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Bridging Documents

Beach Cities Health District

Redondo Beach, California

100% Preliminary Design Submittal

February 28, 2024

Work Order No. TBD

PREPARED BY

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SECTION 01 11 00 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

A. Work covered by Contract Documents.

B. Contractor's use of Premises.

C. Contract document organization.

1.3 SCOPE OF WORK

A. Project Description: New two-story community health care center adjacent to the BCHD campus in the City of Redondo Beach. Construction is Type V-B Modular with complete interior finishes. Spaces include reception, open hang-out space, offices and small meeting rooms, physical care rooms and labs, café, restrooms, and associated support rooms.
   1. The Site has an existing capped oil well that will remain. The building may have a below-slab vapor barrier to mitigate airborne pollutants from the contaminated soil. Refer to Owner's Soil Management Plan.
   2. Sitework, utilities, walkways, curbs, gutters, signage, landscaping, irrigation, site drainage, site lighting, surface parking, communications (security and telephone/data) to prepare for the new building.
   3. The building will be equipped with a design-build automated fire alarm, fire sprinkler system (design-build) and a photovoltaic roof top system (design-build).
   4. The project is designed to meet LEED Gold level of certification.

B. The Project will be conducted under a process of 'Progressive Design-Build' using a qualifications-based, or best value selection, followed by a process whereby the Owner the 'progresses' towards a contract price with the design team.

C. All work shall be in accordance with the California Building Code, 2022 edition or as indicated on the Contract Drawings, State approved accessibility codes, and applicable city ordinances.

D. Time is of the essence in this Contract, and work is to proceed as rapidly as possible, commensurate with good workmanship.

E. Contractor shall pay for any temporary utilities.

F. Contractor to lay out the work with exact locations and elevations as shown in the Drawings.

G. All of the Site facilities existing structures, and improvements shall be protected from damage by the Contractor. Any damage as a result of this work will be the Contractor's responsibility to restore to condition at the time of Notice to Proceed.

H. Provided Storm Water Pollution Prevention Plan if site conditions and contractor's work requires it.

1.4 CODE COMPLIANCE

A. Codes: Project has been designed in accordance with applicable codes. Comply with code requirements as recognized and adopted by the local jurisdiction for construction. Inform Architect of Record on the Design-Build team of discrepancies observed or noted by others before commencement of the work.

B. Applicable Codes:
1. 2022 California Building Code (CBC) including CalGreen (Title 24, Part 11)
2. 2022 California Fire Code (CFC)
3. 2022 California Plumbing Code (CPC)
4. 2022 California Mechanical Code (CMC)
5. 2022 California Electrical Code (CEC)
6. NFPA 13 Automatic Fire Protection

C. Codes and Standard compliance are the responsibility of Contractor. Costs of conformance with the Codes and standards shall be included in the Contract Sum and at no additional cost to Owner.

D. Standards and Codes shall govern over Drawings and Specifications when conflicts occur.

E. Contractor shall comply with the codes, standards and requirements of all local authorities having jurisdiction. Where local codes and requirements are more stringent, Contractor shall comply with no increase in the Contract Sum.

F. Where costs of compliance with codes, standards and requirements of local authorities having jurisdiction is less than the cost of the equivalent function item as required by the Contract Documents, Owner may, at his sole discretion and judgment, require a reduction in the Contract Sum equal to the difference in cost.

1.5 CONTRACTOR USE OF PREMISES

A. Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the public.

B. Coordinate use of premises and access to site under direction of Program Manager and Owner. Prior to the start of construction, the Contractor shall prepare, for review and approval of the Owner, a detailed construction logistics plan, describing the systems that the Contractor will employ to expedite the movement of personnel and the handling of materials at the project site to achieve maximum productivity and to minimize loss of production time due to inefficient movement of personnel or equipment, excessive waiting time and rehandling of construction materials. This planning system should include at a minimum the following criteria (as applicable):
1. Material deliveries, staging, and unloading
2. Material storage areas
3. Requests for soils inspections
4. Concrete operations (sequencing, durations, etc.)
5. Pre warming the building for installation of finishes (sequencing, durations, etc.)
6. Clean-up procedures/trash removal/dumpster locations
7. Scaffolding, if utilized
8. Wash-down areas

9. Exterior painting
10. Safety.

C. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.

D. Keep driveways and entrances clear at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize requirements for storage of materials.

E. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.
1. All material deliveries of substantial size or requiring special logistics or handling, especially those which may interfere or interrupt building activities shall be coordinated by the Contractor with the Owner.
2. Contractor shall arrange for appropriate labor and equipment to receive and unload as promptly as possible.
3. Cranes, if required, shall be boomed down at the end of each workday and during periods of inactivity during the workday.
4. Labels, nameplates, and company logos on equipment, which are visible from outside the construction fence, are not permitted.
5. All equipment shall be properly grounded at all times.

F. Limit use of site for work and storage to areas within the site boundaries unless specific areas are allowed in writing by the Owner. Contractor shall submit a plan for specific delineation of all requested additional storage or lay-down area for Owner’s approval.

G. Move any stored products, under the Contractor's control, which interfere with operations of the Landlord, or separate contractor.

H. If necessary, obtain and pay for the use of additional storage or work areas needed for operations. Unless otherwise agreed upon, on-site storage shall be limited to areas of new construction.

I. Do not unreasonably encumber space with materials.

J. Work area and the vicinity thereof (that may be impacted by its operations) must be kept clean and safe at all times.

K. No propane or similar flammable gas or liquid used in construction is permitted to be stored on the premises. It is to be removed from the premises when not in use during the off hours and weekends.

L. Repair damage caused by construction operations. Take precautions necessary to protect the building and occupants during the construction period.

M. Contractors shall submit both home and office numbers to the Owner’s Project Manager’s office for a minimum of 2 employees in the event they must be contacted during off hours or weekends.

N. Limit on-site parking for non-working vehicles or as further agreed by Owner during Contractor’s performance of the Work
1. On-site parking will be limited to the surrounding spaces. This area is available during normal working hours subject to Owner’s approval. Parking on the street or in adjoining neighborhoods is not allowed.

2. On-site parking is a privilege and not a condition of this Contract. Contractor's inability to park vehicles on-site for any reason, including but not limited to a lack of sufficient space due to Contractor's operations or revocation of privilege for cause by Owner, shall not constitute a violation of the Contract nor shall it be cause for additional cost to Owner.
3. Owner reserves the right to revoke the parking privilege for cause if Contractor fails, in sole determination of the Owner, to properly manage or control the on-site parking operation to the extent that safety or building operations are, in any way, jeopardized.

O. Damage of any kind to Contractor's vehicles shall not be the responsibility of Owner nor cause for claim. All responsibilities associated with the privilege of on-site parking shall be entirely Contractor's to bear.

P. Vehicular traffic into the work areas of the job site shall be limited to those vehicles required to deliver labor or materials. Vehicles not actively supporting job site operations shall not remain within the work areas of the job site.

Q. Contractor represents that it has reviewed Drawings, and examined the job site and the designated areas for parking, storage and delivery made available for its use, and confirms that same are satisfactory for its needs, or that such off-site accommodations have been made by Contractor as it may have determined to be required to perform the Work.

R. Contractor shall not load any part of an existing structure or a structure under construction with loads that may damage or endanger the stability or soundness of that structure.

S. Except as otherwise explicitly indicated on the Drawings or called for in the Specifications, do not cut, alter, remove, or otherwise disturb any existing improvement or construction beyond the demolition line, or disturb any existing utilities without permission of Owner.

T. Upon completion of the Work, deliver all existing improvements or construction complete and undamaged. Existing improvements or construction disturbed or removed as a result of performing the Work shall be patched, repaired, reinstalled, or replaced with new work, refinished and left in a condition equivalent to that which existed prior to commencement of the Work.
1. If not repaired or replaced to Owner's satisfaction, Owner reserves the right to enter the premises and effect such corrective action, and to back charge Contractor for all applicable costs, which Contractor agrees to accept as a deduction from the Contract Sum.

U. Where existing construction scheduled to be modified, extended or otherwise reused is found to be defective in any way, it shall be so reported to Owner before it is disturbed. Notification subsequent to disturbing such existing construction shall constitute dismissal of claims for additional costs connected thereto.

V. Materials and workmanship used in restoring existing work shall conform in type and quality to that of the original existing construction, except as otherwise indicated on Drawings or identified in the Specifications.

W. Verify the location of all existing utilities or obscured existing improvements or construction indicated on the Drawings or in the field to be proximate to or affected by the Work prior to commencement of Work, of excavation or demolition in any given area.

X. Whenever possible, schedule operations so that there will be no service interruptions of any existing, in-use systems.

1. Whenever service disruptions are determined, in coordination with the Owner, to be necessary, Contractor shall secure the written approval of Owner and jurisdictional agencies in a minimum of **5 calendar days** in advance as to the time and date such interruptions will be permitted.
2. Contractor shall return all interrupted services back to operation as soon as possible, including the employment of any overtime or other extended operations, at no additional cost to Owner.

Y. Immediately restore to service and repair any damage caused by it to any existing utilities which are not scheduled for removal, discontinuance or abandonment, or which have not been released by Owner and jurisdictional agencies for removal, discontinuance or abandonment, even if so scheduled.

Z. Remove, re-route, reinstall, modify as required and immediately restore to service any existing utilities as may be necessary to perform the Work.

AA. Create no open cuts or other obstacles on public roadways or public rights-of-way remaining in service without explicit prior approval of Owner and governmental agencies of jurisdiction. Authorized cuts must be bridged to permit traffic to continue without delay or hindrances. Any work that must be performed which may result in delays to public traffic or the rerouting of traffic must be coordinated with and approved in writing by Owner. Contractor shall pay for and secure all required permits.

BB. Contractor shall hand excavate, vacuum excavate, or carefully machine pothole to identify underground utilities prior to trench excavation in operationally sensitive areas.

