDSS
b. Approved equal

D. Wall Sleeve Duct Seal System: Cast-in-place or Core-Drill two piece push-in- place construction, gasketed seal to prevent entry of water and gases.

1. Cable: Duct Seal Bushing, provide interior sleeve duct seal bushing for each duct entry. Provide duct seal bushings with individual seals for each applicable cable.
2. Manufacturers:

a. Polywater Varia PHSI Series
b. Approved equal

2.13 ACCESSORIES

A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.

B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

C. Electric Threaded Ball Swivel: Metallic body, box mounted, threaded conduit, 20-degree ball swivel, rated for weight of application, listed. Thomas and Betts, Appleton, Couse-hinds, or equal. Example applications:

1. Rigid pendant mount with sloped ceiling, vibration, or subject to wind.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Installation Schedule: Refer to drawings.

C. Fire Rated Assemblies:

1. Listed Fire Rated Assemblies: Phenolic RTRC

D. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

E. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 3/41 inch.
3. Below Grade More than 5' from Building Foundation: 3/41 inch.
4. Telecommunication Conduit: 1 inch.
5. Controls Conduit: 1/2 inch3/4 inch.

F. Conduit Embedded in Slabs above Grade:

1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
2. Maximum size 1 inch for conduits crossing each other.

G. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.

B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2"1" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.

F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.

L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

M. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.

4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.

    a. A third bend is acceptable if:

        1) The total run is not longer than (33) feet.
        2) The conduit size is increased to the next trade size.

5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
9. Horizontal conduit routing through slabs above grade

a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
c. No conduits are allowed to be routed horizontally through slabs above grade.

10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.5 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

A. Conduit shall be installed away from high temperature piping and equipment.

B. Conduit shall be installed to prevent exposure to ultraviolet radiation.

C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.

D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.

E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

3.7 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.

E. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

F. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

G. Raceway Seal (Exterior to Raceway):

1. All power, telecommunication, electrical conduits and innerducts shall be sealed between the raceway and the building foundation. The raceway penetration shall be sealed liquid-tight, water-tight, non-corrosive.

2. Below Grade Installation Options:

   a. Cast-in-place concrete installation.
   b. Hydraulic cement, hydraulic group, hydraulic epoxy.
   c. Foundation - Underground Sleeves and Seals; refer to Part 2-Products for product information.

3. Above Grade Installation Options:

   a. Masonry grout for masonry applications.
   b. Caulk Sealant, interior/exterior rated, color per architect. Refer to architectural specifications for additional requirements. Approved Manufacturers include Sachco, Tremco Vulkem, Sika or approved equal when not specified by architectural scope.

H. Raceway Seal (Interior to Raceway, with Cables or Empty):

1. All power, telecommunication, electrical conduits and innerducts, including those with cables, shall be sealed at the building and vault entry. The seal shall prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceways shall also be sealed.

2. Installation Schedule, nominal size:

a. 2" or less: Duct Seal Bushing or Duct Sealnt
b. 2-1/2" through 4": Duct Seal Bushing
c. 5" and 6": Wall Sleeve Duct Seal System

3.8 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.
4. Recessed in stud wall of kitchens and laundries.

B. Cast boxes shall be used in:

1. Exterior locations.
2. Hazardous locations.
3. Exposed interior locations within 8' of the highest platform level.
4. Direct contact with earth.
5. Direct contact with concrete in slab on grade.
6. Wet locations.
7. Kitchens and laundries when exposed on wall surface.

3.9 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.10 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)

D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

F. Provide knockout closures for unused openings.

G. Support boxes independently of conduit.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.

K. Position outlets to locate luminaires as shown on reflected ceiling drawings.

L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.11 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.12 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION 26 05 33

SECTION 26 05 42

EQUIPMENT WIRING SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment specified under other Sections or furnished by the Owner.

1.2 REFERENCES

A. NEMA WD 1 - General Purpose Wiring Devices

B. NEMA WD 6 - Wiring Device Configurations

C. NFPA 70 - National Electrical Code (NEC)

D. CEC California Electrical Code

PART 2 - PRODUCTS

2.1 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated Type SO multi-conductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit over-current protection.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

END OF SECTION 26 05 42

SECTION 26 05 48

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Seismic Requirements.

1.2 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 26 05 27 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.

C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

D. Installer: Company specializing in performing the work of this Section.

1.3 REFERENCES

A. California Building Code (CBC)

B. ASHRAE - A Practical Guide to Seismic Restraint.

C. ASCE 7-02, Chapter 9.

D. ASCE 7-05, Chapter 13.

E. ASCE 7-10, Chapter 13.

F. ASCE 7-16, Chapter 13.

1.4 TESTING AND INSPECTION

A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the Building Code.

B. The Contractor shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.

C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.

D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.6 DESIGN REQUIREMENTS

A. This project is subject to the seismic bracing requirements of California Building Code,.

B. Equipment shall meet California Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

C. All seismic anchorage and bracing shall comply with the St. Louis County Rules & Regulations on Anchorage & Sway Bracing - Mechanical, Electrical & Plumbing (MEP) System Components.

D. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.

1.7 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

1.8 WARRANTY

A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 - PRODUCTS

2.1 SUPPLIERS

A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation http://www.unistrut.us/
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.
6. Tolco (909) 737-5599, www.tolco.com
7. ISAT 877.523.6060, www.isatsb.com
8. Vibro-Acoustics (416) 291-7371, https://virs.vibro-acoustics.com/

2.2 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.

B. Friction from gravity loads shall not be considered resistance to seismic forces.

C. Housekeeping Pads:

1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.3 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:

1. Switchboards, Distribution Panelboards, Panelboards, Load Centers
2. Emergency Feeders
3. Transformers
4. Disconnect Switches
5. Magnetic, Manual, Combination Starters
6. Emergency Luminaires and Exit Signs

7. Fire Alarm Panel, Initiating and Notification Appliances

2.4 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.
3. Corrosive Locations: Stainless steel.

2.5 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type. Comply with IBC, ACI and ICC ES requirements for cracked concrete anchors.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.6 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inch thick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 1011, GR 33.
2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.

1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.

B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.

C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.

D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

E. Installation of seismic restraints shall not cause any change in position of equipment lighting or conduits resulting in stresses or misalignment.

F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

G. Do not install any equipment or conduit that makes rigid connections with the building unless isolation is not specified.

H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.

I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.

K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.

L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.

M. Do not install cables over sharp corners.

N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.

O. Provide reinforced clevis bolts when required.

P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.

Q. Post-Installed anchors shall be provided to meet seismic requirements.

R. Vertical conduit risers flexibly supported to accommodate thermal motion and/or conduit vibration shall be guided to maintain conduit stability and provide horizontal seismic restraint.

S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

T. Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.

U. Do not brace a system to two different structures such as a wall and a ceiling.

V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

W. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.

X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

3.2 SEISMIC RESTRAINT EXCLUSIONS

A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION 26 05 48

SECTION 26 05 53

ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Adhesive Markings and Field Labels

B. Nameplates and Signs

C. Product Colors

1.2 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. NFPA 70 - National Electrical Code (NEC)

C. CEC California Electrical Code

D. ANSI A13.1 - Standard for Pipe Identification

E. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.3 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).

1. Label Size as follows:

a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).

2. Color: As specified for various systems.

B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

D. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.

E. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.

F. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

G. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch minimum text height
c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Text Height: 3/8 inch minimum

C. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

E. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

F. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. Normal Power and General Labels: Black letters on white face
2. Control Labels: Black letters on white face

3. Fire Alarm: Red letters on white face

B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face
2. Control Labels: Black letters on white face
3. GROUNDING: White letters on green face.

C. Raceways and Conduit:

1. Provide color coded conduit as indicated below. Conduit shall be colored by the manufacturer:

a. Normal Power and General Distribution: Silver
b. Emergency Power Distribution System:

1) Life Safety Yellow

c. Fire Alarm System: Red
d. Temperature Controls: Refer to mechanical cover sheet for color
e. Ground: Green
f. Low Voltage and Telephone: Purple

D. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:

a. Normal Power and General: Silver
b. Fire Alarm System: Red
c. Ground: Green
d. Low Voltage and Telephone: Purple

2. Box cover colors shall match conduit colors listed above.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the Architect/Engineer prior to installation and ordering of materials.

C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.

D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.

E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

F. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

G. Apply Danger, Warning, Caution and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.

H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

J. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 05 73.

K. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.

1. Sample Label:

   ! WARNING
   ARC FLASH AND SHOCK HAZARD
   APPROPRIATE PPE REQUIRED
   FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
   REFER TO NFPA 70E

L. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot intervals.

1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

M. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:

1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.

N. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded.

3.2 FEEDER AND BRANCH CIRCUIT DIRECTORIES

A. Product:

1. Adhesive labels and field markings

B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:

1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
2. Location: Room name, number, location.

C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover.

3.3 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.

C. Identification material to be engraved plastic-laminated labels, 1/16-inch minimum thickness with white letters on a red face. Letter and number size to 1/8-inch high.

D. Identification to be engraved directly on the stainless steel coverplates. Letter and number size to 1/8-inch high.

E. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.4 CONDUIT AND EXPOSED CABLE LABELING

A. Product:

1. Adhesive labels and field markings

B. Conduit Identification: Pre-printed, flexible, self-adhesive vinyl labels with legend at 20 foot (7.5 meter) intervals to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned. Refer to color requirements in Part 2 when applicable in addition to the following:

1. 1000 Volt or less Normal/Emergency Power: Indicate feeder identification and voltage.
2. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Maximum interval between label intervals shall be 25 feet or as required by code.
3. Fire Alarm: Indicate "FIRE ALARM".
4. Grounding: Indicate "GROUND" and equipment and designation.
5. Security System: Indicate "Security".
6. Telephone System: Indicate "Telephone".

C. Blank conduit ends or outlet boxes for future extension of system shall have permanent identification marker indicating purpose of conduit or box and where the raceway originated.

3.5 CONDUIT AND RACEWAY COLOR BANDING FOR EXISTING CONDITIONS AND REMODELING

A. Existing Conduit and Raceways: Identify existing conduits and raceways within the limits of the project boundary with color banding.

1. Existing conduit and raceways to be color banded: 3/4 inch and larger.
2. The Contractor shall perform a review of the existing conduit, raceway, and system type prior to submitting a bid. The Contractor's review shall include a review of areas with non-finished ceilings and areas with accessible finished ceilings.

B. New Conduit and Raceways: Identify new conduits and raceways with color banding. The following products and materials shall be identified with color banding when required by Part 1 of this specification.

1. Rigid metallic conduit and fittings (RMC)
2. Intermediate metallic conduit and fittings (IMC)
3. Reinforced thermosetting resin conduit (RTRC)
4. Phenolic reinforced thermosetting resin conduit (phenolic RTRC conduit) Example: Fire-rated cable and assemblies

C. Instructions:

1. Band exposed or accessible raceways, cables, and bare conductors of the. Bands shall be pretensioned, snap-around colored plastic sleeves, colored adhesive marking tape, or a combination of the two. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side. Refer to Part 1 of this specification for specific systems and colors requiring banding.
2. Install bands at changes within 36 inches of direction changes, all wall/floor penetrations, at each junction box, and at 10-foot maximum intervals in straight runs.

3.6 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

3.7 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.
2. All wires and cables, 6 AWG or larger, used in motor circuits, main feeders, sub-main feeders, and branch circuits shall be coded by the application of plastic tape. The tape shall be 3-M, Plymouth or Permacel in colors specified below. The tape shall be applied at each conductor termination with two 1-inch tape bands at 6-inch centers. Contractor option to use colored cabling in lieu of the tape at each end for conductor 6 AWG to 500 KCM. Wire and cables smaller than 6 AWG shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.

D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

E. Conductors shall be color coded as follows:

1. 120/240 Volt, 3-Wire:

   a. A-Phase - Black
   b. B-Phase - Red
   c. Neutral - White
   d. Ground Bond - Green

2. 208Y/120 Volt, 4-Wire:

   a. A-Phase - Black
   b. B-Phase - Red
   c. C-Phase - Blue
   d. Neutral - White
   e. Ground Bond - Green

3. 480Y/277 Volt, 4-Wire:

   a. A-Phase - Brown
   b. B-Phase - Orange
   c. C-Phase - Yellow
   d. Neutral - Gray
   e. Ground Bond - Green

4. 120 Volt, 2-Wire Isolated (Ungrounded) Power System:

   a. A-Phase - Orange with distinctive colored stripe other than white, green or gray along the entire length of the conductor
   b. B-Phase - Brown with distinctive colored stripe other than white, green or gray along the entire length of the conductor
   c. Ground Reference - Green

5. 120/208 Volt, 3-Wire, Isolated (Ungrounded) Power System:

   a. A-Phase - Orange with distinctive colored stripe other than white, green or gray along the entire length of the conductor
   b. B-Phase - Brown with distinctive colored stripe other than white, green or gray along the entire length of the conductor
   c. C-Phase - Yellow with distinctive colored stripe other than white, green or gray along the entire length of the conductor
   d. Ground Reference - Green

6. 0 to 1500 Volt, Direct Current DC Power System:

   a. Ungrounded Positive Polarity: Red or black with permanent red stripe marked along the entire length. Provide shrink wrap sleeves at terminations indication (POS, POSITIVE, or POS (+).
   b. Ungrounded Negative Polarity: Black. Provide shrink wrap sleeves at terminations indication (NEG, NEGATIVE, or NEG (-).
   c. Grounded Conductor in Grounded DC systems (refer to paragraphs a and b above for marking of ungrounded conductors):

      1) When Positive Polarity is Grounded: White along entire length. Provide shrink wrap sleeves at terminations indication (POS. POSITIVE, or POS (+).

2) When Negative Polarity is Grounded: White along entire length. Provide shrink wrap sleeves at termination indication (NEG, NEGATIVE, or NEG (-).

7. Grounding Conductors:

   a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.
   b. Isolated Equipment Ground Conductors: Green with colored distinctive yellow stripe along the entire length of the conductor. Isolated ground for feeders, use colored tape with alternating bands of green and yellow to provide a minimum of three bands of green and two bands of yellow.

8. Cabling for Remote Control, Signal, and Power Limited Circuits:

   a. Fire Alarm: Refer to Fire Alarm and Automatic Detection Section 28 31 00 for cable color requirements Red.
   b. Low Voltage Switching: Per manufacturer recommendations and code requirements.
   c. Building Automation Systems and Control: Refer to the Temperature Control Contactor notes located on the mechanical cover sheet.
   d. Electronic Control: Per manufacturer recommendations and code requirements.
   e. Audio/Visual Systems: Refer to Division 27.
   f. Structured Cabling: Refer to Division 27.