CC. Contractor shall coordinate with Owner's landscaper to ensure that all distribution irrigation systems are functioning at all times within the work area, and will coordinate for capping of all lateral systems with demolition boundary. Contractor shall maintain entire landscape and irrigation areas outside of demo line but within fenced area in an in-kind condition.

1.6 COORDINATION

A. Coordinate work to assure efficient and orderly sequence of installation of construction elements.

B. Verify that characteristics of interrelated operation equipment are compatible; coordinate work having interdependent responsibilities for installing, connection to, and placing such equipment in service. Coordinate space requirements and installation of mechanical and electrical work; make runs parallel with lines of building.

C. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated. Coordinate locations of fixtures and outlets with finish elements.

D. Coordinate construction schedule and operations with Owner and Architect.

E. Verify all existing conditions prior to bidding and re-verify conditions prior to commencement of any portion of the work. Notify Architect of any discrepancies between the existing conditions and those indicated in the contract documents prior to bidding or commencement of construction activities.

F. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

1.7 FIELD ENGINEERING

A. Provide project engineering service; establish lines and levels by use of recognized engineering survey practices.

B. Locate and protect control and reference points.

1.8 REGULATORY REQUIREMENTS AND REFERENCE STANDARDS

A. Regulatory Requirements:
1. Architect has contacted governing authorities and reviewed design requirements of local, state and federal agencies for applicability to Project.
2. Contractor shall be responsible for contacting governing authorities directly for necessary information and decisions bearing upon performance of Work.

B. Reference Standards:
1. For Products specified by association or trade standards, comply with requirements of referenced standard, except when more rigid requirements are specified or are required by applicable codes.
2. Applicable date of each standard is that in effect as of Contract date, except when a specific date is specified.

1.9 PROTECTION OF EXISTING IMPROVEMENTS

A. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements that remain in place or are not indicated to be removed.

B. Protect improvements on adjoining properties as well as those on the Owner's property.

C. Restore any improvements damaged by this work to their original condition as acceptable to the Owner or other parties or authorities having jurisdiction.

D. Provide protective measures to contain dust and dirt within the area of work.

1.10 ARCHEOLOGICAL REMAINS FOUND DURING CONSTRUCTION

A. In the event the Contractor discovers human remains, ceremonial objects, petroglyphs and other artifacts of like nature during construction, the Contractor shall immediately notify the Owner and immediately cease excavation or disturbance of the site. Any remains from burials, including ceremonial objects, petroglyphs, and other artifacts of like nature shall not be destroyed or removed from the site. The Owner, when so notified of such findings, will determine the disposition in accordance with prescribed regulations. The Owner shall notify the Contractor of the determination of the final disposition of such findings.

B. Time extensions for delays in the Work shall be in accordance with the General Conditions of the Contract.

1.11 CONTRACT DOCUMENT ORGANIZATION

A. The Drawings illustrate locations, arrangements, dimensions, and details to determine the general character of the Work. Parts not detailed shall be subject to the Architect's approval.

Where reasonably inferable that a drawing illustrates only a part of a given work on a number of items, the remainder shall be deemed repetitious and so construed. Drawings of greater scale take precedence over drawings of lesser scale. Do not Scale documents.

B. Drawings indicate general arrangement and location of such items as piping, conduit, apparatus, and equipment. Drawings and Specifications are for guidance of the Contractor and exact locations, distances, and levels will be governed by building site and actual building conditions. The Contractor shall make minor changes, as directed, to arrangements or locations shown in order to meet Structural or Architectural conditions.

C. Specifications describe performances and qualities required of materials and of methods. Items listed under each Section of the Specifications are not necessarily all inclusive. The Contractor shall be responsible for the complete work.

D. For convenience, Specifications are separated into topical divisions of work, each of which is further related to topical divisions under which it occurs. Such separation shall not be construed as an attempt by the Architect to establish limits of any agreements between the Contractor and their subcontractor/s.

E. Portions of these Specifications are of abbreviated, simplified type and may include incomplete sentences.
   1. Omissions of words or phrases such as ”the Contractor shall”, “in conformity with”, “shall be”, “as noted on the Drawings”, “in accordance with the details”, “a”, “the”, “all”, “any”, and “each” are intentional. Omitted words or phrases shall be supplied by inference.
   2. Terms such as “approved”, “or approved equal”, “as directed”, as required”, “as provided”, “acceptable”, and “satisfactory” mean by or to the Architect or the District.
   3. Furnish: the term furnish means supply and deliver to the Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.
   4. Install: The term install describes operations at the Project Site, including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
   5. Provide: The term provide means to furnish and install, complete and ready for the intended use.

1.12 SUSTAINABILITY REQUIREMENTS, GENERAL

A. Resource Efficiency:
   1. All products and materials used on the project are to be rapidly renewable and recyclable with the highest recycled content possible.
   2. All wood products to be Forest Stewardship Council (FSC) certified.

B. Energy Conservation:
   1. Shading, skylights and overhangs will be optimized to minimize solar gain and promote natural daylighting.
   2. Night venting will be utilized throughout the building. An HVAC system will be included for supplemental heating and cooling.
   3. Remote refrigeration of all coolers will provide lower operational costs, simplified maintenance, and reduced noise and heat within occupied spaces.
   4. Variable speed kitchen hoods will reduce HVAC loads and provide optimal ventilation.
   5. The building shall include infrastructure for future solar hot water and photovoltaic systems.
   6. The photovoltaic system shall be installed in compliance with CalGreen and building code requirements.

C. Interior Air Quality:
   1. All interior components and finishes are to be free of formaldehyde and other harmful agents, and have low- or no-VOC's.
   2. Provide material safety data sheets (MSDS) to Owner for all products that may contain hazardous materials.

1.13 ENVIRONMENTAL PROTECTION AND NOISE CONTROL

A. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2022 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion. See Section 01 56 39.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Owner's Representative not less than two days in advance of proposed disruptive operations.
   2. Obtain Owner's Representative's written permission before proceeding with disruptive operations.

1.14 ORDERING OF MATERIALS

A. Certain materials are considered custom or long-lead items and must be expedited through submittals and ordering. Contractor shall verify delivery for all materials and schedule submittals and orders accordingly.

B. Contractor shall provide written verification that each custom or long-lead item has been ordered in sufficient time to meet proposed construction schedule.

1.15 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated. Confirm dates and hours with City.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
   2. Obtain Owner's Representative written permission before proceeding with utility interruptions.

D. Nonsmoking Building: Smoking is not permitted within the buildings or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.

E. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

1.16 COMPLIANCE WITH REGULATIONS

A. It is the intent of these Contract Documents that the project, when completed, shall conform to regulations of the "California Building code, current edition (CBC)", California Administrative Code Title I9 Public Safety, California Administrative Code Title 24 Accessibility Standards and Energy Standards, Uniform Plumbing Code, National Electrical Code, NBFU, CAL/OSHA, and other applicable codes. All publications shall be of the latest edition in force at the time of building permit date.

B. Anything in the Contract Documents notwithstanding, the Contractor accepts the responsibility of constructing a **watertight, weathertight** project.

C. Scheduling and reasonable security measures are the responsibility of the Contractor.

D. Approved Applicators: Where specific instructions in these specifications require that a particular product or material(s) be installed or applied by an "approved applicator" of the manufacturer, it shall be the Contractor's responsibility to ensure that any subcontractors used for such work be approved applicators.

1.17 ORDER OF PRECEDENCE

A. The Drawings and Specifications included in the Contract Documents are complementary. If Work is shown on one but not on the other, Contractor must perform the Work as though fully described on both, consistent with the 'Progressive Design-Build' documents and reasonably inferable from them as being necessary to produce the indicated results.

B. The Drawings and Specifications are deemed to include and require everything necessary and reasonably incidental to completion of the 'Progressive Design-Build' process, whether or not particularly mentioned or shown. Contractor must perform all Work and services and supply all things reasonably related to and inferable from the Contract Documents.

C. In the event of a conflict between the Drawings and Specifications, the Specifications will control. Detailed Drawings take precedence over general Drawings, and large-scale Drawings take precedence over smaller scale Drawings.

D. Any arrangement or division of the Drawings and Specifications into sections is for convenience and is not intended to limit the Work required by separate trades. A conclusion presented in the Drawings or Specifications is only a recommendation.

E. Actual locations and depths must be determined by Contractor's field investigation. Contractor may request access to underlying or background information in District's possession that is necessary for Contractor to form its own conclusions.

F. Order of Precedence. Information included in one Contract Document but not in another will not be considered a conflict or inconsistency. Unless otherwise specified in the Special Conditions, in case of any conflict or inconsistency among the Contract Documents, the following order of precedence will apply, beginning from highest to lowest:
1. Change Orders;
2. Addenda;
3. Contract;
4. Notice to Proceed;
5. Notice of Award;
6. Special Conditions;
7. General Conditions;
8. Payment, Performance and Warranty Bonds;
9. Specifications;
10. Drawings;
11. Contractor's Bid Proposal and attachments;
12. Notice Inviting Bids;
13. Instructions to Bidders;
14. the District's standard specifications, as applicable; and
15. Any documents prepared by and on behalf of a third party, that were not prepared specifically for this Project, such as the Caltrans Standard Specifications or Caltrans Special Provisions.

1.18 CERTIFICATE OF SUBSTANTIAL COMPLETION

A. Certificate of Substantial Completion will be executed for the Work occupied.

B. Prior to Owner occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed.

C. Obtain Final Certificate of Occupancy from local building officials for completion of the Project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION 01 11 00

SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS - LEED v4 BD+C

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) **Gold** certification based on USGBC's LEED v4 BD+C.
   1. Specific requirements for LEED are also included in other Sections.
   2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.

B. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract. Related Sections include the following:
   1. Divisions 1 through 16. Sections for LEED requirements specific to the Work of each of those Sections. These requirements may or may not include specific reference to LEED.
   2. Section 01 74 19 – Construction Waste Management and Disposal.
   3. Section 01 91 13 – General Commissioning Requirements.

1.3 ADDITIONAL SUSTAINABILITY REQUIREMENTS’

A. In addition to LEED v4 Gold certification the Project is required to also meet the following:
   1. WELL Building Standard v2 Certification.
   2. BLUE ZONES Certification.

1.4 DEFINITIONS

A. LEED: USGBC's "LEED Version 4 for Building Design and Construction."
   1. Definitions that are a part of "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) apply to this Section.

B. BLUE ZONES: A population of an area that shows a statistically significant higher longevity compared to national levels and displays various features related to their lifestyle, nutrition, genetics and both human and physical environmental conditions that might be considered as determinants for living longer.

C. Bio-based materials. Bio-based products must meet the Sustainable Agriculture Network’s Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material.

1. Products meeting bio-based materials criteria are valued at 100% of their cost for the purposes of credit achievement calculation.

D. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001. Certificates shall include evidence that manufacturer is certified for chain of custody by an FSC-accredited certification body.

E. Composite Wood: A product consisting of wood or plant particles or fibers bonded together by a synthetic resin or binder.

F. Environmental Product Declaration (EPD): A standardized way of communicating the environmental impacts, such as global warming potential and energy resource depletion, of a product or system.

G. Extended producer responsibility: Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility.

H. Industry-Wide (Generic) declarations: Third-party (Type III) certification, which includes verification. The declaration is generic to a product, such as concrete, not specific to a particular manufacturer or company. For the product to be eligible, the manufacturer must claim representation either directly on the EPD or through the Program Operator for the associated EPD.

I. LEED: Leadership in Energy & Environmental Design.

J. Forestry Stewardship Council (FSC) Sets standards for responsible forestry management.

K. Product Category Rule (PCR): Defines how to standardize this information for a specific product type, such as flooring. The PCR defines scope, system boundary, measurement procedures, impact measures and other technical requirements

L. Product-Specific Declarations: publicly available and critically reviewed (but not necessarily verified) by a third party to ensure that they conform to ISO 14044, which defines how LCAs are critically reviewed

M. Product-specific Type III declarations: Third-party certification that includes verification. Unlike generic EPDs, however, product-specific declarations are specific to a particular manufacturer and do not necessarily reflect the practices of the rest of the industry.

N. Regionally Manufactured Materials: Materials that are manufactured or assembled as a finished product within a 100-mile radius of the Project site. Assembly does not include on-site assembly, erection or installation of finished components.

O. Regionally Extracted, Harvested, or Recovered Materials: Materials that are extracted, harvested, or recovered, as well as manufactured, within a radius of 100 miles from the Site.
   1. Extracted materials refer to materials that are removed from the Earth by mining or similar processes.
   2. Harvested materials refer to materials that are removed from the Earth through an agricultural process.
   3. Recovered materials are recycled or salvaged materials that are reprocessed for use in a subsequent manufacturing process.

P. Recycled Content: The recycled content value of a material assembly shall be determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.
   1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
   2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.

Q. Salvaged Materials: Construction materials recovered from existing buildings or construction sites and reused in other buildings.

R. Volatile Organic Compounds (VOCs): Any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions. Compounds that have negligible photochemical reactivity, listed in EPA 40 CFR 51.100(s), are also excluded from this regulatory definition.

S. WELL Certification: An evidence-based road map for creating and certifying spaces that advance human health and well-being through air, water, nourishment, light, fitness, comfort and mind.

1.5 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site. Review LEED requirements and action plans for meeting requirements.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect and the USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application. Document responses as informational submittals.

B. Submit documentation to USGBC and respond to questions and requests from USGBC regarding LEED credits that are the responsibility of the Contractor, that depend on product selection or product qualities, or that depend on Contractor's procedures until the USGBC has made its determination on the Project's LEED certification application.
   1. Document correspondence with USGBC as informational submittals.

1.7 ACTION SUBMITTALS

A. General: Submit additional sustainable design submittals required by other Specification Sections.

B. Multiple Re-Submittals: The LEED Administrator will review the first submittal from the contractor and respond with comments and will review one re-submittal for the same item(s) form the contractor and respond with comments. If the contractor is required to make subsequent submittals for the same item(s) the Engineer shall be compensated by the contractor for the time to review each subsequent re-submittal. The contractor shall agree to compensate the LEED Administrator a minimum of $500 per each re-submittal item.

C. Sustainable design submittals are in addition to other submittals.
   1. If submitted item is identical to that submitted to comply with other requirements, include an additional copy with other submittal as a record copy of compliance with indicated LEED requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable design submittal."

D. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project, as specified in Divisions 03 through 10 and 31, 32.

E. Sustainable Design Documentation Submittals:
   1. LTc8- Green Vehicles:
      a. Provide product documentation for the Electric Vehicle Charging equipment as stated in the Informational Submittals section within this specification.
   2. SSc5– Heat Island Reduction:
      a. Non-Roof: Product Data for site paving materials indicating solar reflectivity (SR). Also, provide cut sheets for all pervious paving materials.
      b. Roof: Product Data for roofing materials indicating reflectance, emittance, and initial and 3-year aged solar reflectance index (SRI).
   3. WEp2– Indoor Water Use Reduction:
      a. Provide product documentation as per the labeling and performance requirements stated in the Informational Submittals section within this specification.
   4. MRp2: Construction and Demolition Waste Management Planning
      a. LEED Online Credit Form
      b. Documentation complying with Division 1 Section 01 74 19 "Construction Waste Management."
   5. MRc2 – Building Product Disclosure and Optimization - Environmental Product Declarations (EPD)
      a. LEED Online Credit Form
      b. Provide product documentation as per the quantity listed and manufacturer diversification criteria stated in Part 2-Products.
      c. Complete MR building product disclosure and optimization calculator or equivalent tracking tool.
         1) Do not include plumbing, mechanical and electrical components, and specialty items, such as elevators, escalators, process equipment and fire suppression systems, in the calculation.
            a) An exception of the following “passive” (meaning not part of the active portions of the system) products may be included in the calculations: piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, showerheads and lamp housings. Note if they are included in the credit calculations, they must be included consistently across relevant MR credits.
      d. EPD and LCA reports or compliant summary documents
         1) Product-Specific Declarations
            a) Name of declaration holder or producer (typically the manufacturer)
            b) Contact information
            c) Product type
            d) Product name
            e) Product description
            f) Summary of impact categories measured and overall values
            g) Functional unit
            h) Standards met
            i) Independent review entity’s name and statement

2) Documentation of EPDs
   a) Declaration holder (the company, usually the manufacturer, that the EPD is attributed to)
   b) EPD program operator (the entity that creates and registers the EPD)
   c) LCA verifier (the third-party entity that verifies the life-cycle assessment)
   d) PCR reviewer (the third-party entity that has reviewed the product category rules)

6. MRc3 - Building Product Disclosure and Optimization - Sourcing of Raw Materials
   a. LEED Online Credit Form.
   b. Raw Material Source and Extraction Reporting. Provide product documentation as per the quantity listed and manufacturer diversification criteria stated in Part 2-Products.
   c. MR building product disclosure and optimization calculator or equivalent tracking tool.
      1) Do not include plumbing, mechanical and electrical components, and specialty items, such as elevators, escalators, process equipment and fire suppression systems, in the calculation.
         a) An exception of the following “passive” (meaning not part of the active portions of the system) products may be included in the calculations: piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, showerheads and lamp housings. Note if they are included in the credit calculations, they must be included consistently across relevant MR credits.
   d. Corporate sustainability reports for 100% of products contributing toward credit.
   e. Third-party verified corporate sustainability reports (CSR) including environmental impacts of extraction operations and activities associated with the manufacturer’s product and the product’s supply chain Acceptable CSR frameworks include the following:
      a) Global Reporting Initiative (GRI) Sustainability Report
      b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
      c) U.N. Global Compact: Communication of Progress
      d) ISO 26000: 2010 Guidance on Social Responsibility
      e) USGBC approved program: Other USGBC approved programs meeting the CSR criteria.
   f. Leadership Extraction Practices
      1) Provide product documentation as per the cost percentage criteria stated in Part 2-Products.
      2) MR building product disclosure and optimization calculator or equivalent tracking tool and product data, which includes the following:
         a) Extended producer responsibility - Product data and certification letter from product manufacturers, indicating participation in an extended producer responsibility program and statement of costs.
         b) Bio-based materials - Product data and certification for bio-based materials, indicating that they comply with the Sustainable Agriculture Standard. Include statement of costs.
         c) Wood products - Itemized invoice showing certification by the Forest Stewardship Council or USGBC-approved equivalent.
         d) Material reuse - Receipts for salvaged and refurbished materials used for Project, indicating sources and costs.

e) Recycled content - Product data and/or letter from product manufacturers, indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content. Include statement of costs.
f) Documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.