3.8 CONTROL EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served.
2. Location of equipment being served if it is not located within sight.
3. Voltage and phase of circuit(s).
4. Panel and circuit number(s) serving the equipment.
5. Method of automatic control, if included ("AUTO CONTROL BY FMCS").
6. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
7. Date of fault current study, refer to one-line diagram
8. Sample Label:

   EXHAUST FAN EF-1 ("LOCATED ON ROOF")
   480V, 3-PHASE
   FED FROM "1HA1-1"
   AUTO CONTROL BY FMCS
   22,000 AMPS AVAILABLE FAULT CURRENT
   DATE OF STUDY: 1 JAN 2017

3.9 EQUIPMENT CONNECTION IDENTIFICATION

A. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

B. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner. The following list of equipment is specifically being listed to receive an equipment connection label; this list does not limit the equipment that shall receive a label:

1. Mechanical heating, ventilation, and air conditioning equipment; chillers, boilers, pumps, air handing ventilation units, condensing units, unit heaters, and similar equipment
2. Plumbing equipment
3. Fire protection equipment including fire pumps
4. Medical gas equipment and equipment skids
5. Elevator
6. Kitchen equipment (hardwired)
7. Industrial machinery

C. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served
2. Location of equipment being served if it is not located within sight.
3. Voltage and rating of the equipment.
4. Panel and circuit numbers(s) serving the equipment
5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study; refer to one-line diagram
7. Sample Label:

UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
480V: 3-PHASE
FED FROM "1HA1-1"
22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.10 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Exterior Equipment: The identification material shall be engraved vinyl labels.
3. Labeling shall include:

a. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Applicable equipment includes components of the life safety and critical branch for healthcare facilities (generators, transfer switches, switchboards, distribution panels, panelboards, etc.).

b. Equipment type and contract documents designation of equipment.
c. Voltage of the equipment.
d. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
e. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").
f. Sample Label:

DISTRIBUTION PANEL DP-H1
480Y/277V
FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:

a. Available fault current; refer to one-line diagram or panel schedules
b. Date of fault current study; refer to one-line diagram
c. Sample Label:

22,000 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

1. Nominal system voltage, service wire size, quantity, material, distance
2. Maximum available fault current; refer to one-line diagram for values
3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 05 73 for value.
4. Date of fault current study; refer to one-line diagram
5. Date of label
6. Sample Label:

480Y/277V, 6 SETS 4#750KCM CU, 75FT
39,800 AMPS AVAILABLE FAULT CURRENT
0.07 SECOND CLEARING TIME
DATE OF STUDY: 1 JAN 2017
DATE OF LABEL: 4 JUL 2017

D. Arc Energy Reduction Label:

1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.

a. Label: "This equipment is designed with a system listed below".
b. Applicable Systems:

1) Zone-selective interlocking system for selective coordination and arc energy reduction
2) Differential relaying system for selective coordination and arc energy reduction
3) Arc energy reducing maintenance switch
4) Energy reducing active arc flash mitigation system

E. Adjustable-Trip Over Current Protection Label:

1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.

a. Label:

1) Long-time delay:
2) Long-time pickup:
3) Short-time delay:
4) Short-time pickup:
5) Instantaneous:

b. Sample Label:

Long-time delay: 10.0
Long-time pickup: 1.0
Short-time delay: 0.15
Short-time pickup: 5.0
Instantaneous: 2.0
Ground fault delay:0.25
Ground fault: 50.0

F. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

G. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

1. Sample Labels for Feeders:

4#3/0 CU & 1#6 CU GND, 125FT
4#250KCM AL & 1#6 GND CU, 125FT
2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

H. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

3.11 INDUSTRIAL CONTROL PANEL IDENTIFICATION

A. Provide identification on the front of all industrial control panels and similar equipment. Labels shall be visible on the exterior of the gear and correspond to the one-line and/or schematic diagram nomenclature.

1. Interior equipment: The identification material shall be engraved plastic-laminated labels.

2. Labeling shall include:

   a. Equipment type and contract documents designation of equipment.
   b. Manufacturer / Assembler of industrial control panel
   c. Voltage, phase, frequency, full load current of each supply circuit
   d. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
   e. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").
   f. Sample Label:

      INDUSTRIAL CONTROL PANEL ICP-1
      ABC COMPANY
      480V, 3PHASE, 60HZ, 60A (PANEL E1-1 LOCATED IN ELEC 123)
      120V, 1PHASE, 60HZ, 20A (PANEL E2-1 LOCATED IN ELEC 123)
      22,000 SHORT CIRCUIT RATING

B. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used shall be permanently posted on the interior of the door or cover of the industrial control panel.

C. Schematic Diagram: Provide a laminated copy of the industrial control panel schematic wiring diagram. Post the diagram on the inside cover of the control panel.

D. Service Equipment Label: Refer to Electrical Distribution Equipment - Service Equipment Label of this specification if applicable for additional requirements.

3.12 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

B. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.
5. Sample Label:

   TRANSFORMER TR-15
   480V: 208Y/120V 15KVA
   FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

3.13 DC VOLTAGE EQUIPMENT IDENTIFICATION

A. Products:

1. Names and signs

B. Provide identification on the front of all DC voltage equipment, storage batteries, disconnects. The identification nameplate shall be engraved plastic-laminate label.

C. Label shall include:

1. Equipment type and contract documents designation of equipment.
2. Name of upstream equipment and location of the upstream equipment if it is not located within sight.
3. Nominal equipment voltage and rating.
4. Available fault current (from batteries if applicable).
5. Date of fault current study; refer to one-line diagram.
6. Sample Label:

STORAGE BATTERY SB-1
600 VOLT DC, 50 KVA
39,800 AMPS AVAILABLE FAULT CURRENT
DATE OF STUDY: 1 JAN 2017

3.14 ELECTRICAL WORKING CLEARANCE IDENTIFICATION

A. Products:

1. Safety Yellow paint and custom stencils

B. Provide custom identification of electrical equipment working clearances in mechanical, electrical, storage, janitorial, and similar non-public areas.

C. Identification shall include a painted rectangular box (on the finished floor) in front of the electrical equipment to define the code-required working clearance. Provide additional diagonal stripping inside the rectangle box. All painted stripping shall be safety yellow paint with 3 inch wide stripes.

1. Width of area: Width of equipment or as required by code
2. Depth of area: Depth as required by code

3.15 SERIES RATING IDENTIFICATION

A. Upstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - IDENTICAL COMPONENT REPLACEMENT REQUIRED".

B. Downstream devices of series rated components not enclosed in a single NEMA type enclosure shall be identified with a nameplate reading "CAUTION - SERIES RATED SYSTEM - ADDITIONAL SERIES COMBINATION RATING: XX,XXX RMS SYMMETRICAL AMPERES" where XX,XXX shall be the series combination rating.

END OF SECTION 26 05 53

SECTION 26 05 73

POWER SYSTEM STUDY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. low voltage distribution system power study.

B. Short-circuit analysis and report.

C. Selective coordination analysis and report.

D. Arc-flash hazard analysis and report.

1.2 RELATED SECTIONS

A. Section 26 05 00 - Basic Electrical Requirements

B. Section 26 24 13 - Switchboards

C. Section 26 24 16 - Panelboards

1.3 QUALITY ASSURANCE

A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections.

1.4 SUBMITTALS

A. Documentation shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.

B. The input for the power system study shall be based on the contract documents, with estimated conductor lengths and field investigation of existing equipment types, sizes, ratings

C. Documentation of the analyses shall be submitted in a single bound electronic (PDF or equal) format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. The submittal of these related specification sections will not be reviewed without this documentation. Submit a sample arc-flash hazard label for Owner review and approval prior to printing.

D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

1.5 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. CEC California Electrical Code

C. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations, latest version

D. ANSI Z535.4 - Products Safety Signs and Labels

1.6 SCOPE

A. Provide a power system study of the electrical system shown on the plans. The study shall include arc-fault analysis, selective coordination analysis and arc flash hazard analysis.

B. Contractor is required to provide a fully coordinated system for the normal electrical system or essential and the associated normal side of each transfer switch and all other locations indicated on the one line diagram. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

PART 2 - PRODUCTS

2.1 POWER SYSTEM STUDY

A. Power systems study shall be completed in Power Tools for Windows (PTW) version 10or later version or pre-approved equivalent program.

B. Power system studies including, but not limited to short-circuit analysis, selective coordination, and arc-flash analysis are inherently iterative in nature. The initial and subsequent analysis commonly requires engineering evaluation, equipment modification, setting adjustments, and revised analysis report. The power system analysis scope shall not be considered complete until all outstanding engineering, equipment and device setting solutions have been resolved and documented by a final report. The power system study vendor shall provide inclusive bid provisions for the initial, subsequent, final analysis and associated reports.

PART 3 - EXECUTION

3.1 SHORT-CIRCUIT ANALYSIS

A. Provide a complete short-circuit analysis from the utility service to and including the entire building distribution as shown on the drawings.

B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.

C. Short-circuit analysis documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted and made available to the AHJ if requested.

3.2 COORDINATION ANALYSIS

A. Provide a complete selective coordination analysis comparing time/current curves of the protective devices to be installed to assure coordination between main and downstream devices. Overcurrent protection devices shall be coordinated based on the maximum available fault current results of the short-circuit analysis report.

B. Provide a complete selective coordination analysis, comparing time/current curves of the protective devices to be installed to assure complete selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the essential electrical system shall selectively coordinate for the period of time that a fault's duration extends beyond 0.1 second. Overcurrent protective devices serving the normal shall selectively coordinate for the period of time that a fault's duration extends beyond 0.1 second.

C. Provide trip settings for all (selectively coordinated and non-selectively coordinated) adjustable trip over current protection devices including long time delay, long time pickup, short time delay, short time pickup, instantaneous and ground fault. Selectively coordinated branches shall be based on the selective coordination study results. Non-selective coordinated branches shall be based on the design trip ratings. Provide selective coordination between all ground fault trip settings.

D. The analysis shall include primary protective device, secondary main switchboard/switchgear device(s), switchboard/switchgear branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.

E. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. The plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), and complete operating bands for circuit breaker trip devices, fuses, etc.

1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.
3. Each primary protective device required for the transformer shall be selected so the characteristics or operating band is within the transformer parameters, which shall include a parameter equivalent to 58% of the withstand point to afford protection for secondary line-to-ground faults. The transformer damage curve shall be included for the transformer when the selected protective device is not within the associated parameters.
4. Molded case circuit breakers shall be separated from each other and the associated primary protective device by a 16% current margin for coordination and protection in the event of secondary line-to-line faults.
5. Include zone selective interlocking, differential relaying, and other selective coordination technology in the study when required by other specification sections.
6. The protective device characteristics or operating bands shall be suitably indicated to reflect the actual symmetrical fault currents sensed by the device.
7. The drawings and specifications indicate the general requirements for motors, motor-starting equipment, and medium-voltage and low-voltage equipment, but additional specific requirements of equipment furnished shall be determined in accordance with the results of the coordination study.

    a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.

F. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

3.3 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, unit substations, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.

C. Safe working distances shall be based on the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit analysis and coordination study models. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

E. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared, and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond 3 to 5 cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

G. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

H. Include Arc Energy Reduction (AER) analysis in the study when required by other specification sections.

I. When performing incident energy calculations on the line side of a main breaker (as required per the above), the line side and load side contributions must be included in the fault calculation.

J. Miscoordination should be checked among all devices within the branch containing the immediate protective device upstream of the calculation location, and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Where it is not physically possible to move outside the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

L. Create and install NFPA 70E compliant labels describing the arc flash hazard level at all switchboards, panelboards, and other locations in the electrical distribution system where work could be performed on energized parts.

M. Labels shall be vinyl or laminated, with a self-adhesive backing, conform with ANSI Z535.4 Products Safety Signs and Labels standard, and include the following:

1. Arc flash boundary
2. Available incident energy calculated in the analysis and the corresponding working distance, or the arc flash personal protective equipment (PPE category) for the equipment, but not both.

N. Examples showing the minimum required information follow:

O. A list of all hazard categories and the corresponding PPE requirements shall be posted in the main electric room, engineering office, or other location. The list shall be plastic laminate or typewritten and housed in a plastic frame.

3.4 ADJUSTMENTS

A. Manufacturer's authorized representative or Contractor shall set all adjustable protective devices to values indicated in the approved coordination study. Apply settings prior to placing equipment into operation. When the scope of work or execution includes remodel or phases construction, the contractor shall adjust applicable settings as required prior to each system component placed in operation.

B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. greater than 8 cal/cm^2), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

3.5 TRAINING

A. Provide four hours of Owner training to explain the implications of arc-flash requirements and work permit procedure.

END OF SECTION 26 05 73

SECTION 26 09 33

LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting Control Overview

B. Standalone Line and Low Voltage Lighting Controls

1. Wall switches and wall dimmers
2. Sensors (occupancy, vacancy, daylighting, photocell, auxiliary power packs, etc.)

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of directly comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. Specification Section 26 24 16 Panelboards (panelboard enclosure and interior bussing used for lighting control panels)
2. Specification Section 26 51 19 LED Lighting
3. Electrical Drawings: Electrical Coversheet, plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 RELATED WORK

A. Section 23 09 01 - Lighting

1.4 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. All components and assemblies are to be factory pre-tested prior to delivery and installation.

C. Comply with Electrical Code as applicable to electrical wiring work.

D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures

E. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.5 REFERENCES

A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

B. FS W S 896 Switch, Toggle

C. California Energy Code - Building Energy Efficiency Standards Title 24

D. NEMA WD 1 - General Color Requirements for Wiring Devices

E. NEMA WD 7 - Occupancy Motion Sensors

F. NFPA 70 - National Electrical Code (NEC)

G. CEC California Electrical Code

H. UL Standard 916 Energy Management Equipment

I. UL 924 - Emergency Lighting and Power Equipment

J. UL 20 - Standards for General-Use Snap Switches

K. UL 917 - Clock Operated Switches

L. UL 1008 - Transfer Switch Equipment

M. UL 1472 - Solid-State Dimming Controls

1.6 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

1.7 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 05 00.

B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.

C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each size and type.

1.8 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

1.10 SYSTEM DESCRIPTION

A. Performance Statement: The specification section and lighting design documents describe the minimum material quality, required features, and operational performance requirements of the lighting control system. The documents do not convey every component, relay, wire, and equipment connection required. The Contractor and lighting control manufacturer/vendor are solely responsible for determining all system components, wiring, and programming required for a complete and operational system based on the performance based requirements of the documents.

B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.

1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.

C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.

1.11 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL OVERVIEW

A. Lighting Control System: As defined in the System Description, the design documents describe the operational performance requirements of the lighting control system. The Lighting Control System has been categorized into the following groups. Refer to the Electrical Symbol Key, this specification section, and the drawings to determine the appropriate lighting control category when more than one is applicable to the project:

1. Standalone Lighting Control Devices: Independent (standalone) devices traditionally operating at line or low voltage, field configurable with other standalone devices to provide an overall lighting control system.

B. All system components and materials of similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.

2.2 ELECTRICAL PLAN SYMBOLS

A. Refer to Electrical Coversheet for Electrical Symbols list and device specification tag.

2.3 DEVICE COLOR AND COVERPLATES

A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space. When the coverplate is proprietary to the device/manufacturer and do not match the wiring device coverplates, the architect shall select the coverplate color and materials from the standard coverplate options.

2.4 STANDALONE LINE AND LOW VOLTAGE LIGHTING CONTROLS

A. Overview:

1. Wall Switches and Wall Dimmers:

a. UL listed with integral air-gap switch for on/off control, integral EMI/RFI suppression, non-viewable heat sink, dimmer to match device color.
b. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.

B. SW-1P; Single Pole Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
2. Manufacturers:

a. Hubbell HBL1221
b. Leviton 1221-2
c. Pass & Seymour PS20AC1
d. Cooper AH1221

C. SW-1P-WP; Weatherproof Single Pole Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired. Provide with weatherproof coverplate.
2. Manufacturers:

a. Hubbell1221/HBL1795
b. Leviton 1221-2
c. Taymac MM180
d. Pass & Seymour PS20AC1/CA1-GL
e. Cooper 2221

D. SW-2P; Two Pole Switch:

1. Single throw, two pole, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
2. Manufacturers:

a. Hubbell HBL 1222
b. Leviton 1222-2
c. Pass & Seymour PS20AC2
d. Cooper 2222

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION MEETING

A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control system and integration with other systems as when applicable per the design documents.

3.2 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 6 inch spacing from electronic ballast and other RFI/EMI sources.

C. Low Voltage Cabling (less than 100 volts): Low voltage lighting control cabling shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage lighting control cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.

1. J-hooks; batwing type.
2. Bridle rings with saddle supports.
3. Low voltage cable batwings supported by independent luminaire support systems (luminaire support cabling); use of batwings on ceiling support systems not allowed.
4. Listed cable ties. Low voltage cabling secured to exterior of luminaire power raceway.

D. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

E. Lighting Control Station Wiring: Provide the grounded (neutral) conductor portion of the branch circuit with the line voltage phase conductors at each lighting control station.

F. Lighting Control Panel Directories: Provide a typewritten directory for each lighting control panel indicating relay/dimmer and description of load controlled.

3.4 INTEGRATION WITH OTHER SYSTEMS

A. The Room-Based lighting control system Network-Based lighting control system interacts, is controlled by, or controls the following other systems per the design documents and lighting sequence of operations descriptions. The contractor shall provide the necessary communication gateways, relays, cabling, and programming to interact with the following systems.

1. Building Automation System
2. Fire Alarm and Automatic Detection System
3. Security and Intrusion Detection System
4. Audio/Visual Systems
5. Shade Raise/Lower Controls

3.5 BRANCH CIRCUIT POWER WIRING FOR CONTROLLERS

1. Branch circuit power for the following lighting control system components shall be provided from the following branches. Lighting control power shall originate from the same branch circuits serving the controlled luminaires:

    a. Lighting Control System (Physical Server, Central Station, or Cloud-based Access): Emergency (Electrical Code Article 700)
    b. Room controllers, lighting control power supplies, devices, components, and accessories when an associated (ALCR) device is applicable to the lighting control sequence of operation: Emergency (Electrical Code Article 700)
    c. Room controllers, lighting control power supplies, devices, components, and accessories when an associated (BCELTS) device is applicable to the lighting control sequence of operation: The load side of the BCELTS device normal and emergency/life safety pending the status of the BCELTS.
    d. The contractor shall coordinate the branch circuit power source required with the Engineer when required for unique lighting control system devices, components, and accessories.

3.6 LOW VOLTAGE LIGHTING CONTROL CABLING

A. Control Cable Raceway Routing: All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring, independently supported, and shall maintain 150 mm (6 inch) spacing from luminaire drivers and other RFI/EMI sources.

B. Control Cabling Installed with Line Voltage Wiring: When low voltage control cabling is installed with line-voltage wiring, the control wiring shall be, copper conductors, minimum 16 AWG or per manufacturer, with cable insulation equal to the line-voltage rating (voltage, temp rating, etc.) and comply with Specification Section 26 05 13 "Wire and Cable."

C. Network Cabling: As required by manufacturer.

D. Splices and Taps: Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

3.7 SUPPORT SERVICES

A. System Startup:

1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Pre-Program, Testing, Training Coordination:

1. The construction documents and sequence of operations define the original design intent of the lighting controls as coordinated between the owner and the design team. The definition of the scope is intended to identify the hardware and programming flexibility required prior to programming, system testing, and owner training.
2. The final system programming, control station labels, scene presets, dimmer presets, dimmer range limits, fade times, etc. are subject to on site coordination between the design team, owner, contractor, and manufacturer. Contractor/manufacturer programming of the system prior to an onsite coordination with the owner and design team shall not be considered final programming nor commissioning.
3. The contractor and manufacturer shall provide on site representatives to provide final programming including preset, scene, switch labeling, and other programming adjustments based on owner and design team onsite observation and verbally requested adjustments as part of the based bid scope of work.
4. The contractor shall document onsite requested changes and update operation and maintenance manuals to match final programming.

C. Testing:

1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:

    a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.

b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
d. Confirm control station labeling, presets, switch labels, and scenes.

3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.

a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

D. Training:

1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.

E. Documentation:

1. Manufacturer shall provide system documentation including:

a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or building automation system BAS interface unit.
b. Drawings for each panel showing hardware configuration and numbering.
c. Panel wiring schedules.
d. Typical diagrams for each component.

3.8 SYSTEM COMMISSIONING

A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 09 00, General Commissioning, for further details.

B. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

C. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00, General Commissioning, for system verification tests and commissioning requirements.

D. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 09 00, General Commissioning, for Contractor training requirements.

END OF SECTION 26 09 33

SECTION 26 22 00

DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dry type two winding transformers

1.2 REFERENCES

A. NEMA - ST 1 - Specialty Transformers

B. NEMA ST 20 - Dry Type Transformers for General Applications

C. ANSI/IEEE C57.12.01 - General Requirements for Dry Type Distribution and Power Transformers

D. ANSI/IEEE C57.12.91 - Test Code for Dry Type Distribution and Power Transformers

E. Department of Energy 10 CFR Part 431 - Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.

F. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

G. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency

1.3 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 26 05 00.

B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 - PRODUCTS

2.1 DRY TYPE TWO WINDING TRANSFORMERS

A. Acceptable Manufacturers:

1. Square D 7400 EX##T / SK300##KB Series
2. Eaton V48M / H48M / B48M Series
3. ABB 9T Series
4. Hammond SG / SMK Series
5. Siemens 3F3 Series

B. Dry Type Transformers: NEMA ST 20, factory-assembled, air-cooled dry type transformers; ratings as shown on the drawings. Transformers supplied under this project shall meet the US Department of Energy (DOE) 2016 Efficiency requirements or the most current DOE CFR in effect.

C. Insulation system and average winding temperature rise for rated KVA as follows:

Ratings	Class	Rise (degree C)
Less than 15	185	As shown on the drawings
or higher	220	As shown on the drawings

D. Case temperature shall not exceed 40°C rise above ambient at its warmest point.

E. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

F. Winding Taps, Transformers 15 KVA and Larger: Two (2) 2-1/2% below and two (2) 2-1/2% above rated voltage, full capacity taps on primary winding.

G. Sound Levels: Average audible sound level shall not exceed the values given below when tested to NEMA ST 20 standards:

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

I. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.

J. Coil Conductors: Continuous windings with terminations brazed or welded.

K. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.

L. Isolate core and coil from enclosure using vibration-absorbing mounts.

M. Nameplate: NEMA TP 3; Include transformer connection data and overload capacity based on rated allowable temperature rise.

KVA Rating	Insulation Class	Temperature Rise (degree C)
0.25-2	185	80
3-7.5	220	115

KVA Rating	Insulation Class	Temperature Rise (degree C)
0.25-2	185	80
3-7.5	220	115

KVA Rating	Insulation Class	Temperature Rise (degree C)
1-9	185	115
10-500	220	130

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

2.2 ACCESSORIES

A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

B. Electronic Isolation Shield:

1. Provide electrostatic winding shield with separate insulated grounding connection as shown on the drawings. REQUIRED

C. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

D. Barriers (Service Equipment): Provide solid barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

E. Transformer Disconnect Lockable Hasp: Provide circuit breakers, fused switches, and disconnects serving transformers with a lockable padlock hasp capable of being locked in the open/closed position. REQUIRED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount transformers on four 3”x3”x1/2” thick, 50 durometer rubber vibration isolating pads suitable for isolating the transformer noise from the building structure.

D. Ventilated transformers: Provide factory label on horizontal surface to prohibit storage on top, front, or adjacent to transformer.

E. Install primary, secondary, and grounding electrode conductors using factory or field fabricated enclosure entries. Conductors shall not be routed through ventilated openings.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments. Adjustments shall be made at completion of project and at approximately 6 months following project acceptance when requested by the Owner.

END OF SECTION 26 22 00

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Service and distribution panelboards

B. Lighting and appliance branch circuit panelboards

1.2 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

B. Section 26 09 13 - Energy Metering and Management System

1.3 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA FU 1 - Low voltage cartridge fuses

C. NEMA KS 1 - Enclosed Switches

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

G. UL 248 - Low-Voltage Fuses

H. UL 67 - Panelboards

1.4 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Selective Coordination Study: Submit study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.

D. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.

E. Refurbished branch panel enclosure documentation for new branch panelboards installed in existing enclosures.

F. Submit manufacturer's instructions under provisions of Section 26 05 00.

1.5 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type and rating installed to the Owner.

C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

PART 2 - PRODUCTS

2.1 RATINGS

A. Definitions:

1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 05 53 for additional requirements.
2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 MAIN AND DISTRIBUTION PANELBOARDS

A. General

1. Manufacturers:

a. Square D QMB, I-Line
b. ABB ReliaGear neXT
c. Siemens F2, P4
d. Eaton PRL4, PRL5

B. Panelboards: NEMA PB 1; type as shown on the drawings.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.

H. Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

I. Fuse Clips (Switches 600 Amperes and Smaller): Provide with Class 'R' rejection clips. Fuse Clips (601 Amperes and Larger): Designed to accommodate Class 'L' fuses.

J. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

K. Molded Case Circuit Breakers with Current Limiters: Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

2.3 BRANCH CIRCUIT PANELBOARDS

A. General

1. Manufacturers:

a. Square D NQ, NF
b. ABB ReliaGear Series
c. Siemens P1
d. Eaton PRL1, PRL2

B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Hinged trim shall be secured with screws. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.

G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

H. Minimum Integrated Short Circuit Rating: As shown on the drawings.

I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.

J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

2.4 ACCESSORIES

A. Provide REQUIRED accessories as described below. Provide SCHEDULED accessories when listed with plan schedules. Refer to plan schedules for additional requirements.

B. Barriers: Provide finger safe barriers for lineside uninsulated and ungrounded terminations and components which remain energized when the main disconnecting device is 'open'. REQUIRED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard and panelboards installed in electrical closets less than 36" deep.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 26 24 16

SECTION 26 24 19

MOTOR CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor starters and switches

B. Magnetic motor starters

C. Combination magnetic motor starters

D. Solid-state reduced voltage motor starters (soft starters)

E. Motor control centers

F. Motor starter panelboards

1.2 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule and One-Line Diagram for rating and configuration.

1.3 REFERENCES

A. ANSI/UL Standard 508. Standard for Industrial Control Equipment

B. FCC Rules and Regulations, Part 15, Subpart J- Radio Frequency Interference

C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service

D. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)

E. FS W-P-115 - Power Distribution Panel

F. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted

G. IEEE Standard 519-1981 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters

H. NEMA AB 1 - Molded Case Circuit Breakers

I. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies

J. NEMA ICS 6 - Enclosures for Industrial Controls and Systems

K. NEMA KS 1 - Enclosed Switches

L. NEMA PB 1 - Panelboards

M. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less

1.4 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

B. Fuses: Furnish three (3) spare fuses of each type and rating installed to the Owner.

C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Deliver in 60-inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.

C. Store and protect products under provisions of Section 26 05 00.

D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from fumes, dirt, water, construction debris, traffic, and physical damage.

E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00.

B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions on concrete bases.

B. Install fuses in fusible switches.

C. Select and install heater elements in motor starters to match installed motor characteristics.

D. Set field-adjustable switches and circuit-breaker trip ranges.

E. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

F. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

END OF SECTION 26 24 19

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Device plates and box covers

B. Receptacles (REC-#)

1.2 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the Electrical Code.

1.3 REFERENCES

A. DSCC W-C-896F - General Specification for Electrical Power Connector

B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

G. UL 498 - Standard for Attachment Plugs and Receptacles

H. UL 943 - Standard for Ground Fault Circuit Interrupters

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

C. Provide a non-returnable sample of each countertop and furniture-mounted receptacle assembly as part of the submittal process.

1.5 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

A. All switch, receptacle, and outlet colors shall be white verified with Architect, unless indicated otherwise.

2.2 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:

1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
2. Decorator Grade - Public: Decorator thermoset plastic and match device color wallplates in public finished spaces where walls are finished.

    a. Manufacturer:

        1) Leviton Decora
        2) Hubbell Decorator
        3) Cooper Decorator
        4) or approved equal

3. #302 stainless steel coverplates in unfinished spaces for flush boxes.
4. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. Devices that are shaded on the drawings shall be red.

C. REC-DUP: NEMA 5-20R Duplex Receptacle:

1. Spec Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.

    a. Manufacturers:

        1) Hubbell 5352
        2) Leviton 5362-S
        3) Pass & Seymour 5362
        4) Cooper 5362

2. Heavy Duty: 125-volt, 20 amp, 3-wire grounding type heavy duty industrial grade with impact resistant thermoplastic face and one-piece brass back strap with integral ground contacts.

    a. Manufacturers:

        1) Hubbell 5362
        2) Leviton 5362
        3) Pass & Seymour 5362A
        4) Cooper AH5362

D. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.

    a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    b. Manufacturers:

        1) Hubbell GF20L
        2) Leviton GFNT2
        3) Pass & Seymour 2097
        4) Cooper SGF20

E. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use cast aluminum outlet box hood.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.

    a. Manufacturers:

        1) Hubbell:

            a) GFTWRST20 with aluminum housing WP826

        2) Leviton GFWT2 with aluminum housing M5979
        3) Pass & Seymour 2097TRWR with aluminum housing WIUCAST1
        4) Cooper WRSGF20 with aluminum housing WIUMV-1

F. REC-AFGF: NEMA 5-20R Duplex Receptacle with Arc Fault Circuit Interrupter, Ground Fault Circuit Interrupter, and Tamper Resistant:

1. 125-volt, 20 amp, 3-wire grounding type specification grade, arc fault circuit interrupter, ground fault circuit interrupter, tamper resistant receptacle with test and reset buttons in impact resistant thermoplastic face, listed.

    a. Device shall perform self-test of GFCI circuitry in accordance with UL-943.
    b. Manufacturers:

        1) Hubbell GFCI type devices are not allowed. Contractor may substitute an alternative manufacturer when Hubbell is the basis of submittal for all other wiring devices.
        2) Leviton AGTR2

3) Pass & Seymour AFGF202
4) Cooper TRAFGF20A

G. REC-ARC: NEMA 5-20R Receptacle with Arc Fault Circuit Interrupts:

1. 125-volt, 20 amp, 3-wire grounding type specification grade, arc fault circuit interrupter receptacle and tamper resistant with test and reset buttons in impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell AFR20
2) Leviton AFTR2
3) Pass & Seymour AF202
4) Cooper TRAFCI20

2. 125/250-volt, 50 amp, 3-pole, 4-wire grounding type with thermoplastic face. Flush mounted at +4" AFF.

a. Manufacturers:

1) Hubbell HBL9450A
2) Leviton 279
3) Pass & Seymour 3894
4) Cooper 5754N

H. REC-TAMP: NEMA 5-20R Tamper Resistant Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell BR20TR
2) Leviton TBR20
3) Pass & Seymour TR5362
4) Cooper TRBR20

I. REC-TAMP-QUAD: NEMA 5-20R Double Duplex Tamper Resistant Receptacle:

1. Consists of two duplex tamper resistant receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Tamper Resistant Receptacle above.

J. REC-QUAD-O: NEMA 5-20R Plug Load Controlled Duplex Receptacle:

1. Consists of two plug load controlled duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Plug Load Controlled Duplex Receptacle above.

K. REC-QUAD-IL: NEMA 5-20R Double Illuminated Face Duplex Receptacle:

1. Consists of two illuminated face duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex Illuminated Face Receptacle above.

L. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex Receptacle above.