7. MRc4-Building Product Disclosure and Optimization - Material Ingredients
   a. LEED Online Credit Form
   b. Provide product documentation as per the cost percentage criteria stated in Part 2-Products.
   c. MR building product disclosure and optimization calculator or equivalent tracking tool and product data, which includes the following:
      1) Documentation of chemical inventory through Health Product Declarations, Cradle to Cradle certification labels, Declare labels, ANSI/BIFMA e3 Furniture Sustainability Standard, Cradle to Cradle Material Health Certificates, manufacturers' lists of ingredients with GreenScreen assessment reports for confidential ingredients, or USGBC-approved programs (if applicable)
      2) Verification of ingredient optimization through Cradle-to-Cradle certification labels, manufacturers' lists of ingredients with GreenScreen benchmarks listed for all ingredients, or manufacturers' declaration (for REACH), or USGBC-approved programs (if applicable)
      3) Documentation for products that comply with LEED requirements for product manufacturer supply chain optimization.
      4) Do not include plumbing, mechanical and electrical components, and specialty items, such as elevators, escalators, process equipment and fire suppression systems, in the calculation.
         a) An exception of the following "passive" (meaning not part of the active portions of the system) products may be included in the calculations: piping, pipe insulation, ducts, duct insulation, conduit, plumbing fixtures, showerheads and lamp housings. Note if they are included in the credit calculations, they must be included consistently across relevant MR credits.
   d. Include documentation for regional materials, indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material and costs of regional materials.
8. MRc5 Construction and Demolition Waste Management
   a. LEED Online Credit Form
   b. Comply with Division 1 Section 01 74 19 "Construction Waste Management and Disposal."
9. EQc2 – Low Emitting Materials
   a. LEED Online Credit Form
   b. USGBC Low Emitting Materials Calculator
   c. Adhesives and Sealants
      1) Product data for adhesives and sealants used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.
   d. Paints and Coatings
      1) Product data for paints and coatings used inside the weatherproofing system, indicating VOC content and laboratory test reports showing compliance with requirements for low-emitting materials.

e. Flooring Materials:
   1) Laboratory test reports for all flooring materials, indicating compliance with California Department of Public Health (CDPH) Standard Method v1.2-2017, using the applicable exposure scenario, and stating the exposure scenario used to determine compliance.
   2) Manufacturers' claims of compliance stating the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.2:
      a) 0.5 mg/m3 or less
      b) between 0.5 and 5.0 mg/m3; or
      c) 5.0 mg/m3 or more

f. Composite Wood:
   1) Product data for all composite wood or agrifiber products (including but not limited to particleboard, wheat board, strawboard, agriboard products, engineered wood components, solid-core wood doors, OSB, MDF, and plywood products), or wood glues, indicating compliance with one of the following:
      a) Low formaldehyde emission levels that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins
      b) Contain no added formaldehyde resins

g. Ceilings, Walls, Thermal and Acoustic Insulation
   1) Laboratory test reports for all flooring materials, indicating compliance with California Department of Public Health (CDPH) Standard Method v1.2-2017, using the applicable exposure scenario, and stating the exposure scenario used to determine compliance.
   2) Manufacturers' claims of compliance stating the range of total VOCs after 14 days (336 hours), measured as specified in the CDPH Standard Method v1.2:
      a) 0.5 mg/m3 or less
      b) between 0.5 and 5.0 mg/m3; or
      c) 5.0 mg/m3 or more

h. Furniture (if in scope of work)
   1) Test results for all stand-alone furniture items, indicating compliance with ANSI/BIFMA M7.1-2011 Standard Test Method for Determining VOC Emission from Office Furniture Systems, Components and Seating. Comply with ANSI/BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2, using either the concentration modeling approach or the emissions factor approach.

10. Construction Indoor-Air-Quality (IAQ) Management:
    a. LEED Online Credit Form
    b. Construction indoor air quality management plan. The plan shall address the protection of the ventilation system components during construction and cleanup of contaminated components after construction is complete, including the applicable SMACNA approaches.
    c. Product data for temporary filtration media, including manufacturer, model number, MERV rating, and location of installed filter.
    d. Product data for filtration media used during occupancy, including manufacturer, model number, MERV rating, and location of installed filter.
    e. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For LEED coordinator.

B. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
1. Plumbing.
2. Mechanical.
3. Electrical.
4. Specialty items, such as elevators and equipment.
5. Furniture.
6. Wood-based construction materials.

C. Sustainable Design Action Plans: Provide preliminary submittals within **30** days of date established for commencement of the Work, indicating how the following requirements will be met:
1. LTc8: Green Vehicles
   a. Product Data for Electric Vehicle Charging equipment indicating conformance with the following requirements:
      1) Provide a Level 2 charging capacity (208 – 240 volts) or greater.
      2) Comply with the relevant regional or local standard for electrical connectors, such as SAE Surface Vehicle Recommended Practice J1772, SAE Electric Vehicle Conductive Charge Coupler or IEC 62196 of the International Electrotechnical Commission for projects outside the U.S.
      3) Be networked or internet addressable and be capable of participating in a demand-response program or time-of-use pricing to encourage off-peak charging.
2. SSp1: Construction Activity Pollution Prevention
   a. Develop an erosion and sedimentation control drawing and/or written erosion and sedimentation control plan, with specifications that detail the erosion and control best management practices used on the project site and the responsible parties for implementation. The plan must conform to the erosion and sedimentation requirements of the 2012 EPA Construction General Permit and touch on the following:
      1) Erosion Control and Minimizing the Impact of Construction
         a) Minimize disturbed area and protect natural features and soil
         b) Phase construction activity
         c) Control stormwater flowing onto and through the project
         d) Stabilize soils promptly
         e) Protect slopes
      2) Sediment Controls
         a) Protect storm drain inlets
         b) Establish perimeter controls
         c) Retain sediment on-site and control dewatering practices
         d) Establish stabilized construction exits
         e) Inspect and maintain controls
   b. Over the course of site work activities, document implementation of the erosion and sedimentation control plan through date-stamped photos, inspection logs or reports, along with descriptions of corrective action in response to problems.
3. WEp2: Indoor Water Use Reduction
   a. Product Data for plumbing fixtures and fittings indicating conformance with the following requirements:

1) Toilets, Urinals, Private Lavatories, Showerheads and Aerators: WaterSense Labeling.
2) Residential Clothes Washers, Residential Dish Washers, Ice Machine: ENERGY Star or performance equivalent. Ice Machine ENERGY Star or performance equivalent and either air-cooled or close-loop cooling.
3) Commercial Clothes Washers: CEE Tier 3A.
4) Prerinse Spray Valve: < or = 1.3 gpm.
5) Heat Rejection and Cooling: No once-through cooling with potable water for any equipment or appliances that reject heat.
6) Cooling Towers and evaporative condensers: Equipped with makeup water meters, conductivity controllers and overflow alarms, efficient drift eliminators that reduce drift to maximum of 0.002% of recirculated water volume for counterflow towers and 0.005% of recirculated water flow for cross-flow towers.

4. MRp2: Waste management plan complying with Section 017419 "Construction Waste Management and Disposal."
5. MRc2: Building Product Disclosure and Optimization – Environmental Product Declarations
   a. Environmental Product Declaration (1 point)
      1) Collect all EPDs and life-cycle assessment (LCA) reports for contributing products for credit documentation. Ensure that EPD documentation includes a summary sheet of measured impacts.
      2) Retain product data for all materials that contribute to credit achievement.
   b. Multi-attribute Optimization (1 point)
      1) Collect Third-party verification on products demonstrating impact reduction below industry average in at least three of the following:
         a) global warming potential (greenhouse gases), in CO2e
         b) depletion of the stratospheric ozone layer, in kg CFC-11
         c) acidification of land and water sources, in moles H+ or kg SO2
         d) eutrophication, in kg nitrogen or kg phosphate
         e) formation of tropospheric ozone, in kg NOx or kg ethene; and depletion of nonrenewable energy resources, in MJ
6. MRc3: Building Product Disclosure and Optimization - Sourcing of Raw Materials
   a. Raw Material Source and Extraction Reporting (1 point)
      1) Collect Third-party verified corporate sustainability reports (CSR)
   b. Leadership Extraction (1 point):
      1) Extended producer responsibility: Manufacturer (producer) data indicating they participate in an extended producer responsibility program or is directly responsible for extended producer responsibility
      2) Biobased Materials - Manufacturer-declared conformance to the Sustainable Agriculture Standard (except bamboo and non-wood forest products that could be FSC certified) under the following three conditions:
         a) A signed letter from the product's manufacturer on company letterhead from the raw material supplier attesting that its practices meet the standard.
         b) The letter includes a link to a publicly available document that specifies how the raw material supplier's practices conform to each paragraph in all 10 sections of the standard and attesting that each "critical criterion" is met
         c) Both the letter and the detailed documentation are dated within one year before the date of project registration
      3) FSC-certified products:
         a) Indicate each product containing certified wood, its source, and cost.

b) Include statement indicating total cost for wood-based materials that will be permanently installed in the Project.
c) Products must be itemized on the vendor's invoice with the COC number for each item

4) Recycled Content: List of materials with recycled content.
a) Indicate cost, post-consumer recycled content, and pre-consumer recycled content for each product having recycled content.

7. MRc4 - Building Product Disclosure and Optimization - Material Ingredients
a. Material Ingredient Reporting (1 point)
1) Collect documentation of chemical inventory through Health Product Declaration, Cradle to Cradle certification labels, manufacturers' lists of ingredients with GreenScreen assessment reports for confidential ingredients, or USGBC-approved programs (if applicable)
2) Information must be publicly available; direct disclosure to the contractor is not acceptable.
b. Material Ingredient Optimization (1 point)
1) Collect documentation verifying ingredient optimization through Cradle-to-Cradle certification labels, manufacturers' lists of ingredients with GreenScreen benchmarks listed for all ingredients, or manufacturers' declaration (for REACH), or USGBC-approved programs (if applicable)
c. Product Manufacturer Supply Chain Optimization (1 point)
1) Collect documentation of supply chain optimization
8. EQc3: Construction IAQ management plan.
a. Construction indoor-air-quality management plan.
b. Product data for temporary filtration media.
c. Product data for filtration media used during occupancy.
d. Construction Documentation: Six photographs at three different times during the construction period, along with a brief description of the SMACNA approach employed, documenting implementation of the indoor-air-quality management measures, such as protection of ducts and on-site stored or installed absorptive materials.

D. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans for the following:
1. MRc2-Building Product Disclosure and Optimization - Environmental Product Declaration.
2. MRc3-Building Product Disclosure and Optimization - Sourcing of Raw Materials
3. MRc4-Building Product Disclosure and Optimization - Material Ingredients
4. MRc5-Construction Waste Management

1.9 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-accredited professional to coordinate LEED requirements. LEED coordinator may also serve as waste management coordinator.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to these LEED credits, the Contractor shall provide additional materials and procedures necessary to obtain LEED credits indicated.