M. REC-QUAD-GFI: NEMA 5-20R Double Duplex GFI Receptacle:

1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex GFI Receptacle above.

N. REC-QUAD-USB: NEMA 5-20R Double Duplex USB Receptacle:

1. Consists of two duplex USB receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to USB Receptacle above.

O. REC-QUAD-WP: NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:

1. Consists of two duplex, GFCI receptacles. Double gang box. Provide extra-duty NEMA 3R rated while-in-use cast aluminum outlet box hood.

a. Manufacturers:

1) Receptacle: Refer to GFCI Receptacle above.
2) Cover:

a) Intermatic WP1030MXD
b) Pass & Seymour WIUCAST2
c) Thomas & Betts Red Dot 2CKU

P. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

Q. Side wired devices shall have four binding screws that are undercut for positive wire retention.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:

1. Bathrooms, locker rooms, shower rooms
2. Interior/Exterior locations subject to damp/wet conditions
3. When located within 6 feet of sinks, bathtubs, and shower stalls
4. Exterior dwelling outlets (disconnects, equipment connections, etc.) when required by code.
5. Boathouses
6. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
7. Horticultural luminaire branch circuits
8. Future Provisions: Provide a conduit raceway and backbox for the future addition of countertop pop-receptacle when receptacles are not installed in kitchen islands and peninsulas.

D. Arc-Fault Protection: Provide arc-fault protection for all branch circuit breakers serving the following spaces, or required by adopted code.

1. Guest rooms and guest suites

E. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.

1. Guest rooms, guest suites, and common public areas
2. Public Buildings: Corridors, waiting rooms, common areas
3. Public Spaces involving: Transportation waiting, gymnasiums, fitness centers, auditoriums, public use venue common areas

F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.

G. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

J. Install devices and wall plates flush and level.

K. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fuses

B. Spare Fuse Cabinet

1.2 REFERENCES

A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types

B. UL 198E - Class R Fuses

C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)

D. NEMA FU 1 - Low Voltage Cartridge Fuses

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

1.3 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS

A. Provide two fuse pullers.

B. Provide three of each size and type of fuse installed.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS - FUSES

A. Bussman, Division of Eaton

B. Edison Fuse, Division of Cooper Industries

C. Mersen

D. Littelfuse Inc

2.2 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.

D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.

E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

F. Control transformer fuses: Class CC (time delay).

G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

2.3 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses where indicated on the drawings and specifications.

B. Install fuses in accordance with manufacturer's instruction.

C. Install fuses in packaged equipment as required by equipment manufacturer.

D. Install fuse with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 28 13

SECTION 26 28 16

DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fusible switches

B. Molded case circuit switches

C. Motor disconnect switch

D. Elevator Service Disconnect Switch

E. Enclosures

1.2 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.3 REFERENCES

A. NEMA KS 1 - Enclosed Switches

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.

C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.5 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Acceptable Manufacturers:

1. Square D 3110 Series

2. Eaton DH Series
3. ABB TH Series
4. Siemens HNF / HF Series

B. Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

C. Enclosures: Type as indicated on the disconnect schedule.

D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

2.2 MOLDED CASE CIRCUIT BREAKERS AND SWITCHES

A. Acceptable Manufacturers:

1. Square D
2. Eaton
3. ABB
4. Siemens

B. Molded Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Adjustable Instantaneous Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip settings.

C. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

2.3 MOTOR DISCONNECT SWITCH

A. Acceptable Manufacturers:

1. Square D 3110 Series
2. Eaton r5 Series
3. ABB ML Series
4. Siemens LBR Series

B. Rotary Switch Assemblies: Rated for making and breaking loads, rotary type enclosed switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.

C. Enclosures: Type as indicated on the Disconnect Schedule.

D. Ground lug connection provided in enclosure.

E. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

F. Listed UL 508 suitable for motor control.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION 26 28 16

SECTION 26 43 00

SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated.

1.2 QUALITY ASSURANCE

A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.

B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.3 REFERENCES

A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components

B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components

C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices

F. CBEMA - Computer Business Equipment Manufacturers Association

G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage

H. NFPA 70 - National Electrical Code (NEC)

I. CEC California Electrical Code

J. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors

K. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)

L. UL 248-1 - Fusing

M. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.4 SUBMITTALS

A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.

1.5 SPARE PARTS

A. Surge Protection Modules: Furnish2 replacement module for each type installed.

B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.

1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

B. Minimum Repetitive Surge Current Capacity:

1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
2. Minimum Repetitive Surge Current Capacity Test:

    a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
    b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
    c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.

3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
4. Proof of such testing shall be the test log generated by the surge generator.

C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.

D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

E. No scheduled parts replacement or preventative maintenance shall be required.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.2 RATINGS

A. Secondary Distribution Suppressors:

1. For 277/480 120/208-volt, 3 phase, 4 wire, type 2, category B3/1 unit.

    a. Surge current capacity: 60,0000/120,000 amps per protection mode/phase
    b. Nominal Discharge Current: 20 kA.
    c. Mounting: Refer to the drawings.
    d. Voltage Protection Rating: Refer to requirements below.
    e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).

2. Manufacturers:

    a. Square D Surgelogic EMA Series
    b. Siemens TPS4 Series
    c. Eaton SPD Series
    d. Current Technology Current Guard Plus

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.

B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.2 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the panel and transformer secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the transformer switchboard panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. Integral surge protection devices mount between the main and branch circuit breakers.
3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard. Single phase 120-volt units shall be hardwired without a disconnecting means.
2. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

END OF SECTION 26 43 00

SECTION 26 51 19

LED LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories

B. Exterior luminaires and accessories

C. Light-emitting diode (LED) luminaire systems

D. LED emergency lighting units

E. Emergency exit signs

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 REFERENCES

A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products

B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement

C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment

D. NFPA 70E - National Electrical Safety Code

E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System

F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products

G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED

I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)

J. UL 924 - Standard for Emergency Lighting and Power Equipment

K. UL676 Standard for Underwater Luminaires and Submersible Junction Box

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Basic Requirements of Submittal:

1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.
4. Submit manufacturer origin of LED chipset and driver.

C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):

1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.

D. LED Lighting - Control Compatibility Submittal:

1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

E. Submit Design Lights Consortium (DLC) information for each luminaire type.

1.5 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 05 00.

B. LED Light Engines or Modules: Insert percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.

C. Lenses: Insert percent of quantity installed, minimum one (1) of each size and type.

D. LED Drivers: Insert percent of quantity installed, minimum one (1) of each size and type.

E. Exit Signs: Provide Insert **a**dditional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 05 00.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.7 MOCKUP

A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

1.8 WARRANTY

A. The warranty period begins at the date of Substantial Completion.

B. LED Light Engines and Drivers:

1. LED Drivers and Dimming Drivers: Five (5) years
2. Light Emitting Diode (LED) Light Engines: Five (5) years

C. Emergency Lighting Units and Exit Signs:

1. Emergency Lighting Units: Three (3) year, non-prorated
2. Exit Signs: Three (3) year, non-prorated
3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.

D. Emergency Drivers:

1. Emergency LED Driver: Five (5) years

E. Emergency Inverter for LED Light Engines:

1. Emergency Battery: Sealed nickel cadmium five (5) year, non-prorated.

F. Automatic Load Control Relay (ALCR): Five (5) year

1.9 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.

B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.

D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.

E. Painted reflector surfaces shall have a minimum reflectance of 90%.

F. All painted components shall be painted after fabrication.

2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.

B. Provide low temperature LED drivers, with reliable starting to -20°F.

C. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

A. Light emitting diodes used in interior applications shall have a minimum color rendering index (CRI) of 80 90. The R9 color rendering value shall be a minimum of 50. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the luminaire schedule. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.

B. Refer to the luminaire schedule for color temperature and minimum color rendering index CRI requirements. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.

C. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.

D. Rated life shall be minimum of 50,000 hours at L70.

E. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.

F. Luminaire delivered lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.

G. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.

H. LED light engine shall have a maximum LLD of 0.85 at 50,000 100,000 hours at 25°°C ambient.

I. LED Driver:

1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 10%. Driver shall have a voltage fluctuation tolerance of +/- 10%.
2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
3. Driver shall have a minimum of 50,000 hours rated life.
4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
5. Driver shall be field replaceable without removal of the luminaire.
6. Class A sound rating; inaudible in a 27 dBA ambient.
7. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

2.4 LED EMERGENCY LIGHTING UNITS

A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

B. Battery: Maintenance free lead calcium type, with 90 minute capacity to supply the connected lamp load.

C. Charger: Dual-rate solid state current charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.

D. LED Lamp Wattage: As scheduled on luminaire schedule.

E. Remote Lamps: Match LED lamps on unit.

F. Indicators: Provide lamps to indicate AC ON and RECHARGING. Provide voltmeter.

G. Provide test switch to transfer unit from normal supply to battery supply.

H. Electrical Connection: Knockout for conduit connection.

I. Unit Voltage: Refer to luminaire schedule volts, AC.

J. Self-Diagnostics and Testing:

1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

2.5 EMERGENCY EXIT SIGNS

A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.

B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.

C. Self-Diagnostics and Testing:

1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.

1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:

   a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
   b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
   c. Luminaires larger than eight square feet (8 ft2): Support luminaire independent of the ceiling system.

B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.

D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.

E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (Cc) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.

F. Install lamps in lamp holders of luminaires.

G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

H. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.

I. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.

J. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

3.2 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

A. Install units plumb and level.

B. Aim directional lamp heads as directed.

C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.3 RELAMPING

A. Replace failed LED light engine modules or arrays at completion of work.

3.4 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Touch up luminaire and pole finish at completion of work.

3.5 OWNER TRAINING

A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner's Representative.

B. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.6 LUMINAIRE SCHEDULE

A. As shown on the drawings.

END OF SECTION 26 51 19

DIVISION 28: FIRE ALARM

28 0000 COMMON WORK RESULTS FOR FIRE ALARM

END OF TABLE OF CONTENTS

SECTION 28 31 02

FIRE ALARM AND DETECTION SYSTEMS PERFORMANCE BASED

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The fire alarm and detection system shall be included as a deferred submittal package.

B. Performance-based designs shall be submitted to the Authority Having Jurisdiction (AHJ) for review and approval in a format acceptable to the approving authority. The submittal shall include documentation for each system function, performance objective, integration with other system(s), and design configuration. Documentation shall also include design calculations for system batteries, voltage drop, and other AHJ-requested items. The AHJ shall act as the sole authority for approval and shall approve all applicable modifications/variations to the design prior to installation.

C. The fire alarm and automatic detection systems shall be designed, stamped, programmed, submitted for approval, installed, tested, and commissioned as a turnkey solution by the Contractor. Contractor shall be responsible for the coordination and interface of other systems.

D. The contract documents define the minimum fire alarm system requirements. The most stringent requirement/interpretation shall apply when there is a discrepancy among the contract documents, code-minimum requirements, and the interpretation of the AHJ.

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.

B. Installer: A factory-authorized electrical or security contractor licensed with the State and local jurisdiction with five years' experience in the design, installation and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 2.This person's name and certification number shall appear on the start-up and testing reports.

1.4 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. CEC California Electrical Code

C. NFPA 72 - National Fire Alarm and Signaling Code

D. NFPA 101 - Life Safety Code

E. UL 2017 - General Purpose Signaling Devices and Systems

F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

G. UL 2572 - Control and Communication Units for Mass Notification Systems

H. California Fire Code (CFC)

I. 2022Insert Fire Code

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.

1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.

B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.
2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 26 05 00.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

H. Incident Commander Display: Submit sample display screen layouts and list of functions for Authority Having Jurisdiction (AHJ) review and coordination.

I. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.

J. When required to comply with local or state regulatory reviews, the fire alarm submittal shall have a Professional Engineer's stamp and signature NICET Certification of the state in which the project is completed.

1.6 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. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.

    a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
    b. Notification Appliances: Speakers, speaker strobes, and strobes.

2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet minimum of one (1) set each and shall turn over to the Owner upon completion.
3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."
4. Portable Firefighter Emergency Handset Phones: Provide 10. Locate in the room with the main fire alarm panel.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Store and protect products under provisions of Section 26 05 00.

1.8 REGULATORY REQUIREMENTS

A. System: UL or FM Global listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.9 CODES, LAWS, AND ORDINANCES

A. The fire alarm design shall comply with the following applicable codes, laws, and standards:

1. ASME A17.1 Safety Code for Elevators and Escalators
2. International Building Code IBC 2021
3. IFC2022Insert International Fire Code with local amendments
4. NFPA 72 National Fire Alarm & Signaling Code 2022

5. NFPA 70 National Electrical Code 2023
6. NFPA 101 Life Safety Code
7. NFPA 80 Fire Door and other Opening Protectives
8. NFPA 101 Life Safety Code
9. Conform to all requirements of State of CA codes, laws, ordinances and other regulations having jurisdiction.
10. Conform to published standards of CA

1.10 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, voice evacuation equipment, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.

C. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

D. Campus Ethernet IP Network: A complete fire alarm and mass notification Ethernet network shall be provided. The network shall be Class X, Resilient Ethernet Protocol (REP) 100BaseTX / 100 Mbps that shall be able to operate with any single break and self-restoring network communications. Each building shall contain an independent building fire alarm / voice communications system, with full command and control from the campus command center. In no case shall read only network annunciation be acceptable as the only networking function.

E. In-Building Network: A complete fire alarm system network shall be provided. Provide quantity of control panels as indicated on the drawings. The network shall be a Style 7 token ring, peer-to-peer network. The network shall be characterized by simultaneous or sequential transmission, or both, and reception of multiple signals on a signaling line circuit or communication channel. The distributed intelligent characteristic of the network shall provide for all nodes independently making pertinent system decisions with no need for a central controller. Each node shall be capable of independent operation should loss of network communications occur. In no case shall read-only network annunciation be acceptable as the only networking function.

F. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

G. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.

H. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.

I. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.11 SYSTEM DESIGN CRITERIA

A. Audio Notification: Horn based; full coverage

B. Visual Notification: Full coverage

C. Automatic Fire/Smoke/Heat Detection: Partial coverage

D. Full coverage is defined as all occupiable interior spaces.

E. Partial coverage is defined as all commonly occupied spaces including corridors, lobbies/waiting, toilets/restrooms, open office areas, meeting rooms, common work spaces, storage, mechanical/electrical spaces, and stairways.

1.12 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 26 05 00.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.13 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 05 00.

B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer's representative's letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.14 DOCUMENT STORAGE CABINET

A. The cabinet shall have all fire alarm system documents, including record drawings, wiring diagrams, operation manuals, etc. A legend sheet permanently attached to the door shall contain system passwords and inspection logs. The enclosure shall also provide two (2) key ring holders for system keys and a location for a standard size business card with service contact information.

B. The cabinet will have, permanently and securely mounted inside, a digital flash memory device with a minimum of 4 GB of storage capacity and a standard USB B connector for uploading and downloading electronic versions of record documents and system programming information.

C. The cabinet shall be red in color with an identification label reading "FIRE ALARM DOCUMENTS". Refer to Identification Section 26 05 53. The cabinet shall be lockable. The minimum cabinet size shall be 14" x 14" x 48".

D. The final version of the system database program shall be stored within the cabinet.

E. Locate cabinet in the Electrical Room - 140.

1.15 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

1.16 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT

A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.

B. Provide an alternate cost for a complete inspection/testing and service/maintenance contract for the fire alarm system for starting one year after the Date of Substantial Completion. Submit sample contract terms and conditions for review with shop drawings.

C. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notifier by Honeywell

B. Gamewell - FCI

C. Silent Knight

D. Or approved equal.

2.2 FIRE ALARM CONTROL PANEL (FAP)

A. Control Panel: Modular, power-limited electronic design. Provide surface wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:
   1. Panel Expansion Capability, Minimum Total SLC Loops: 10
   2. Minimum Node Capacity for Network System: 100

C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:

   1. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
   2. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.

D. Central Processing Unit:

   1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.
   2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
   3. All power for the unit shall be supervised and supplied by the FAP.

E. Display:

   1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
   2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
   3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.
   4. The board shall provide a touch key-pad with control capability to command all system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.

F. Memory: The CPU and display interface board shall be augmented by non-volatile field programmable memory. EPROM memory will also be allowed provided the memory is burned in with minimum expansion capability equal to the total system capacity of the panel. Memory shall not be lost upon primary and secondary power failure.

G. Serial Interface Board: The board shall provide interfaces to a printer, LCD display and other monitoring devices through RS-232 connections. The minimum operational distance between the board and the peripheral devices shall be 500 feet. Up to three (3) RS-232 outputs shall be supported.

H. Power Supply:

1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
4. The power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of the entire system for 24 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.

I. Surge Protection:

1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.
2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.

J. Digital Communicator:

1. Provide dual phone line interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Communicator shall report in SIA and most major communication formats, with the capability of transmitting each device address point in a format compatible with the central station receiver.
2. Monitoring fees and initial connection charges are not part of this project.
3. Communicator shall be fully supervised and shall operate on loop start phase lines ahead of the building PBX system.
4. Communicator shall be FCC registered. Contractor shall provide two RJ31X jacks. Contractor to provide connection of communicators to Owner's telephone system as shown on the drawings.
5. Approvals: UL listed - UL 864/NFPA 72, FM approved.
6. The communicator shall be provided integral to the fire alarm panel as furnished by the fire alarm panel manufacturer. If the panel construction requires a separate unit, the unit shall be as manufactured by Silent Knight, Ademco, or fire alarm panel manufacturer approved equal.

2.3 FIRE ALARM PATHWAY CLASS AND SURVIVABILITY LEVEL

A. Pathway Class:

1. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.

B. Pathway Survivability Level:

1. Pathway Survivability Level 0: Circuits have no requirements for pathway survivability beyond the requirements of the code.
2. Pathway Survivability Level 2: Pathway survivability includes one or more of the following:

a. Listed 2-hour fire-rated circuit integrity (CI) or fire-resistive cable.
b. Pathway installed in a 2-hour fire-rated enclosure or assembly.

2.4 FIRE ALARM TERMINAL CABINET (FATC)

A. Fire Alarm Terminal Cabinet with locked hinged door. Provide as an extension of the main fire alarm system.

2.5 SIGNALING LINE CIRCUIT DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) W - Weather Proof
2) WG = Wire guard is required
3) Candela Ratings:

a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela
b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

b. Sequence of operation as follows:

1) A=Atrium
2) CR=Computer Room
3) D=HVAC Control
4) DH=Door Hold Release
5) DIPS = Dual Interlock Pre-Action System
6) FD= Fire Door Release
7) MP=Medical Procedure Room
8) S=Sleeping / Patient Room
9) SW=Stairwell

C. FA-120; Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) Blank = Photoelectric
2) H = Combination Smoke / Heat Detectors
3) ID = In-Duct Detector

2. (BLANK) Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.

3. Each smoke detector shall connect directly to an SLC loop, unless listed as stand alone.
4. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
5. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
6. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.
7. A test means shall be provided to simulate an alarm condition.
8. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

D. FA-122; Duct Smoke Detectors, Sampling Tube Type:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
b. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.
c. Provide a remote alarm LED indicator device (FA-241 or FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

E. FA-130; Manual Pull Stations:

1. Manual pull station, addressable, single action, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provided with all necessary mounting hardware. Use surface mount only on precast concrete or structure.
2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
3. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

F. FA-140; Heat Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types as follows:

        1) Blank = Combination Rate of Rise / Fixed Temp
        2) AT = Attic (located in)
        3) F = Fixed Temp
        4) RC = Rate Compensated
        5) X = Explosion Proof

2. (BLANK) Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.

3. (F) 200°F fixed temperature. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
4. (RC) Rate Compensated
5. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
6. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
7. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
8. Provide a remote LED indicator device if detector is not visible from a floor-standing position.
9. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.
10. A test means shall be provided to simulate an alarm condition.
11. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

G. FA-160; Monitor Modules:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types as follows:

        1) Blank = Refer to Plans
        2) KB = Knox Box Monitor

2. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.

3. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
4. The module shall supply the required power to operate the monitored device(s).
5. The module shall provide address setting means using rotary decimal or DIP switches.

H. FA-161; Addressable Control Module:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types as follows:

        1) Blank = Refer to Plans
        2) DH = Door Hold Open
        3) PD = Hold Open Override

2. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
3. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
4. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
5. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

I. FA-280; Isolation Module:

1. Provide fault isolation modules or isolator detector base capable of isolating and removing the fault from Class A or Class X addressable loop data circuits while allowing the remaining data loop to continue operation. Provide a minimum of two isolation modules or bases and between every 15 devices.

2.6 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types as follows:

        1) W = Weather Proof
        2) WG = Wire guard is required

3) Candela Ratings:

a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela.
b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

C. Notification Device(s):

1. Wall Mounted: Red housing with white lettering or pictogram.
2. Ceiling Mounted: White housing with red lettering or pictogram.

D. FA-200; Visual Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.

a. Mounting: Semi-flush wall.
b. Conduit shall not be exposed.

E. FA-210; Audio Chime Alarm Devices:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
2. Device types as follows:

a. M = Mini-Horn
b. S = Sleeping / Patient Room

3. Wall or ceiling mounted, refer to plans.
4. Sound Rating: 85 dB at 10 feet. Sound levels for alarm signals shall not exceed 120 dBA in the occupied area.
5. Device shall be capable of a high and low dB level setting. Unless noted otherwise, the device shall be set to the high setting at building completion.
6. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
7. (M) Mini-Horn Audio Notification Device: Electronic horn.

a. Mounting: single-gang flush wall.

F. FA-211; Combination Audio Horn and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine audio and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (W) Weatherproof Audio/Visual Notification Device: Electronic horn with high intensity strobe, square housing, 75 Candela, suitable for wet locations. Provide with weatherproof back box.

a. Mounting: Semi-flush wall.
b. Conduit shall not be exposed.

2.7 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)

A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.

B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 60 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.

C. Power for each NAC shall be from a local 120 VAC circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with the Architect/Engineer prior to installation.

D. NAC extender panels may be installed only where shown on drawings.

E. Mounting: Surface.

2.8 ANNUNCIATION

A. CGA; Color Graphics Network Annunciation System:

1. The annunciator shall provide custom color graphics displays for the control panel to annunciate the status of the panel and every peripheral device. It shall record and display system historical information on an LCD flat panel display.
2. The annunciator shall have the ability to display a minimum of 256 custom screens and shall be fully field programmable. The fire alarm vendor shall develop screens from DXF or DWGCAD files provided by the Owner.
3. Operator control shall be via an attached keyboard and mouse.
4. The annunciator shall store all alarms, troubles and operator activity to an internal hard drive and shall have a capacity of 10,000 events without data loss.
5. Events shall have a time and date stamp.
6. Graphics shall contain eight (8) different colors from a palette of sixty-four (64).
7. Graphics software shall be provided to display on single or multiple screens, the status of every device located on a floor plan of the building. Alarms shall be audio and visual and shall annunciate regardless of the screen that is currently visible. Text on screens shall be a minimum of 1/10" high. Coordinate with the Owner, the floor plan on each screen prior to programming.
8. Provide TROUBLE ACKNOWLEDGE, DRILL, and ALARM SILENCE capability at the color graphics annunciation location.
9. The systems shall operate on the most current UL 864 listed computer system. The system shall be supplied by the fire alarm vendor and be listed for fire alarm use.
10. Provide an uninterruptible power supply (UPS) to provide a minimum of 10 minutes of operating power for the computer graphic annunciator upon loss of normal power.
11. All equipment for the color graphics network annunciator shall be suitable for locating on a desk, provided by the Owner. When multiple workstations are required (multiple locations within a facility or multiple buildings on a campus), they shall be server/client based configuration.

12. Remote Client Workstations: All workstations shall have the same user functionality. User shall have the ability to take over network control functionality from any station as follows:

    a. Request to take control
    b. Accept/deny control request
    c. Restore command center to normal operation
    d. Priority request override

13. PC computer workstation shall have the following minimum operating system requirements:

    a. Operating system shall be a minimum of Microsoft Windows 7.
    b. 3.0 GHz processor (server workstation)
    c. 128 GB RAM installed (server workstation)
    d. i7 Intel processor (client workstation)
    e. 32 GB RAM installed (client workstation)
    f. 500 GB hard drive
    g. 22-inch LCD monitor minimum

B. Printer:

1. Printer shall be UL 864 listed and shall be the automatic type with code, time, date, location, category and condition.
2. The printer shall provide hard copy printout of all changes in status of the system and shall time-stamp such printouts with the current time of day and date. The printer shall be standard carriage with 80 characters per line and shall use standard bond paper. The printer shall be enclosed in a separate enclosure, suitable for placement on desk or countertop. The printer shall communicate with the control panel using an interface complying with Electrical Industries Association Standard EIA-232D. Power to the printer shall be 120 VAC, 60 Hertz.
3. The printer shall be connected to the fire command center and shall have all interfaces in place to be connected to the Fire Command Center and all transponders in case of network or hardware failure.

C. FAA; Remote LCD Annunciators:

1. Auxiliary annunciators shall indicate alarm and trouble conditions visually and audibly as shown on the drawings. Provide local TROUBLE ACKNOWLEDGE, TEST, and ALARM SILENCE capability. Minimum 80-character display.
2. Communications and power to the annunciators shall be supervised. The annunciator shall receive power from the fire alarm control panel.
3. A single key switch shall enable all switches on the annunciator.
4. Mounting: Flush.

D. FA-241; Fire Alarm Remote Indicator:

1. Red LED type.
2. Mounts flush to a single gang box.

E. FA-242; Fire Alarm Remote Indicator and Test Switch:

1. Red LED type.
2. Key switch test selector.
3. Mounts flush to a single gang box.

2.9 WIRE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

2.10 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:

1. Manufacturers:

a. Comtran Corp.
b. Helix/HiTemp Cables, Inc.
c. Rockbestos-Suprenant Cable Corp.
d. West Penn Wire/CDT.
e. Radix.

PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

A. General:

1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.
2. The GUI/graphic annunciator shall display audible and visual alarms. The device activated shall be immediately displayed on a CAD floor plan at approximately 1/8" scale. Visual indication shall further indicate the device by utilizing an easily recognized color change of the symbol. The use of flashing symbols is encouraged.
3. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:

1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
2. A local signal in the control panel and the color graphics PC shall sound.
3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
4. Printing and history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.

6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.

C. Audible Alarms Sequence:

1. Audible alarms throughout the building shall sound.
2. Audible alarms within the floor or where the emergency signal originated floors shall sound.
3. Separate voice announcements shall be played in different fire compartments depending on proximity to the device that initiated the alarm. Refer to the requirements above for the Voice Command Center programming.

D. Visual Alarms Sequence:

1. Visual alarms throughout the building shall flash.
2. Visual alarms within the floor or where the emergency signal originated floors shall flash.

E. HVAC System Sequence:

F. AHU and Mechanical Fan Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.
4. All AHUs and mechanical fans shall be shutdown simultaneously throughout the building.

G. Access Control Override Sequence:

1. The fire alarm shall use addressable output relay(s) to signal the access control panel.
2. Refer to the access control specifications for requirement upon fire alarm signal. The fire alarm shall initiate an override of delayed egress doors.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Fire Alarm Control Panel:

1. Install the control panel where shown on the drawings.
2. All expansion compartments, if required, shall be located at the control panel.
3. Install the voice command center and fire command center in the location as indicated on the drawings. This location should be primary fire department "attack" location. Coordinate with the local fire department prior to submitting shop drawings.
4. The fire alarm voice prerecorded messages shall be verified by the Contractor, as approved by the Owner, prior to the shop drawing submittal process.

C. Devices:

1. General:

   a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
   b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
   c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
   d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall notify the Architect/Engineer to coordinate a different acceptable location.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
3. Protection of Fire Alarm System:

   a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.

4. Duct-type Analog Smoke Detectors:

   a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
   b. All detectors shall be accessible.
   c. Duct-type detectors shall be installed according to the manufacturer's instructions.

5. In-Duct Analog Smoke Detectors:

   a. In-duct analog smoke detectors shall be installed in the duct where shown on the drawings and details. The devices shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
   b. All detectors shall be accessible.

6. Manual Pull Stations:

   a. Stations shall be located where shown and at the height noted on the drawings.

7. Addressable Relays and Monitor Modules:

    a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
    b. All modules shall be mounted in or on a junction box in an accessible location.
    c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

8. SLC Loop Isolation Modules:

    a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
    b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings.

9. Notification Appliance Devices:

    a. Devices shall be located where shown on the drawings.
    b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
    c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.

D. Annunciators:

1. Color Graphics Annunciation System: The annunciator shall be installed with custom graphics software showing the floor plan of the entire building and shall include a close approximation of the location of all devices in the system. The annunciator shall be located approximately where shown on the drawings as directed by the Owner. Each smoke compartment zone, (refer to architectural drawings) as a minimum, shall be on a single screen. A screen shall be created depicting an overall plan indicating the entire facility and the quantity of floors or zones that will clearly indicate the area(s) the alarm(s) are being reported.
2. Remote Annunciators: The annunciators shall be located where shown on the drawings and approved by the fire marshal.

E. Wiring:

1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
2. Wiring shall be installed in conduit. Refer to Identification Section 26 05 13 for color and identification requirements.
3. Wiring shall be installed in conduit from device to above accessible ceilings. Exposed plenum-rated cable (FPLP) shall be used above accessible ceilings supported every 4 feet or run in cable trays (if applicable) maintaining a minimum of 5-inches clearance from all lighting ballasts. Fire alarm cabling shall not be installed in the same bridle rings or cable trays designated for the cabling of other systems.
4. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.

5. Partial evacuation or relocation of occupants is the standard operating procedure for this facility in the event of an alarm. Therefore, all notification appliance circuits (NAC), including circuits serving NAC extender panels (NAC) and other network communication circuits, must be installed and protected in accordance with the "circuit survivability" requirements described in NFPA 72. Contractor shall maintain the following:

    a. NACs serving separate evacuation signaling zones shall be routed separately such that they are no less than 4 feet apart when run horizontally and 1 foot apart when run vertically. They may come simultaneously only within 10 feet of the control panel.
    b. NACs passing through other evacuation signaling zone(s) shall be installed in conduit and routed through the 2-hour fire-rated chase(s) or enclosure(s) identified on the drawings.
    c. NACs passing through other evacuation signaling zone(s) shall be Electrical Code classified CIC cable (Fire Alarm Circuit Integrity) installed in conduit. Provide CIC cable meeting UL requirements for 2-hour listing.

        1) The CIC cable system shall be installed in a conduit system meeting all requirements of its UL-listed installation system (conduit, boxes, connectors, etc.).

6. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
7. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.

    a. Fire alarm temporal audible notification for all audio appliances.
    b. Synchronization of all visual devices where two or more devices are visible from the same location.
    c. Ability to silence audible alarm while maintaining visual device operation.
    d. Emergency communication alert and textual visible appliance notification.