B. WEp2 – Indoor Water Use Reduction:
   a. All plumbing fixtures and fittings eligible for labeling shall be WaterSense Labeled.
   b. All appliances and process water systems shall meet the labeling or performance requirements as outlined in the Informational Submittals section within this specification.

C. MRc2 - Building Product Disclosure and Optimization - Environmental Product Declaration:
   1. At least 10 different products from at least five different manufacturers shall have Environmental Product Declarations that comply with LEED requirements. Industry-wide (generic) Environmental Product Declarations shall be valued as one-half of a product.
   2. At least 50 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for multi-attribute optimization.
   3. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.

D. MRc3 - Building Product Disclosure and Optimization - Sourcing of Raw Materials:
   1. At least 20 different products from at least five different manufacturers shall have publicly-released reports that comply with LEED requirements for raw material source and extraction reporting. Self-declared reports by manufacturers shall be valued as one-half of a product.
   2. Not less than 25 percent of building materials, by cost, shall comply with LEED requirements for leadership extraction practices.
   3. Structure and enclosure materials shall not be more than 30 percent, by cost, of the materials used to comply with this requirement.

E. MRc4 - Building Product Disclosure and Optimization - Material Ingredients:
   1. At least 10 different products from at least five different manufacturers shall comply with LEED requirements for material ingredient reporting, which demonstrate the chemical inventory of the product to at least 0.1%.
   2. At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for material ingredient optimization.
   3. At least 25 percent, by cost, of the permanently installed products for the Project shall comply with LEED requirements for product manufacturer supply chain optimization.

2.2 LOW-EMITTING MATERIALS

A. Adhesives and Sealants: For field applications that are inside the weatherproofing system, adhesives and sealants shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
   1. Wood Glues: 30 g/L.
   2. Metal-to-Metal Adhesives: 30 g/L.
   3. Adhesives for Porous Materials (Except Wood): 50 g/L.
   4. Subfloor Adhesives: 50 g/L.
   5. Plastic Foam Adhesives: 50 g/L.
   6. Carpet Adhesives: 50 g/L.
   7. Carpet Pad Adhesives: 50 g/L.
   8. VCT and Asphalt Tile Adhesives: 50 g/L.
   9. Cove Base Adhesives: 50 g/L.
   10. Gypsum Board and Panel Adhesives: 50 g/L.
   11. Rubber Floor Adhesives: 60 g/L.
   12. Ceramic Tile Adhesives: 65 g/L.
   13. Multipurpose Construction Adhesives: 70 g/L.
   14. Fiberglass Adhesives: 80 g/L.

15. Contact Adhesives: 80 g/L.
16. Structural Glazing Adhesives: 100 g/L.
17. Wood Flooring Adhesives: 100 g/L.
18. Structural Wood Member Adhesives: 140 g/L.
19. Single-Ply Roof Membrane Adhesives: 250 g/L.
20. Special-Purpose Contact Adhesives (That Are Used to Bond Melamine-Covered Board, Metal, Unsupported Vinyl, Rubber, or Wood Veneer 1/16 Inch or Less in Thickness to Any Surface): 250 g/L.
21. Top and Trim Adhesives: 250 g/L.
22. Plastic Cement Welding Compounds: 250 g/L.
23. ABS Welding Compounds: 325 g/L.
24. CPVC Welding Compounds: 490 g/L.
25. PVC Welding Compounds: 510 g/L.
26. Adhesive Primer for Plastic: 550 g/L.
27. Sheet-Applied Rubber Lining Adhesives: 850 g/L.
28. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent by weight.
29. Aerosol Adhesive, General-Purpose Web Spray: 55 percent by weight.
30. Special-Purpose Aerosol Adhesives (All Types): 70 percent by weight.
31. Other Adhesives: 250 g/L.
32. Architectural Sealants: 250 g/L.
33. Nonmembrane Roof Sealants: 300 g/L.
34. Single-Ply Roof Membrane Sealants: 450 g/L.
35. Other Sealants: 420 g/L.
36. Sealant Primers for Nonporous Substrates: 250 g/L.
37. Sealant Primers for Porous Substrates: 775 g/L.
38. Modified Bituminous Sealant Primers: 500 g/L.
39. Other Sealant Primers: 750 g/L.

B. Adhesives and Sealants: For field applications that are inside the weatherproofing system, 90 percent of adhesives and sealants, by volume, shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Paints and Coatings: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 50 g/L.
   3. Dry-Fog Coatings: 150 g/L.
   4. Primers, Sealers, and Undercoaters: 100 g/L.
   5. Rust-Preventive Coatings: 100 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Clear Wood Finishes, Varnishes: 275 g/L.
   9. Clear Wood Finishes, Lacquers: 275 g/L.
   10. Floor Coatings: 50 g/L.
   11. Shellacs, Clear: 730 g/L.
   12. Shellacs, Pigmented: 550 g/L.
   13. Stains: 100 g/L.
   14. Waterproofing Sealers: VOC not more than 100 g/L.
   15. Waterproofing Concrete/Masonry Sealers: VOC not more than 100 g/L.

D. Paints and Coatings: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings, by volume, shall comply with the requirements of the California

Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Flooring: 100 percent of flooring shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

F. Composite Wood: 100 percent of composite wood, agrifiber products, and adhesives shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

G. Ceilings, Walls, and Thermal Insulation: 100 percent of ceilings, walls, and thermal insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

H. Furniture (if in scope of work): 90 percent of furniture, by cost, shall comply with the requirements of ANSI/BIFMA Standard Method M7.1-2011, based on BIFMA e3-2011 Furniture Sustainability Standard, Sections 7.6.1 and 7.6.2 using either concentration modeling approach or emission factor approach. Model test results using open plan, private office, or seating scenarios in ANSI/BIFMA M7.1 as appropriate.

PART 3 - EXECUTION

3.1 LANDSCAPE MAINTENANCE

A. WEc1 – Water Efficient Landscaping: Take responsibility for hand watering plants until all plant materials are well-established or until Final Acceptance, whichever comes first.

3.2 NONSMOKING BUILDING

A. Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

3.3 CONSTRUCTION WASTE MANAGEMENT

A. Comply with Section 017419 "Construction Waste Management"

3.4 CONSTRUCTION IAQ MANAGEMENT

A. During Construction: The IAQ measures undertaken shall meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.
   1. Moisture Damage Prevention: Stored on-site or installed absorptive materials shall be protected from moisture damage.
   2. HVAC Protection: Do not operate air handling units (AHU's) during building construction phase unless filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 are used at each return air grill, as determined by ASHRAE 52.2-2007.
      a. Seal all return air openings with plastic and close all return air dampers during construction.

b. Protect fan motors, switches, equipment, fixtures and other items from dirt, rubbish and foreign matter.
c. When running AHU's to dry out the building, the ceiling system shall be completely in place and temporary filters installed with the same efficiency rating as required for the final installation.
d. Control the building temperature to drop very slowly, and verify all doors and windows are installed and closed, to prevent condensation of water from humid air on building interior surfaces, equipment, materials and ductwork.
e. Do not operate AHU's if the building is not clean or if dust can enter the coils or fan housing.
f. Replace all filtration media immediately prior to occupancy with filtration media of at least MERV 13.

3. Source control: Refer to other sections of this Project Manual for the requirements and use of materials such as adhesives, sealants, paints, carpet, and composite wood.
4. Pathway Interruption: During construction, isolate areas of work to prevent contamination of clean or occupied spaces. Provide temporary barriers that contain the construction area.
5. Housekeeping: Keep interiors of duct and pipe systems clean and free from dirt, rubbish and foreign matter. Prevent dust, debris and foreign material from entering the piping and ductwork. Remove temporary labels, stickers, etc. from fixtures and equipment. Do not remove permanent nameplates, equipment model numbers, etc. Remove debris, rubbish, leftover materials, tools and equipment from work areas and site. Final acceptance shall not be approved until site is cleaned.
6. Scheduling: Refer to Division 1 for the requirements for construction sequencing to minimize impacts on indoor air quality.

END OF SECTION 01 81 13

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Principal work in this Section:

1. Forms for cast-in-place concrete.

2. Shoring, bracing, accessories and form coating.

B. Work installed but furnished in other Sections:

1. Inserts, bolts, anchors and other items furnished by other trades for installation in formed concrete.

C. Related work:

1. Section 03 30 00 – Cast-in-place Concrete

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 00

B. Records: Keep an accurate record of the dates of all form removal and furnish copies to the Construction Manager.

C. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

D. Include information on Material Tracking Worksheets.

1.3 QUALITY ASSURANCE

A. Lumber and plywood shall be grade-marked by a grading agency acceptable to the Building Department.

1.4 HANDLING

A. Procedure: In compliance with Section 01 60 00.

B. Storage: Store form facing materials above ground on framework or blocking. Protect from moisture and damage. Handle form facing materials to prevent damages which could be transferred to the concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for exposed concrete surfaces:

1. General: Plywood, metal, metal-framed/plywood-faced, or FRP which will provide continuous, flat, exposed concrete surface with the appropriate texture and appearance as specified on the architectural drawings. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings, where indicated.

2. Type:

a. For concrete surfaces to be sacked and rubbed: US Product Standard PS-1 'B-B (Concrete Form) Plyform", Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

b. Elsewhere where concrete will remain exposed, with or without a mechanical finish: Overlaid plywood complying with US Product Standard PS-1 'A-C or B-B High Density Overlaid Concrete Form,' Class 1, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.

B. Forms for concealed concrete surfaces: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form ties and spreaders:

1. Provide cone or snap type ties designed to be completely removed from wall, or to break off and provide minimum 1-1/2 in. coverage over ends of the portion of snap tie remaining in the concrete.

2. Do not use wire ties, wood spreaders, or embedded types in which embedded portion is less than 1-1/2 in. from exterior face of concrete.

D. Chamfer strips: Extruded PVC, with 3/4 in. diagonal faces unless otherwise indicated, by The Burke Co., Greenstreak Plastic Products Co., or Sonneborn-Rexnord, Inc., or oiled softwood shapes with the same profile.

E. Form coatings: Commercial formulation form-coating compounds that will, not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

F. Prefabricated construction joint keyways: Key-Loc by Form-A-Key Products Div., or Keyed Kold Joint by The Burke Co., complete with all accessories.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Reinforcing steel (rods and mesh) for cast-in-place concrete.
2. Accessories such as chairs and tie wires.

B. Related work in other Sections:

1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 04 22 20 – Concrete Masonry Units

1.2 SUBMITTALS

A. Procedure: In compliance with Division 1.

B. Shop drawings: Submit for reinforcement deviating from that shown on the Drawings.

1. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project when submitted.
2. Reinforcing shop fabrication and field placement drawings shall be submitted in an acceptable form, be checked and complete. Reuse of the Contract Documents is not permitted. Each submittal shall be provided at least five weeks in advance of reinforcing delivery to site.
3. Reinforcement shall be detailed based on construction joint locations that have been shown on shop drawings, as reviewed. Construction joints shall be indicated on reinforcing shop drawings. Submit proposed construction joints for review prior to submittal of reinforcing shop drawings.
4. The drawings shall be in such detail as to assure that there will be a minimum, if any, of difficulties in execution of the work in the field. Show layout of reinforcing by mark for each member on plan. For each member or collinear series of members, show side elevation of the member with top, bottom and tie reinforcing and spacing shown. Show cross section of each pertinent location. Show all bar lengths and dimensioned bar bending details for each bar type. The detailed bar listing shall be shown on a member-by- member basis indicating the number of bars of each type etc. Clearly show splicing and placing conditions at each splice area. Detail pilaster verticals with respect to beam, and anchor bolts. Placement diagrams shall clearly indicate locations of beam reinforcing passing through verticals and anchor bolts. Placement diagrams shall clearly show layering of beam reinforcement and slab reinforcement locations relative to beams. Walls shall be shown in side elevations of each wall face indicating vertical, horizontal and beam reinforcing with sections showing placement.
5. The drawings shall consist of sections, plans and details clearly showing locations, sizes and spacing of all reinforcing steel, supporting bars and accessories. Include particular details at foundation-column intersections showing locations of vertical and horizontal reinforcing. Include detailed schedules and diagrams to indicate bends, sizes and lengths of all reinforcing steel items and clear cover for reinforcing.

6. Floor openings, wall openings, wall recesses and sleeves for all mechanical, plumbing and electrical work shall be coordinated with the respective trades and reinforcing shown on these drawings in accordance with the criteria indicated on the drawings.
7. After review, furnish all copies needed for fabrication and erection, and for the coordination and use of other trades.
8. Be fully responsible for furnishing and installing all materials called for or required by the Contract Documents even though these materials may have been omitted from the reviewed shop drawings or incorrectly indicated thereon.

C. Mill reports: Submit copies of mill reports and test data for reinforcing steel sampled and tested, prior to starting this work.

D. Proprietary splicing details.

E. Mill Certificates: Submit to Architect, three (3) copies of manufacturer's certificates of reinforcing steel mill tests.

F. Provide alignment templates at top of pilaster cage to maintain position of vertical bars such that the proper location of beam bars passing through the pilaster and anchor bolts is assured.

1.3 QUALITY ASSURANCE

A. Source quality control: Obtain mill reports for all types and sizes of reinforcing steel.

1. Mill reports shall contain the steel source, description, heat number, yield point, ultimate tensile strength, elongation percentage, bend test and chemical analysis.

    a. If the reports show that material is satisfactory, no tests will be required.
    b. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.
    c. For foreign steel, testing as specified below will be required by a testing laboratory acceptable to the Architect.
2. Ensure that the material delivered for use is that represented by the mill reports and obtain copies of mill reports, examine them, certify whether the material represented complies with Specifications requirements, and make distribution of reports as required. Report chemical composition of each heat, as determined by ladle analysis.
3. Where materials proposed for use cannot be identified, pay for an approved testing laboratory to make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel. Include 2 samples, minimum, of sufficient length to allow tests to be made on the as-rolled bar.

1.4 HANDLING

A. Procedure: In compliance with Section 01 60 00.

B. Electrode storage: Comply with the combined recommendations of AWS and the electrode manufacturer for storage of electrodes. Do not use electrodes that have been wetted.

C. Delivery: Deliver reinforcement to the site bundled, tagged and marked; handle to prevent damage to material. Use metal tags indicating size, length and other markings shown on placement drawings. Maintain tags after bundles are broken.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing steel: Use ASTM A615, Grade 60 for gravity elements. Use ASTM A706, Grade 60 for primary reinforcing in moment frame columns, beams and shear wall boundary elements. ASTM A615 may be substituted for A706 if the actual yield strength based on mill tests does not exceed 78,000 psi and the ratio of actual tensile strength to the actual yield strength is not less than 1.25. For welding, conform to specified carbon equivalent or use bars conforming to ASTM A706.

B. Reinforcing mesh: ASTM A 185. Provide welded wire fabric in flat sheets, not rolls.

C. Welding electrodes for Reinforcing Bars: AWS A5.1 E80XX Series, low hydrogen, having a minimum yield point of 80,000 psi.

D. Tie wire: ASTM A 82, 16 gage (minimum) annealed steel wire.

E. Supports for reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).
3. Over waterproof membranes and vapor barriers, use pre-cast concrete chairs to prevent puncturing of membrane.

2.2 FABRICATION

A. General: Except as modified by the Drawings and the Specifications, comply with Chapter 7 of CRSI Manual of Standard Practice for fabrication of reinforcing steel. Exposed Sealing Materials: All sealing materials exposed at entrance and storefront perimeter joints in contact with adjacent cladding materials: 2 component silicone, refer to Division 7 Section “Joint Sealants”.

B. Bending and forming:

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or pre-cast concrete block chairs with embedded wire ties.
2. Heating reinforcement for bending is prohibited. Do not install bars with unscheduled kinks or bends.
3. Bars larger than #4 shall not be bent once cast in concrete or masonry.

C. Tolerances: Comply with ACI 117.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 20 00

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Cast-in-place concrete.
2. Concrete floors, walls, curbs, and slabs on grade and over metal decking.

B. Work installed but furnished in other Sections:

1. Items to be embedded in concrete. Contractor shall prepare embed shop drawings for fabrication and placement for architect and engineer review prior to placement.

C. Related work in other Sections:

1. Section 03 10 00 – Concrete Formwork.
2. Section 03 20 00 – Concrete Reinforcement
3. Section 03 60 00 – Grout

1.2 SUBMITTALS

A. Procedure: In compliance with Division 1.

B. Data: Manufacturers' brochures and technical data for all manufactured products.

C. Certificates:

1. Cement certification.
2. Admixture certification: Include chloride ion content.
3. Batch plant tickets.

D. Concrete mix designs for approval: Certified concrete mix designs for initial and any subsequent changes in mix designs.

1.3 QUALITY ASSURANCE

A. Mock-up: Before beginning work, cast a sample panel of each type of finish at a location on the site agreed-upon with the Architect.

1. Protect panel until its removal is authorized by the Architect. Make such modifications as necessary to achieve a panel satisfactory to the Architect.
2. Approved panel shall serve as the standard for all remaining work. Remove panel only after completion and acceptance of work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland cement: ASTM C 150, Type II low alkali, typical, Type V for all elements in contact with earth. Do not change source, brand or type of cement without Architect's written approval.

B. Fly ash: ASTM C 618, Type C or F. Do not change source, brand or type of fly ash without Architect's written approval.

C. Aggregates: Submit pit source and characteristics of each type aggregate to Architect prior to designing mixes.

1. Hardrock aggregates: ASTM C 33 graded so that coarse aggregate nominal size is not larger than 1/5 of the narrowest dimension between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, whichever is less, but never greater than ¾ inch in any dimension for slabs 4 inches thick or less; 1-1/2 inches at all other locations.
2. Lightweight structural concrete: Mixed of Portland cement, sand, coarse lightweight aggregates, an air-entraining admixture and water. Testing laboratory shall design lightweight structural concrete in accordance with ACI 211.2 for 28-day compressive strengths required by Drawings or specified herein, with weight not exceeding 110 lbs. per cubic foot air dry. Trial batch strengths shall be as specified above. Lightweight structural concrete shall meet the drying shrinkage requirements specified.

D. Admixtures:

1. May be used only with the Architect and the Building Department approval.
2. Submit manufacturer's data for products proposed for use to the Architect in compliance with the requirements of Section 01 33 40.

E. Water: Fresh, clean, potable, and free of oil and other materials injurious to concrete.

F. Structural adhesive: ASTM C 881, 2-component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.

1. Rezi-Weld 1000 by WR Meadows.
2. Thiopoxy by WR Grace.
3. Sikadur Hi-Mod by Sika Chemical Corp.
4. Patch and Bond Epoxy by The Burke Co.

G. Curing compound:

1. Liquid membrane-forming compound complying with ASTM C 309, Type I (1D), Class B, guaranteed not to affect the appearance of the concrete surfaces, and the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.
2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age.
3. Curing compound for use on concrete floors to receive adhered covering shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives.

~~H.~~ Dry-pack and grout: See Section 03 60 00.

I. Expansion joint materials:

1. Joint filler: Use in combination with plastic joint cap made by Greenstreak, Quaker Plastic Corp., WR Meadows, or equal.
   a. Homex Expansion Joint by Homasote Co., or equal non-bituminous product compatible with sealant specified in Section 07 92 00.
   b. Sealtight self-expanding cork by WR Meadows, or equal compatible with sealant specified in Section 07 92 00.