8. Notification Appliance Circuits shall not span floors or smoke compartments. Refer to architectural drawings for smoke compartments.
9. Signal line circuits connecting devices shall not span floors or 2-hour smoke compartments.
10. Signal line circuits connecting devices shall be provided with an isolation module at each floor separation or as otherwise shown on the drawings.
11. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

F. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.

1. Power Branch Circuit Conductors: In accordance with Section 26 05 53.
2. Signaling Line Circuit: Overall red jacket with black and red conductors.
3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.

5. Door Release Circuit: Gray conductors.
6. Central Station Trip Circuit: Orange conductors.
7. Central Station Fire Alarm Loop: Black and white conductors.

G. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

H. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.

C. Contractor shall test and adjust the fire alarm system as follows:

1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:

    a. 70dBA.
    b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
    c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
    d. As specified on the drawings.

2. Sound level measurement procedure shall meet the following requirements:

    a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
    b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
    c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
    d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
    e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
    f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of 2 rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
    g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
    h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

D. Additionally, test the voice alarm communication system intelligibility per IEC 60849:

1. The following acoustically distinguishable spaces shall be tested: All unique rooms shall be tested. If there are multiple rooms with the identical dimensions and function, 10%, or a minimum of two (2) rooms, shall be tested. The results from the rooms tested shall be averaged, and the remaining rooms may be adjusted per the average.
2. Utilize equipment designed to test per IEC 60849 per the equipment manufacturer's instructions. This equipment includes a signal generator, which is input to the fire alarm system and a portable measurement device. This equipment is available from Simplex Grinnell or Gold Line.
3. Testing equipment that can simulate 'crowd babble' shall be used in rooms with occupancy of greater than 200.
4. Wide-area notification intelligibility shall be tested in acoustically distinguishable spaces and areas as designated by the Owner.
5. When testing for intelligibility, the quantity and location of the measurement points shall be the same as the points used for measurement of dBA level.
6. Provide a room by room report, showing the average dBA level and STI for each room tested, the number and location of. The report shall be presented to the Architect/Engineer in an Excel .xls file.

3.4 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 26 05 00.

B. Include services of the manufacturer's software programmer to write initial custom-user program (for Color Graphics Annunciation System).

C. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

D. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. The Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

E. Include the services to train up to three of the Owner's staff in operation, maintenance, and programming of the fire alarm system at the manufacturer's factory. Airfare and lodging expenses for the Owner's staff will be by the Owner.

F. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, 4 hours each visit, outside normal occupancy hours.

3.5 SYSTEM TRAINING

A. System training shall be performed under provisions of Section 26 05 00.

B. Minimum on-site training times shall be:

1. System Operators: One (1) day.
2. GUI Operation and Editing: One (1) day.
3. Emergency Communication System: Four (4) hours.

END OF SECTION 28 31 00

DIVISION 31: EARTHWORK

END OF TABLE OF CONTENTS

SECTION 31 0501

COMMON EARTHWORK REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited to:
   1. General procedures and requirements for earthwork.

B. Related Requirements:
   1. Pre-Installation conferences held jointly with Section 31 0501 as described in Administrative Requirements on Part 1 of this specification section:

1.2 REFERENCES

A. Definitions:
   1. Aggregate Base: Layer of granular material immediately below concrete and asphalt paving or miscellaneous site concrete (sidewalks, curbs, etc) and below interior concrete slabs on grade.
   2. Base: See aggregate base.
   3. Building Grading: sloping of grounds immediately adjacent to building. Proper grading causes water to flow away from a structure. Grading can be accomplished either with machinery or by hand.
   4. Compacted Fill: Placement of soils on building site placed and compacted per Contract Documents. Used to replace soils removed during excavation or to fill in low spot on building site.
   5. Excavation: Removal of soil from project site or cavity formed by cutting, digging or scooping on project site.
   6. Fine Grading (FG): Preparation of subgrade preceding placement of surfacing materials (aggregate base, asphalt or concrete paving, and topsoil) for contour of building site required. Fine Grading is conducted to ensure that earth forms and surfaces have been properly shaped and subgrade has been brought to correct elevations. It is performed after rough grading and placement of compacted fill but before placement of aggregate base or topsoil.
   7. Finish Grading: Completed surface elevation of landscaping areas for seeding, sodding, and planting on building site.
   8. Natural Grade: Undisturbed natural surface of ground.
   9. Rough Grading (RG): Grading, leveling, moving, removal and placement of existing or imported soil to its generally required location and elevation. Cut and fill is part of rough grading.
   10. Subgrade (definition varies depending upon stage of construction and context of work being performed):
       a. Prepared natural soils on which fill, aggregate base, or topsoil is placed.
          or
       b. Prepared soils immediately beneath paving or topsoil.
   11. Topsoil Placement and Grading: Topsoil placement and finish grading work required to prepare site for installation of decomposed granite.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Participate in pre-installation conference for common earthwork sections:
      a. Schedule conference after completion of site clearing but before beginning grading work.

b. Participate in pre-installation conference held jointly with following sections:
   1) Section 03 3053: 'Miscellaneous Exterior Cast-In-Place Concrete'.
   2) Section 31 1413: 'Topsoil Stripping and Stockpiling'.
   3) Section 31 2216: 'Fine Grading'.
   4) Section 31 2316: 'Excavation'.
   5) Section 31 2323: 'Fill'.
c. In addition to agenda items specified in Section 01 3100, review following:
   1) Review common earthwork schedule.
   2) Review protection requirements.
   3) Review cleaning requirements.
   4) Review safety issues.
   5) Review field tests and inspections requirements.
d. In addition to agenda items specified above, review following. These are items that will occur before pre-installation conference for landscape sections:
   1) Review clearing and grubbing requirements.
   2) Review topsoil stripping and stockpiling requirements.
   3) Review landscape grading requirements.
   4) Review landscape finish grade tolerance requirements.
   5) Review landscape and plant tolerances.
   6) Review surface preparation of landscape and planting areas.
   7) Review additional agenda items as specified in related sections listed above.

B. General Earthwork Sequencing:
   1. Excavation.
   2. Rough Grading.
   3. Compacted Fill.
   4. Fine Grading.
   5. Aggregate Base or Topsoil Grading.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Forty eight (48) hours minimum before performing any work on site, contact DIG ALERT to arrange for utility location services.
   2. Perform minor, investigative excavations to verify location of various existing underground facilities at sufficient locations to assure that no conflict with the proposed work exists and sufficient clearance is available to avoid damage to existing facilities.
   3. Perform investigative excavating ten (10) days minimum in advance of performing any excavation or underground work.
   4. Upon discovery of conflicts or problems with existing facilities, notify Architect by phone or fax within twenty four (24) hours. Follow telephone or fax notification with letter and diagrams indicating conflict or problem and sufficient measurements and details to evaluate problem.

3.2 PREPARATION

A. Protection:
   1. Spillage:
      a. Avoid spillage by covering and securing loads when hauling on or adjacent to public streets or highways.

b. Remove spillage and sweep, wash, or otherwise clean project, streets, and highways.

2. Dust Control:
   a. Take precautions necessary to prevent dust nuisance, both on-site and adjacent to public and private properties.
   b. Correct or repair damage caused by dust.
3. Existing Plants And Features:
   a. Do not damage tops, trunks, and roots of existing trees and shrubs on site that are intended to remain.
   b. Do not use heavy equipment within branch spread.
   c. Interfering branches may be removed only with permission of Architect.
   d. Do not damage other plants and features that are to remain.

3.3 REPAIR / RESTORATION

A. Adjust existing covers, boxes, and vaults to grade.

B. Replace broken or damaged covers, boxes, and vaults.

C. Independently confirm size, location, and number of covers, boxes, and vaults that require adjustment.

3.4 FIELD QUALITY CONTROL

A. Field Tests:
   1. Owner reserves right to require additional testing to re-affirm suitability of completed work including compacted soils that have been exposed to adverse weather conditions.

B. Field Inspections:
   1. Notify Architect forty eight (48) hours before performing excavation or fill work.
   2. If weather, scheduling, or any other circumstance has interrupted work, notify Architect twenty four (24) hours minimum before intended resumption of grading or compacting.

C. Non-Conforming Work:
   1. If specified protection precautions are not taken or corrections and repairs not made promptly, Owner may take such steps as may be deemed necessary and deduct costs of such from monies due to Contractor. Such action or lack of action on Owner's part does not relieve Contractor from responsibility for proper protection of The Work.

END OF SECTION

SECTION 31 1413

TOPSOIL STRIPPING AND STOCKPILING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Strip and stockpile acceptable topsoil as described in Contract Documents.

1.2 REFERENCES

A. Definitions:
   1. Existing topsoil: Defined as total amount of soil stripped and stored for reuse, less vegetation layer stripped and disposed of as specified in Paragraphs below.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Strip existing vegetation layer **12** inches (mm) deep minimum from exiting planter areas of site to receive paving and remove from site before stripping topsoil for storage and reuse.

B. After stripping vegetation layer, strip existing topsoil additional **12** inches (mm) deep minimum from areas of site to receive buildings and paving and store on site for later use.
   1. Existing topsoil is property of Contractor with restriction that topsoil is to be used first for Project landscape topsoil requirements and second for non-structural fill and backfill.
   2. After Project fill, backfill, and landscape topsoil requirements are satisfied, remove excess existing topsoil from site. Do not remove existing topsoil from site without Architect's written approval.

END OF SECTION

SECTION 31 2216

FINE GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform fine grading work required to prepare site for paving finish grading and for landscape finish grading as described in Contract Documents.

B. Related Requirements:
   1. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
   2. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
   3. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   4. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   5. Section 01 7800: 'Closeout Submittals'.
   6. Section 31 0501: 'Common Earthwork Requirements' for:
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
   7. Section 31 1413: 'Topsoil Stripping And Stockpiling' for stripping and storing of existing topsoil.
   8. Section 31 2316: 'Excavation'.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. ACI 229R-99, *Controled Low-Strength Materials* (Reapproved 2005).
   2. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
   3. International Code Council (IBC):
      a. IBC Chapter 17, 'Structural Tests and Special Inspections'.

B. Definitions (Following are specifically referenced for testing):
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
   2. Approved: To authorize, endorse, validate, confirm, or agree to.
   3. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
   4. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
      a. Inspection: Not required by code provisions but may be required by Contract Documents.
      b. Special Inspection: Required by code provisions and by Contract Documents.
      c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.

d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.

5. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operation, including installation, erection, application, and similar operations.
6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
7. Owner's Representative: Owner's Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.
8. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
9. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
10. Relative Compaction: Ratio of field dry density as determined by ASTM D6938 or ASTM D2216, and laboratory maximum dry density as determined by ASTM D1557.
11. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
12. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
13. Service Provider: Agency or firm qualified to perform required tests and inspections.
14. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
15. Special Inspection: See Inspection.
16. Special Inspector: Certified individual or firm that implements special inspection program for project.
17. Special Test: See Test.
18. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.
19. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
20. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
21. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

C. Reference Standards:
   1. ASTM International (Following are specifically referenced for fill and aggregate base testing):
      a. ASTM D698-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))'.
      b. ASTM D1556-07, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method'.
      c. ASTM D1557-09, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))'.
      d. ASTM D2167-08, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method'.
      e. ASTM D2216-10, 'Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass'.
      f. ASTM D2487-11, 'Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)'.
      g. ASTM D3666-11, 'Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials'.

h. ASTM D3740-12a, 'Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction'.
i. ASTM D6938-10, 'Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)'.
j. ASTM E329-11c: 'Standard Specification for Agencies Engaged in Construction Inspection and/or Testing'.
k. ASTM E543-09, 'Standard Specification for Agencies Performing Nondestructive Testing'.
l. ASTM E1212-09, 'Standard Practice for Quality Management Systems for Nondestructive Testing Agencies'.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
1. Participate in pre-installation conference as specified in Section 31 0501.
2. In addition to agenda items specified in Section 01 3100 and Section 31 0501, review following:
a. Review backfill requirements.
b. Review geotechnical report.
c. Review Section 01 4523 for Testing and Inspection administrative requirements and responsibilities and Field Quality Control tests and inspections required of this section.
1) Review frequency of testing and inspections.

B. Scheduling:
1. Notify Testing Agency and Architect twenty four (24) hours minimum before installation of fill / engineered fill to allow inspection.
2. Allow special inspector to review all subgrades and excavations to determine if site has been prepared in accordance with geotechnical report prior to placing any fill, aggregate base or concrete.
3. Allow inspection and testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after inspections and test results for previously compacted work comply with requirements.

1.4 SUBMITTALS

A. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Testing and Inspection Reports:
a) Testing Agency Testing and Inspecting Reports of fill / engineered fill.

1.5 QUALITY ASSURANCE

A. Testing and Inspection.
1. Contractor to provide Testing and Inspection for fill / engineering fill:
a. See Section 01 1200: 'Multiple Contract Summary'.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection Of In-Place Conditions: Protect utilities and site elements from damage.

B. Surface Preparation:

1. Landscaping and Planting Areas:
   a. Before grading, dig out weeds from planting areas by their roots and remove from site. Remove rocks larger than 1-1/2 inches (38 mm) in size and foreign matter such as building rubble, wire, cans, sticks, concrete, etc.
   b. Remove imported paving base material present in planting areas down to natural subgrade or other material acceptable to Architect.

3.2 PERFORMANCE

A. General:
   1. Do not expose or damage existing shrub or tree roots.

B. Tolerances:
   1. Site Tolerances:
      a. Subgrade (material immediately below aggregate base):
         1) 0.00 inches (0.00 mm) high.
         2) Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
      b. Maximum variation from required grades shall be 1/10 of one foot (28 mm).
   2. Aggregate Base (Asphalt paving) Tolerances:
      a. Aggregate base shall be 6 inches (150 mm) thick minimum after compaction, except where shown thicker on Drawings.
      b. Measure using string line from curb to curb, gutter, flat drainage structure, or grade break.
   3. Aggregate Base (Concrete paving) Tolerances:
      a. Finished base course shall be 4 inches (100 mm) thick minimum after compaction and true to line and grade within plus or minus 1/4 inch in 10 feet (6 mm in 3 m).
   4. Landscaping and Planting Tolerances:
      a. Maximum variation from required grades shall be 1/10 of one foot (28 mm).
      b. To allow for final finish grades of planting areas, fine grade elevations before placing topsoil and mulch are:
         1) Ground Cover Areas: 7 inches (180 mm) below top of walk or curb.
         2) Tree And Shrub Areas: 4 inches (100 mm) below top of walk or curb.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Fill / Engineered Fill:
      a. Testing Agency shall provide testing and inspection for fine grading.
      b. Number of tests may vary at discretion of Architect.
      c. Testing Agency is to provide one moisture-maximum density relationship test for each type of fill material.
   2. Site preparation:
      a. Prior to placement of engineered fill, inspector shall determine that site has been prepared in accordance with geotechnical report.
      b. Footing subgrade: At footing subgrades, Certified Inspector is to verify that soils conform to geotechnical report.

END OF SECTION

SECTION 31 2316

EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform Project excavating and trenching as described in Contract Documents, except as specified below.
   2. Procedure and quality for excavating and trenching performed on Project under other Sections unless specifically specified otherwise.

B. Related Requirements:
   1. Section 31 0501: 'Common Earthwork Requirements' for:
      a. General procedures and requirements for earthwork.
   2. Section 31 1413: 'Topsoil Stripping and Stockpiling'.
   3. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.
   4. Performance of excavating inside and outside of building required for electrical and mechanical work is responsibility of respective Section doing work unless arranged differently by Contractor.