2. Joint sealant and back-up rod: As specified in Section 07 92 00.

J. Curing paper: Orange Label Sisalkraft by Fortifiber Corp., or equal.

K. Water stop: One of the following.

1. Waterstop-Rx by Cetco.
2. Waterstop-Plus by Intercontinental Chemical and Equipment, Inc. (Waterstop-Plus is extruded from a cartridge sealant.)
3. Bluestop by Vinyltex Corp.

2.2 SOURCE QUALITY CONTROL

A. Employ a testing laboratory, acceptable to the Owner and Architect, to test the materials for conformance with these Specifications before concrete mixes are established and when source is changed, unless recent test results of materials to be used on the Project, performed by an acceptable testing laboratory, are accepted by the Architect.

B. Testing coarse aggregates:

1. Test aggregates before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 500 cubic yards.
2. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C 33, and as follows:
   a. Sampling of aggregates: ASTM D 75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready-mixed concrete plant.
   b. Testing of aggregates shall include:
      1) Sieve analysis: ASTM C 136.
      2) Organic impurities: ASTM C 40. Fine aggregate shall develop a color not darker than the referenced standard color.
      3) Soundness: ASTM C 88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.
      4) Abrasion: ASTM C 131. Weight loss not over 10-1/2% after 100 revolutions, nor 42% after 500 revolutions.
      5) Deleterious materials: ASTM C 33.
      6) Materials passing No. 200 sieve: ASTM C 117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C 33.
      7) Reactive materials: ASTM C 289. Aggregates shall indicate no potential deleterious reactivity.
      8) Definitions: ASTM C 125.

3. Cement test:

a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by the Building Department. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof of cement used, in compliance with ASTM C 150.
b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Agency shall certify that materials being used are taken from the lots sampled and tested for this report.

2.3 CONCRETE MIXES

A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.
2. Proportion lightweight structural concrete according to ACI 211.2 and ACI 301.

B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

1. Requirements of Mix designer:
   a. List design mixes required, stating where each applies, and identified as follows:
      1) "(3-57 AR Col)" which interpreted means 3000 psi, Size 57 agg., air-entrained retarder used for columns.
   b. Design concrete mixes subject to controls specified under Paragraph, "Proportioning", including adjustments for seasonality.
   c. Verify adequacy of design mix for compressive strength in accordance with ACI 301, Method 1 or Method 2 as hereinafter modified.
      1) Method 1: Make and test compressive test cylinders in accordance with appropriate ASTM procedures to substantiate an average compressive strength as specified in Paragraph, "Proportioning".
      2) Method 2: Appropriate field test data for concrete made with the same ingredients may be used. Thirty (30) or more consecutive strength test results of mixes with same materials and proportions used in similar construction and climatic conditions within past year shall be used to indicate performance in accordance with specification. Required average compressive strength shall be specified in Paragraph, "Proportioning".
   d. Adjust mix designs that prove unsatisfactory in use, subject to Architects review. Concrete that does not consistently exhibit specified control characteristics shall be considered unsatisfactory. All work constructed with such concrete shall be removed and replace by Contractor.

2. Submit for Architects Review.
   a. List of mixes.
   b. Mix Proportions.
   c. Proposed adjustments for seasonality.
   d. Test results and/or mill certificates showing that mix proportions and materials comply with performance characteristics specified.
   e. A concrete mix design submittal shall include the proposed mix components and quantities, material sources, aggregate gradations, manufacturer's data sheets for admixtures, etc. As well as actual strength and slump data for trial mix or historical data statistically summarized. Relative to semi-lightweight concrete also include splitting strength, modulus, shrinkage unit weight and other

information as well as identify if the materials are vacuum saturated or not and the supplies description of their product. The mix sheet shall clearly indicate location of use, a pumped or place mix, and other conditions of proposed usage.

C. Proportioning:

1. Structural Concrete:
   a. Water reducing (plasticizing) admixture required.
   b. Trial Mix: Determine average compression strength by ACI 301, Method 1 with minimum of 15% greater than specified f'c or by Method 2 where average strength exceeds specified strength f'c by at least:
   c. 400 psi if standard deviation is less than 300 psi.
   d. 530 psi if standard deviation is 300 psi to 400 psi.
   e. 690 psi if standard deviation is less that 400 psi to 500 psi.
   f. 898 psi if standard deviation is less that 500 psi to 600 psi.
   g. 1131 psi if standard deviation is less than 600 psi to 700 psi.

2. Minimum Cement Content: (94 pounds per bag)
   a. 3000 psi concrete: 5 bags per cubic yard. Maximum water 6.3 gallons per bag.
   b. 4000 psi concrete: 5 ¾ bags per cubic yard. Maximum water 5.5 gallons per bag.
   c. Pumped concrete: Increase minimum cement content as required to maintain equivalent water/cement ratios to those required for strengths of non-pumped concrete.
   d. Maximum Water/Cementitious material ratio is 0.50 unless noted otherwise in project plans.

3. Exterior Exposed Concrete:
   a. Air entrainment and water reducing admixtures as required. Do not add air entrainment agents to concrete to be abrasive blasted.
   b. Minimum Cement: 5 ½ bags per cubic yard.
   c. Maximum Water: 5 ½ gallons per bag.

4. Semi Lightweight Structural Concrete:
   a. Dry Weight: 110 pounds per cubic foot
   b. Splitting Tensile Strength: When tested in accordance with ASTM C496, minimum as follows for given compressive strength.
   c. Modulus of Elasticity: Minimum 2,400,000 pounds per square inch (secant modulus at 0.3 f'c).
   d. Cement Factor and Water-Cement Ratio: Base on degree of saturation and absorption characteristics of lightweight aggregates stockpiled for use.
   e. Shrinkage Compensated Cement: May be used to control drying shrinkage if acceptable to Architect.
   f. Natural Sand: ASTM C33 Substitute for lightweight fines.

5. Pumped Concrete:
   a. Aggregates:
      1) Maximum Size: One-third maximum opening in either pump or pipeline, whichever is smaller.
      2) Grading: As close as possible to middle of ASTM C33; for normal weight concrete and ASTM C330 for semi lightweight concrete grading range.
      3) Fine Aggregate Fineness Modulus (FM): 2.4 to 3.0 with 15 to 30 percent passing number 50 sieve and 5 to 10 percent passing number 100 sieve.

4) Daily Variation in Fineness Modulus (FM): 0.20 from value used in selecting proportion.
5) Lightweight Aggregate Moisture Content: At lease equal to 24-hour absorption percentage when tested in accordance with ASTM C127.

b. Admixtures:
1) Pumping Aids: As required to produce pumpable mix with sufficient strength.
2) Accelerators: Do not use with pumped concrete.

D. Concrete shrinkage test:

1. Before placing any concrete slabs or exposed concrete above grade, prepare a trial batch of the mix design, using the same aggregates, cement and admixtures (if any) proposed for use on the Project. Prepare at least 3 specimens for determining the "drying shrinkage" of each mix design including structural semi-lightweight concrete.
2. The "drying shrinkage" specimens shall be 4” x 4” x 11” prisms, made, cured, dried and measured as specified in ASTM C 157. Measure and report separately for 7, 14, 21 and 28 days of drying, after 7 days of moist curing. The effective gauge length of the specimens shall be 10”.
3. The average "drying shrinkage" of the test specimens after 28 days of drying shall not exceed 0.045%.

E. Submit reports showing results of sieve analysis, mix design and results of compression tests.

1. Make test specimens from not less than 3 batches of each design mix.
2. The trial batch strength for each mix shall exceed indicated f'c by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318.
3. Do not start concrete production until mixes have been reviewed and are acceptable to the Architect.

F. Concrete mixing:

1. Mixing and delivery shall comply with ASTM C 94, these Specifications, and Building Code requirements.
2. The Owner's Testing Agency will perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. The Owner's Testing Agency will send a written report of each inspection to Architect indicating compliance with these Specifications.
3. In addition to the requirements of ASTM C 94 section 16.1, provide the following information on delivery tickets signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site.
   a. Type and brand of cement.
   b. Cement content per cu. yd. of concrete.
   c. Maximum size of aggregate.
   d. Total water content expressed as water/cement ratio.
   e. Time batched.
4. Deliver batch tickets to Inspector at the site when concrete is delivered.
5. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.

6. Remove all materials, including water remaining in the ready-mix truck drum, completely before ingredients for the following loads are introduced in the drum.
7. Do not use concrete that has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 30 00

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SECTION 03 35 00 - CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete finishes and concrete surface repairs.

B. Related Sections:
   1. Section 03 10 00 - Concrete Formwork.
   2. Section 03 20 00 - Concrete Reinforcing.
   3. Section 03 30 00 - Cast-In-Place Concrete.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. As-Cast”: Formed concrete surfaces upon removal of forms, without additional finishing, coloring, sandblasting or other remedial work.

B. Cast-In-Place Architectural Concrete or Architectural Concrete: Formed concrete that is exposed to view on surfaces of the completed site work, structure or building and that requires special concrete materials, formwork, placement, or finishes such that the resulting finished surfaces have a smooth, as-cast, finish and obtain the specified architectural appearance. For the purposes of this project Cast-In-Place Architectural Concrete shall include, but is not limited to, exterior building walls or structural walls exposed to view, the visible surfaces of all site walls, planters and benches and the visible surfaces of the vertical concrete elements in the courtyards and building entry stairs.

C. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

D. Defective Finished Surfaces: Architectural concrete surfaces, including slabs, not meeting requirements of this section, as determined by the Architect.

E. Design Reference Sample: Sample designated by the Architect in the Contract Documents that reflects acceptable surface quality and appearance of cast-in-place architectural concrete.