PART 2 - PRODUCTS: Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification Of Conditions:
   1. Carefully examine site and available information to determine type soil to be encountered.
   2. Discuss problems with Architect before proceeding with work.

3.2 PREPARATION

A. Protection of Existing Utilities:
   1. Protect existing utilities identified in Contract Documents during excavation.
   2. If existing utility lines not identified in Contract Documents are encountered, contact Architect before proceeding.

3.3 PERFORMANCE

A. Interface With Other Work:
   1. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.

B. Excavation:
   1. Pavement And Miscellaneous Cast-In-Place Concrete:
      a. Excavate as necessary for proper placement and forming of concrete site elements and pavement structure. Remove vegetation and deleterious material and remove from site.
      b. Backfill over-excavated areas with compacted base material specified in Section 31 1123.
      c. Remove and replace exposed material that becomes soft or unstable.

2. Utility Trenches:
    a. Unless otherwise indicated, excavation shall be open cut. Short sections of trench may be tunneled if pipe or duct can be safely and properly installed and backfill can be properly tamped in tunnel sections and if approved by Architect.
    b. Excavate to proper alignment, depth, and grade. Excavate to sufficient width to allow adequate space for proper installation and inspection of utility piping.
    c. If trenches are excavated deeper than required, backfill until trench bottom is proper depth with properly compacted native material.
    d. Pipe 4 Inches (100 mm) In Diameter Or Larger:
        1) Grade bottom of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its length.
        2) Except where rock is encountered, take care not to excavate below depths indicated.
            a) Where rock excavations are required, excavate rock with minimum over-depth of 4 inches (100 mm) below required trench depths.
            b) Backfill over-depths in rock excavation and unauthorized over-depths with loose, granular, moist earth, thoroughly compacted.
        3) Whenever wet or unstable soil incapable of properly supporting pipe, as determined by Architect, occurs in bottom of trench, remove soil to depth required and backfill trench to proper grade with coarse sand, fine gravel, or other suitable material acceptable to Architect.
3. If unusual excavating conditions are encountered, stop work and notify Architect.

3.4 REPAIR / RESTORATION

A. Repair damage to other portions of the Work resulting from work of this Section at no additional cost to Owner. On new work, arrange for damage to be repaired by original installer.

3.5 CLEANING

A. Debris and material not necessary for Project are property of Contractor and are to be removed before completion of Project. However, if material necessary for Project is hauled away, replace with specified fill / backfill material.

END OF SECTION

SECTION 31 2323

FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Perform Project backfilling and compacting as described in Contract Documents, except as specified below.
   2. Procedure and quality for backfilling and compacting performed on Project under other Sections unless specifically specified otherwise.

B. Related Requirements:
   1. Section 01 3100: 'Project Management and Coordination' for pre-installation conference.
   2. Section 01 4000: 'Quality Requirements' for administrative and procedural requirements for quality assurance and quality control.
   3. Section 01 4301: 'Quality Assurance – Qualifications' establishes minimum qualification levels required.
   4. Section 01 4523: 'Testing and Inspecting Services' for testing and inspection, and testing laboratory services for materials, products, and construction methods.
   5. Section 01 7800: 'Closeout Submittals'.
   6. Section 31 0501: 'Common Earthwork Requirements' for:
      a. General procedures and requirements for earthwork.
      b. Pre-installation conference held jointly with other common earthwork related sections.
   7. Section 31 1413: 'Topsoil Stripping And Stockpiling' for stripping and storing of existing topsoil.
   8. Section 31 2316: 'Excavation'.
   9. Division 32: Compaction of subgrade under walks and paving.
   10. Performance of backfilling and compacting inside and outside of building required for electrical and mechanical work is responsibility of respective Section doing work unless arranged differently by Contractor.

1.2 REFERENCES

A. Association Publications:
   1. American Concrete Institute, Farmington Hills, MI www.concrete.org. Abstracts of ACI Periodicals and Publications.
      a. ACI 229R-99, *Controled Low-Strength Materials* (Reapproved 2005).
   2. Council of American Structural Engineers. CASE Form 101: *Statement of Special Inspections*. Washington, DC: CASE, 2001. (c/o American Council of Engineering Companies, 1015 15th St., NW, Washington, DC 20005; 202-347-7474; www.acec.org).
   3. International Code Council (IBC):
      a. IBC Chapter 17, 'Structural Tests and Special Inspections'.

B. Definitions (Following are specifically referenced for testing):
   1. Accreditation: Process in which certification of competency, authority, or credibility is presented. Verify that laboratories have an appropriate quality management system and can properly perform certain test methods (e.g., ANSI, ASTM, and ISO test methods) and calibration parameters according to their scopes of accreditation.
   2. Approved: To authorize, endorse, validate, confirm, or agree to.
   3. Field Quality Control: Testing, Inspections, Special Testing and Special Inspections to assure compliance to Contract Documents.
   4. Inspection/Special Inspection: Inspection of materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards:
      a. Inspection: Not required by code provisions but may be required by Contract Documents.

b. Special Inspection: Required by code provisions and by Contract Documents.
c. Inspection-Continuous: Full-time observation of the Work requiring inspection by approved inspector who is present in area where the Work is being performed.
d. Inspection-Periodic: Part-time or intermittent observation of the Work requiring inspection by approved inspector who is present in area where the Work has been or is being performed and at completion of the Work.

5. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operation, including installation, erection, application, and similar operations.
6. Observation: Visual observation of building / site elements or structural system by registered design professional for general conformance to approved construction documents at significant construction stages and at completion. Observation does not include or waive responsibility for performing inspections or special inspections.
7. Owner's Representative: Owner's Designated Representative (Project Manager or Facilities Manager) who will have express authority to bind Owner with respect to all matters requiring Owner's approval or authorization.
8. Preconstruction Testing: Tests and inspections that are performed specifically for Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
9. Product Testing: Tests and inspections that are performed by testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
10. Relative Compaction: Ratio of field dry density as determined by ASTM D6938 or ASTM D2216, and laboratory maximum dry density as determined by ASTM D1557.
11. Quality Assurance: Testing, Inspections, Special Testing and Special Inspections provided for by Owner.
12. Quality Control: Testing, Inspections, Special Testing and Special Inspections provided for by Contractor.
13. Service Provider: Agency or firm qualified to perform required tests and inspections.
14. Source Quality Control Testing: Tests and inspections that are performed at source, i.e., plant, mill, factory, or shop.
15. Special Inspection: See Inspection.
16. Special Inspector: Certified individual or firm that implements special inspection program for project.
17. Special Test: See Test.
18. Test/Special Test: Field or laboratory tests to determine characteristics and quality of building materials and workmanship.
    a. Test: Not required by code provisions but may be required by Contract Documents.
    b. Special Test: Required by code provisions and by Contract Documents.
19. Testing Agency: Entity engaged to perform specific tests, inspections, or both.
20. Testing Agency Laboratory: Agency or firm qualified to perform field and laboratory tests to determine characteristics and quality of materials and workmanship.
21. Verification: Act of reviewing, inspecting, testing, etc. to establish and document that product, service, or system meets regulatory, standard, or specification requirements.

C. Reference Standards:
1. ASTM International (Following are specifically referenced for fill and aggregate base testing):
    a. ASTM D698-12, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))'.
    b. ASTM D1556-07, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method'.
    c. ASTM D1557-09, 'Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))'.
    d. ASTM D2167-08, 'Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method'.
    e. ASTM D2216-10, 'Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass'.
    f. ASTM D2487-11, 'Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)'.

g. ASTM D3666-11, ‘Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials’.
h. ASTM D3740-12a, ‘Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction’.
i. ASTM D6938-10, 'Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)’.
j. ASTM E329-11c: ‘Standard Specification for Agencies Engaged in Construction Inspection and/or Testing’.
k. ASTM E543-09, ‘Standard Specification for Agencies Performing Nondestructive Testing’.
l. ASTM E1212-09, ‘Standard Practice for Quality Management Systems for Nondestructive Testing Agencies’.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Sequencing:
1. Before backfilling, show utility and service lines being covered on record set of Drawings. Do not backfill until utilities involved have been tested and approved by Architect and until instructed by Architect.

B. Scheduling:
1. Notify Testing Agency and Architect seventy two (72) hours minimum before installation of fill / engineered fill to perform proctor and plasticity index tests on proposed fill or subgrade.
2. Notify Testing Agency and Architect twenty four (24) hours minimum before installation of fill / engineered fill to allow inspection.

1.4 SUBMITTALS

A. Closeout Submittals:
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Record Documentation:
1) Testing and Inspection Reports:
a) Testing Agency Testing and Inspecting Reports of fill / engineered fill.

1.5 QUALITY ASSURANCE

A. Testing and Inspection.
1. Contractor to provide Testing and Inspection for fill / engineering fill:

PART 2 - PRODUCTS

2.1 MATERIALS

A. Site Material:
1. Existing excavated material on site is suitable for use as fill and backfill to meet Project requirements.

B. Imported Fill / Backfill:
1. Well graded material conforming to ASTM D2487 free from debris, organic material, frozen materials, brick, lime, concrete, and other material which would prevent adequate performance of backfill.
a. Under Structure Footprint And Paved Areas: Fill shall comply with soil classification groups GW, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches (150 mm) diameter and 90 percent minimum of fill shall be smaller than 1-1/2 inch (38 mm) in any direction.
b. Under Landscaped Areas:

1) Fill more than 36 inches (900 mm) below finish grade shall comply with soil classification groups GW, GP, GM, SW, SP, or SM. Fill may not contain stones over 6 inches (150 mm) diameter and 90 percent minimum of fill shall be smaller than 1-1/2 inch (38 mm) in any direction.
2) Fill less than 36 inches (900 mm) below finish grade shall comply with soil classification groups SW, SP, SM, or SC. Fill may not contain stones larger than 1-1/2 inches (38 mm) in any direction and 90 percent minimum of fill shall be smaller than 3/8 inch (4.7 mm) in any direction.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before placing fill, aggregate base, or finish work, prepare subgrade as follows:
1. Do not place fill or aggregate base over frozen subgrade.
2. Under Building Slabs / Pads, Concrete Site Elements, And Concrete Driveways And Parking Areas: Scarify subgrade 6 inches (150 mm) deep, moisture condition to uniform moisture content of between optimum and 4 percent over optimum, and mechanically tamp 6 inches (150 mm) deep to 90 percent minimum of relative compaction.
3. Under Asphalt Driveways And Parking Areas: Scarify subgrade 6 inches (150 mm) deep, moisture condition to uniform moisture content between optimum and 4 percent over optimum, and mechanically tamp to 95 percent minimum of relative compaction.
4. Landscape Areas: Compact subgrade to 85 percent relative compaction.

3.2 PERFORMANCE

A. Interface With Other Work:
1. Section 31 2216: 'Fine Grading' for grading of subgrade below aggregate base and topsoil.

B. Fill / Backfill:
1. General:
a. Site Utilities:
1) In Landscape Areas: Use backfill consisting of on-site soil.
b. Do not use puddling or jetting to consolidate fill areas.
2. Compacting:
a. Fill / Backfill And Aggregate Base:
1) Under Building Slabs or Pads, Driveways, And Parking Areas: Place in 8 inch (200 mm) maximum layers, moisture condition to plus or minus 2 percent of optimum moisture content, and mechanically tamp to 95 percent minimum of maximum density as established by ASTM D1557.
2) Under Concrete Site Elements And Around Footing Walls: Place in 8 inch (200 mm) maximum layers, dampen but do not soak, and mechanically tamp to 90 percent minimum of maximum density as established by ASTM D1557.
3) Utility Trenches:
a) Site: Place fill in 12 inch (300 mm) layers and moisture condition to plus or minus 2 percent of optimum moisture content. Compact fill to 90 percent minimum relative compaction to within 12 inches (300 mm) of finish grade. Compact fill above 12 inches (300 mm) to 85 percent relative compaction.
b) Under Slabs: Place fill in 6 inch (150 mm) layers, moisture condition to plus or minus 2 percent of optimum moisture content, and compact to 95 percent minimum relative compaction to within 4 inches (100 mm) of finish grade. Final 4 inches (100 mm) of fill shall be aggregate base as specified in Section 31 1123.
4) Fill Slopes: Compact by rolling or using sheepsfoot roller.
5) Backfill Under Footings: Not allowed.
6) Other Backfills: Place other fills in 12 inch (300 mm) layers and compact to 90 percent relative compaction.

3.3 REPAIR / RESTORATION

A. Repair damage to other portions of the Work resulting from work of this Section at no additional cost to Owner. On new work, arrange for damage to be repaired by original installer.

3.4 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Fill / Engineered Fill:
      a. Testing Agency shall provide testing and inspection for fill.
      b. Number of tests may vary at discretion of Architect.
      c. Testing Agency is to provide one (1) moisture-maximum density relationship test for each type of fill material.
      d. Prior to placement of engineered fill, inspector shall determine that site has been prepared in accordance with geotechnical report.
      e. Footing subgrade: At footing subgrades Certified Inspector is to verify that soils conform to geotechnical report.
      f. Testing Agency will test compaction of soils according to ASTM D1556, ASTM D2167, and ASTM D6938, as applicable. Lift thicknesses shall comply with geotechnical report. Inspector shall determine that in-place dry density of engineered fill material complies with geotechnical report. Tests will be performed at following locations and frequencies:
         1) Paved Areas: At each compacted fill and backfill layer, at least one (1) test for every 10,000 sq. ft. (930 sq. m) or less of paved area but in no case less than three (3) tests.
         2) Building Slab Areas: At each compacted fill and backfill layer, at least on test for every 2,500 sq. ft. (232 sq. m) or less of building slab area but in no case less than three (3) tests.
         3) Foundation Wall/Continuous Footing Backfill: At each compacted backfill layer, at least one (1) test for each 40 linear feet (12 linear m) or less of wall length, but no fewer than two (2) tests.
         4) Trench Backfill: At each 12 inch (305 mm) compacted lift for each 100 linear feet (30.5 linear m) or less of trench length but no fewer than two (2) tests.
         5) Sidewalks, Curbs, Gutters, Exterior Pads: Minimum of one (1) test for each lift for each 40 lineal feet (12 linear m) or one (1) test for every 5,000 sq. ft. (465 sq. m) or less of pad area but no fewer than three (3) tests.
      g. Required verification and inspection of soils as referenced in 2009 IBC Table 1704.7. Periodic and continuous inspections include:
         1) Verify materials below shallow foundations are adequate to achieve design bearing capacity (periodic).
         2) Verify excavations are extended to proper depth and have reached proper material (periodic).
         3) Perform classification and testing of compacted fill materials (periodic).
         4) Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill (continuous).
         5) Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly (periodic).

3.5 CLEANING

A. Debris and material not necessary for Project are property of Contractor and are to be removed before completion of Project. However, if material necessary for Project is hauled away, replace with specified fill / backfill material.

END OF SECTION

DIVISION 32: EXTERIOR IMPROVEMENTS

END OF TABLE OF CONTENTS

SECTION 32 1713

PARKING BUMPERS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install parking bumpers as described in Contract Documents.

1.2 REFERENCES

A. Reference Standards:
   1. ASTM International:
      a. ASTM A615/A615M-18, ‘Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement'.
      b. ASTM A1064/A1064M-18a, 'Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete'.
      c. ASTM C33/C33M-18, ‘Standard Specification for Concrete Aggregates'.
      d. ASTM C150/C150M-18, ‘Standard Specification for Portland Cement'.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Precast Concrete:
   1. Cement: ASTM C150/C150M, Type II.
   2. Aggregates: ASTM C33/C33M.

B. Reinforcing:
   1. Bars: ASTM A615/A615M, Grade 60.
   2. Reinforcing Mesh: ASTM A1064/A1064M.

C. Sealants:
   1. Approved Products. See Section 01 6200.
      a. Dow Corning Corp, Midland, MI www.dowcorning.com:
         1) Primer: 1200 Prime Coat.
         2) Sealant: 790 Silicone Building Sealant.
      b. Momentive Performance Materials Inc. (formally GE Sealants & Adhesives), Huntersville, NC www.ge.com/siliconesPrimer: SS4044 Primer.
         1) Primer: SS4044 Primer.
         2) Sealant: GE SCS2000 SilPruf Silicone Sealant & Adhesive.

D. Pins: Epoxy coated No. 4 bar, 24 inches (610 mm) long.

2.2 FABRICATION

A. Precast Concrete Parking Bumpers:
   1. 3000 psi (20.68 MPa) concrete minimum.
   2. Chamfered edges.
   3. Smooth finish free from pits and rock pockets.

4. Cast openings for pins.
5. Cast in two (2) bars, No. 3 minimum, full length of bumper less coverage requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install level with paving and aligned with sidewalks.

B. Recess anchoring pins 1/2 inch (12.7 mm) below top of bumper. Install sealant in hole to top of bumper.

END OF SECTION

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish material and apply pavement and curb markings as described in Contract Documents.

1.2 REFERENCES

A. Definitions:
   1. Reflectorization: Material, treatment or process to enable incident light to be returned in high proportions in the general direction of the light source.

B. Reference Standards:
   1. U.S. Department of Transportation Federal Highway Administration:
      a. Manual on Uniform Traffic Control Devices (MUTCD).

1.3 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Paint handicap spaces to conform to ADA Standards and local code requirements.

1.4 FIELD CONDITIONS

A. Ambient Conditions:
   1. Apply only on dry surfaces, during favorable weather, and when damage by rain, fog, or condensation not anticipated.
   2. Latex Paint:
      a. Atmospheric temperature above 50 deg F (10 deg C).
      b. When temperature is not anticipated to drop below 50 deg F (10 deg C) during drying period.
   3. Alkyd or Chlorinated Rubber Paint:
      a. Atmospheric temperature above 40 deg F (4 deg C).
      b. When temperature is not anticipated to drop below 40 deg F (4 deg C) during drying period.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Paint:
   1. Non-reflectorized.
   2. Types:
      a. Acrylic Latex for uncured paving.
      b. Alkyd or chlorinated rubber for cured paving.
      c. Water based latex for sealed paving.
   3. Colors:

a. White:
   1) Lane lines, edge lines, transverse lines, arrows, words, symbol markings, speed bump markings, parking space markings.
b. Blue And White:
   1) In parking spaces specifically designated as reserved for the disabled.
c. Red:
   1) Fire lanes, no parking zones, special raised pavement markers that are placed to be visible to “wrong-way” drivers.

4. Acceptable Products:
   a. 442XX Traffic Marking Paint by ICI Devoe, Cleveland, OH www.devoepaint.com.
   b. Set-Fast Traffic Marking Paint by Sherwin-Williams, Cleveland, OH www.sherwin-williams.com.
   c. Equal as approved by Architect before application. See Section 01 6200.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not apply acrylic latex system until paving has cured seven (7) days minimum. Other paint systems may be applied as per Manufacturer's recommendations.

B. Surfaces shall be dry and free of grease and loose dirt particles. Scrape and wire brush chipped or damaged paint on existing curbs.

C. Perform layout with chalk or lumber crayon only.

3.2 APPLICATION

A. Tolerances:
   1. General: Make lines parallel, evenly spaced, and with sharply defined edges.
   2. Line Widths:
      a. Plus or minus 1/4 inch (6 mm) variance on straight segments.
      b. Plus or minus 1/2 inch (13 mm) variance on curved alignments.

B. Coverage:
   1. Apply a single coat to parking lots which are being re-striped and where no surface treatments are being applied.
   2. Apply a single coat to an emulsion seal coat.
   3. Apply two (2) coats to a slurry seal coat. Apply a single coat and then wait thirty (30) to forty five (45) days and after ravel sweeping to apply the second coat.
   4. Apply two (2) coats to new parking lots and new overlays.
   5. Apply each coat at 150 sq ft (14 sq m) per gal.
   6. Apply second coat after three (3) hours minimum or when first coat is thoroughly dried, whichever is longer.

3.3 CLEANING

A. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect before performance.

END OF SECTION

SECTION 32 1726

TACTILE WARNING SURFACES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install off detectable warning panels as described in Contract Documents.

1.2 SUBMITTALS

A. Informational Submittals:
   1. Manufacturer's Instructions: Provide Manufacturer's installation instructions.

1.3 WARRANTY

A. Manufacturer Warranty:
   1. Manufacturer's 5 year minimum warranty on materials and installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Detectable Warning Surface:
   1. Color: Verify with local jurisdiction for required color if required.
   2. Show location of all detectable warning panels on Site Plan.
   3. Approved Products. See Section 01 6200.
      a. TopMark by Flint Trading, Inc., Thomasville, NC www.flinttrading.com.
         1) Phone: (336) 475-6600.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temperature: Ambient and surface temperature must be 45 deg F (7 deg C) and rising. If substrate surface temperatures exceed 90 deg F (32 deg C), do not attempt to apply more than a 48 inch x 24 inch (1 200 mm x 600 mm) at one time.

B. Surface: Apply on asphalt, or concrete surfaces.
   1. Surface must be free of dirt, dust, deicing agents, chemicals and significant oily substances.
   2. Concrete surfaces must have surface porosity.
   3. Do not apply on top of previous markings, or coatings.
   4. Follow Manufacturer's written instructions on how to prepare the surface.

3.2 INSTALLATION

A. Follow Manufacturer's written installation instructions.

END OF SECTION

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete fence, coyote roller and gates as described in Contract Documents.

B. Related Requirements:
   1. Section 03 3111: 'Cast-In-Place Structural Concrete' for mow strips at fencing and setting sleeves in concrete.
   2. Section 05 0503: 'Shop-Applied Metal Coatings' for priming and galvanizing repair.
   3. Section 05 0523: 'Metal Fastening' for welding requirements.

1.2 REFERENCES

A. Association Publications: / Organizations:
   1. Chain Link Fence Manufacturers Institute (CLFMI), Columbia, MD www.chainlinkinfo.org.
      a. WLG 2445, *'Chain Link Fence Wind Load Guide for the Selection of Line Post and Line Post Spacing*' (2012).
      b. CLF-SFR0111, *'Chain Link Fence Manufacturers Institute Security Fencing Recommendations'*.
      c. CLF-PM0610, *'Field Inspection Guide'*.
      d. CLF-TP0211, *'Tested and Proven Performance of Security Grade Chain Link Fencing Systems'*.

B. Reference Standards:
   1. ASTM International:
      a. ASTM A123/A123M-17, 'Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products'.
      b. ASTM A153/A153M-16a, 'Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware'.
      c. ASTM A392-11a(2017), 'Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric'.'
      d. ASTM A1011/A1011M-18a, 'Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength'.
      e. ASTM C1107/C1107M-17, 'Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)'.
      f. ASTM F1043-18, 'Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework'.
      g. ASTM F1083-18, 'Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures'.
      h. ASTM F3000/F3000M-13(2018), 'Standard Specification for Polymer Privacy Insert Slats for Chain Link Fabric and Privacy Chain Link Fabric Manufactured Containing Pre-Installed Privacy Slats'.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: Manufacturer literature or cut sheets on fence components.

2. Samples: Types of vision slats and colors for Architect's selection.

PART 2 - PRODUCTS

2.1 ASSEMBLIES

A. Materials:
1. Fabric:
   a. Chain Link Fabric of 9 ga (3.7 mm) wire, galvanized before or after weaving with 1.2 ounce (34 grams) zinc coating conforming to requirements of ASTM A392, Class I.
   b. Mesh:
      1) With 98% Opaque Visual Privacy / Security Slats:
         a) 2 inch (50 mm) square mesh or 3-1/2 inch by 5 inch (89 mm by 125 mm) mesh as selected by Architect.
   c. Knuckle both selvages.
2. Framework:
   a. Posts and Rails shall be roll-formed, self-draining shapes meeting strength requirements of ASTM F1043, Table 3, and with 2 ounce (56.7 grams) zinc coating per 1 sq ft (0.0929 sq meter) of surface area conforming to ASTM A123/A123M.
   b. Line Posts:
      1) Line Posts 8 feet (2.45 m) and under:
         a) 1.875 by 1.625 inch (48 by 41 mm) C-section roll formed from steel conforming to ASTM A1011/A1011M, Grade 45, with minimum theoretical bending strength of 247 lbs (112 kg) under 6 foot (1.80 m) cantilever load.
         b) 2.375 inch (60 mm) outside diameter Schedule 40 tubular section weighing 3.65 lbs (1.6 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
         c) 2.375 inch (60 mm) outside diameter Schedule 40 tubular section weighing 3.12 lbs (1.42 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.
   c. Terminal And Gate Posts:
      1) Gate Posts and gate posts for gate leaves under 6 feet (1.80 m) wide:
         a) 3.5 by 3.5 inch (89 by 89 mm) roll formed section with minimum theoretical bending strength of 486 pounds (220.5 kg) under 6 foot (1.80 m) cantilever load.
         b) 3 inch (76 mm) outside diameter Schedule 40 pipe weighing 5.79 lbs (2.63 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
         c) 3 inch (76 mm) outside diameter Schedule 40 tubular section weighing 4.64 lbs (2.11 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.
      2) Gate Posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths over 6 feet (1.80 meter):

Leaf Width	Post Outside Diameter	Lbs / lin ft (305 mm)
Over 6 ft (1.80 m) to 13 ft (3.96 m)	4 inches (100 mm)	9.11 (4.13 kg)
Over 13 ft (3.96 m) to 18 ft (5.49 m)	6.625 inches (168 mm)	18.97 (8.60 kg)
Over 18 ft (5.49 m)	8.925 inches (227 mm)	28.55 (12.95 kg)

   d. Top And Brace Rail:
      1) 1.625 by 1.25 inch (41 by 32 mm) roll formed section of 45,000 psi (310 MPa) yield strength channel shaped rail with minimum theoretical bending strength of 247 lbs (112 kg) on 10 foot (3.050 m) midpoint load.
      2) 1.660 inch 42 mm outside diameter Schedule 40 pipe weighing 2.27 lbs (1.03 kg) per lineal 1 ft (305 mm) meeting requirements of ASTM F1083.
      3) 1.660 inch 42 mm outside diameter Schedule 40 tubular section weighing 1.84 lbs (0.83 kg) per lineal 1 ft (305 mm) formed from steel meeting requirements of ASTM A1011/A1011M.
      4) Coyte Roller per manufacturer

a) Approved Manufacture
b) Coyote Roller (480) 707-2096 sales@coyoteroller.com
c) Equal approved by Architect prior to bidding.

e. Fittings:
1) Pressed steel or malleable iron, hot-dip galvanized conforming to ASTM A153/A153M.
2) Tie wires shall be 12 ga (2.05 mm) minimum galvanized steel or 9 ga (3 mm) minimum aluminum wire.

f. Tension Wire: 7 ga (3.66 mm) minimum galvanized spring steel.

3. Gate Leafs Wider Than 6 Feet (1.80 Meters):
a. Fabricate perimeter frames from metal and finish to match fence framework. Assemble frames by welding or with special fittings and rivets, for rigid connections, providing security against removal or breakage connections.
1) Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretchers bars to frame at not more than 15 inches (380 mm) on center.
2) Install diagonal cross-bracing consisting of 3/8 inch (9.5 mm) diameter adjustable length truss rods to ensure frame rigidity without sag or twist.

b. Swing Gates: Fabricate perimeter frames of minimum 1.90 inches (48.26 mm) OD pipe.

c. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A153/A153M, and in accordance with following:
1) Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degree gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 foot (1.80 m) nominal height.
2) Latch At Paving: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.

d. Keeper: Provide keeper for vehicle gates, which automatically engages gate leaf and holds it in open position until manually released.

e. Double Gates:
1) Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar.
2) Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.

B. Mixes:
1. Post Foundation Concrete:
a. One cu ft cement, 2 cu ft (0.0566 cu m) sand, 4 cu ft (0.1132 cu m) gravel, and 5 gallons (18.93 liters) minimum to 6 gallons (22.71 liters) maximum water.
b. Mix thoroughly before placing.

2.2 ACCESSORIES

A. Post Setting Grout at Sleeves:
1. Commercial nonshrink grout conforming to requirements of ASTM C1107/C1107M, Type B or C.
2. Approved Products:
a. Normal Construction Grout A by W R Bonsal, Charlotte, NC www.bonsal.com.
b. Advantage 1107 Grout by Dayton Superior, Miamisburg, OH www.daytonrichmond.com.
c. NS Grout by Euclid Chemical Co, Cleveland, OH www.euclidchemical.com.
d. 5 Star Special Grout 110 by Five Star Products Inc, Fairfield, CT www.fivestarproducts.com.
e. Duragrout by L&M Construction Chemicals Inc, Omaha, NE www.lmcc.com.
f. Masterflow 713 Pre-mixed Grout by Master Builders, Cleveland, OH www.masterbuilders.com.
g. Tamms Grout 621 by TAMMS Industries, Mentor, OH www.tamms.com.
h. U S Spec MP Grout by U S Mix Products Co www.usspec.com.
i. CG-86 Grout by W R Meadows, Elgin, IL www.wrmeadows.com.
j. Equal as approved by Architect before use. See Section 01 6200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fence shall be installed by mechanics skilled and experienced in erecting fences of this type and in accordance with Contract Documents.
   1. When general ground contour is to be followed, make changes of grade in gradual, rolling manner.
   2. Evenly space posts in line of fence a maximum of 10 feet (3.050 meter) center to center.

B. Post Foundations:
   1. Except atop retaining walls, set posts with concrete post foundations as specified below:
      a. Line Posts:
         1) Diameter 8 inch (200 mm)
         2) Depth 36 inch (915 mm).
      b. Gate, End, And Corner Posts:
         1) Diameter 12 inch (305 mm)
         2) Depth 42 inch (1 065 mm).
      c. At mow strips, set top of post foundation below grade sufficient to allow for placing of mow strip. Measure post foundation depth from top of mow strip.
      d. Where fences are incorporated into slabs, measure post foundation depth from top of slab. Extend bottom of slab footing sufficient to allow specified amount of concrete around post. At existing slabs, install fence outside perimeter of slab.

C. Fence:
   1. After posts have been permanently positioned and concrete cured for one (1) week minimum, install framework, braces, and top rail. Join top rail with 6 inch (150 mm) minimum couplings at not more than 21 foot (6.40 meter) centers.

D. Gates:
   1. Weld gate frames and provide for free and easy operation.
   2. Provide gate latching device with padlocking capabilities. Provide cane bolt to engage sleeve set in concrete at double gates.
   3. Align top bar of gates with top rail of fence.
   4. Gates shall be plumb and on same plane as fence, both vertically and horizontally.
   5. Set gate stops and other catches in concrete.

3.2 CLEANING

A. Spread dirt from foundation excavations evenly around surrounding area unless otherwise directed. Leave area free of excess dribbles of concrete, pieces of wire, and other scrap materials.

END OF SECTION