F. Reveal: Projection of coarse aggregate from matrix or mortar after completion of exposure operations.

G. Surface Air Voids: Small regular or irregular cavities, usually not exceeding 5/8-inch (15mm) in diameter, resulting from entrapment of air bubbles in the surface of formed concrete during placement and consolidation (bugholes).

H. Surface Finishes as follows: Provide surface finishes complying with ACI 347.3R
   1. Formed Concrete Surface Category CSC1
      a. Concrete surfaces in areas with low visibility or of limited importance with regard to formed concrete surface requirements, used or covered with subsequent finish materials.
      b. Texture: T1; as described in ACI 347.3R, Table 3.1b
      c. Surface Void Ratio: SVR1; as described in ACI 347.3R, Table 3.1d
      d. Color Uniformity: CU1; described in ACI 347.3R, Table 3.1b
      e. Surface Irregularities: SJ1; as described in ACI 347.3R, Table 3.1b
      f. Construction and Facing Joint: CJ1; as described in ACI 347.3R, Table 3.1b
      g. Mockup: Not required
      h. Form-Facing Category: FC1; described in ACI 347.3R, Table 3.1c
   2. Formed Concrete Surface Category CSC2
      a. Concrete surfaces where visual appearance is of moderate importance
      b. Texture: T2; as described in ACI 347.3R, Table 3.1b
      c. Surface Void Ratio: SVR2; as described in ACI 347.3R, Table 3.1d
      d. Color Uniformity: CU1; described in ACI 347.3R, Table 3.1b
      e. Surface Irregularities: SJ2; as described in ACI 347.3R, Table 3.1b
      f. Construction and Facing Joint: CJ1; as described in ACI 347.3R, Table 3.1b
      g. Mockup: Not required
      h. Form-Facing Category: FC1; described in ACI 347.3R, Table 3.1c
   3. Formed Concrete Surface Category CSC3
      a. Concrete surfaces that are in public view or where appearance is important, such as exterior or interior exposed building elements.
      b. Texture: T3; as described in ACI 347.3R, Table 3.1b
      c. Surface Void Ratio: SVR3; as described in ACI 347.3R, Table 3.1d
      d. Color Uniformity: CU2; described in ACI 347.3R, Table 3.1b
      e. Surface Irregularities: SJ3; as described in ACI 347.3R, Table 3.1b
      f. Construction and Facing Joint: CJ3; as described in ACI 347.3R, Table 3.1b
      g. Mockup: Required
      h. Form-Facing Category: FC2; described in ACI 347.3R, Table 3.1c
   4. Formed Concrete Surface Category CSC4
      a. Concrete surfaces where the exposed concrete is a prominent feature of the completed structure or visual appearance is important.
      b. Texture: T4; as described in ACI 347.3R, Table 3.1b
      c. Surface Void Ratio: SVR3 or SRV4; as described in ACI 347.3R, Table 3.1d
      d. Color Uniformity: CU2 or CU3; described in ACI 347.3R, Table 3.1b
      e. Surface Irregularities: SJ4; as described in ACI 347.3R, Table 3.1b
      f. Construction and Facing Joint: CJ4; as described in ACI 347.3R, Table 3.1b
      g. Mockup: Required
      h. Form-Facing Category: FC3; described in ACI 347.3R, Table 3.1c

1.4 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide smooth concrete surfaces at exposed cast-in-place concrete, utilizing steel, fiberglass or plastic-coated forms or any other kind of material that will impart no pattern to concrete.

B. Pour joints of cast-in-place concrete shall align with reveals, rustication joints and/or control joints as indicated on the Drawings.

2.2 MATERIALS

A. Concrete Formwork: See Section 03 10 00.
   1. High Quality Forms: Meeting ACI A347R, Class A.

B. Concrete Reinforcing: See Section 03 20 00.

C. Cast-In-Place Concrete: See Section 03 30 00.

D. Curing Compound: ASTM C309, and shall conform with all applicable air pollution regulations.

E. Curing Compound: ASTM C309, and shall conform with all applicable air pollution regulations.

F. Finishing:
   1. Exterior Concrete Walls: Texture TBD
   2. Interior Concrete Walls: Smooth trowel texture.
   3. Interior Concrete Floor over Metal Deck: Smooth trowel texture.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 35 00

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SECTION 03 35 44 – POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polished natural concrete slabs.
   2. Special floor flatness performance requirements for polished concrete floors.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete: Standard floor flatness troweling requirements.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Class A – Cream Finish: Polish portland cement paste resulting in little or no aggregate exposure.

B. Class B – Fine Aggregate (Salt and Pepper) Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.

C. Class C – Medium Aggregate Finish: Remove not more than 1/8 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying medium aggregate with no, or small amount of, large aggregate at random locations.

D. Class D – Large Aggregate Finish: Remove not more than 1/4 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying large aggregate with no, or small amount of, fine aggregate at random locations.

E. Level 1 – Low Gloss Appearance:
   1. Procedure: Not less than 4 step process with full refinement of each diamond pad up to 400 grit resin bonded pad with one application of densifier.
   2. Gloss Reading: Not less than 40 according to ASTM E430 before polish guard application.

F. Level 2 – Medium Gloss Appearance:

1. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
2. Gloss Reading: Not less than 55 according to ASTM E430 before polish guard application.

G. Level 3 – High Gloss Appearance:
1. Procedure: Not less than 6 steps with full refinement of each diamond pad up to 1500 grit resin bonded pad with one application of densifier.
2. Gloss Reading: Not less than 60 according to ASTM E430 before polish guard application.
3. Gloss Reading: Not less than 70 according to ASTM E430 before polish guard application.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical data sheets and installation instructions for each product specified including the following:
1. Liquid surface treatment.
2. Floor polish.

B. CALGreen Submittals: Provide product data for the following:
1. For CALGreen 5.504.4.3 – Finish Material Pollutant Control, Paints and Coatings: Product data and material safety data sheets (MSDS) for coatings, including printed statement of chemical composition and VOC content of each product used.

1.5 SITE CONDITIONS

A. Coordinate the work so as not to delay other work in progress.

B. Maintain the immediate work areas clear of other trades, pedestrian traffic and disturbances immediately prior to and during polishing operations.

C. Damage and Stain Prevention: Take precautions to prevent damage and staining of concrete surfaces to be polished.
1. During Concrete Pour: Do not permit workers to walk through concrete pour during placement as foot tracks may telegraph to the surface when floors are polished.
2. Inspect and Diaper all hydraulic powered equipment to avoid staining of the concrete.
a. Ensure vehicles and equipment used on slabs have tires that will not leave marks.
3. Prohibit vehicle parking over concrete surfaces to be polished.
a. If necessary to complete their scope of work, place drop cloths under vehicles at all times.
4. Prohibit pipe cutting and threading operations over concrete surfaces to be polished.
5. Prohibit ferrous metals storage over concrete surfaces to be polished.
6. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment working over concrete surfaces to be polished.
7. Protect from acids and acidic detergents contacting concrete surfaces to be polished.
8. Protect from painting activities over concrete surfaces to be polished.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Improve performance of floor by installation of polished concrete floor system as measured by the following criteria:
   1. Static Coefficient of Friction: Achieve the following for level floor surfaces as determined by quality control testing according to ANSI/NFSI B101.1:
      a. Dry Surface: 0.80.
      b. Wet Surface: 0.74.
   2. Specular Gloss/Reflectance, ASTM D523:
      a. 20 Degrees: 3.66 degrees.
      b. 60 Degrees: 23.7 degrees.
      c. 85 Degrees: 30.6 degrees.
   3. Floor Surface Profile, ASTM E 1155:
      a. Floor Flatness Number (F_F): 50.
      b. Floor Levelness Number (F_L): 35.

2.2 POLISHING MATERIALS

A. Liquid Densifier: Odorless, non-hazardous, silicate that penetrates concrete to react with free lime and calcium hydroxide to produce permanent chemical reaction that hardens and densifies concrete surface.
   1. Use materials that have maximum VOC content of 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Grout Material: Clear modified silicate sealant, containing no pore clogging latex, when mixed with dust salvaged from grinding process forms a paste that reacts with calcium hydroxide in concrete that hardens when surface imperfections are filled.

C. Polish Guard: Non-film forming, stain resistant, food resistant, chemical stain resistant, impregnating sealant designed to be used on concrete surfaces previously densified.

D. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

E. Water: Potable.

F. Final Polished Concrete Floor Finish:
   1. Class B – Fine Aggregate (Salt and Pepper) Finish: Remove not more than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.
   2. Level 2 – Medium Gloss Appearance:
      a. Procedure: Not less than 5 step process with full refinement of each diamond pad up to 800 grit resin bonded pad with one application of densifier.
      b. Gloss Reading: Not less than 55 according to ASTM E430 before polish guard application.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 35 44

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SECTION 03 60 00 - GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Grout under column base plates, and elsewhere as shown on the Drawings and required by job conditions.

B. Related work in other Sections:

1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 05 12 00 – Structural Steel

1.2 SUBMITTALS

A. Procedure: In compliance with Division 1, General Conditions.

B. Data: Manufacturer's data sheets and independent test data for each type of grout proposed for use.

1.3 HANDLING

A. Procedure: In accordance with Division 1, General Conditions.

PART 2 - PRODUCTS

2.0 PRODUCTS

2.1 MANUFACTURERS

A. One of the following:

1. Euco NS Grout, The Euclid Company
2. Masterflow 928 Grout; Master Builders.
3. Five Star Grout; US Grout Corp.
4. Sonogrout, Sonneborn-Contech, Inc.

2.2 MATERIALS

A. Grouts:

1. Pre-packaged, non-metallic, non-gaseous, non-shrinking when tested in accordance with ASTM C 1107 Grade B or C at a fluid consistency (flow cone) of 20 to 30 seconds.

2. 30-minute old grout shall flow through flow cone after slight agitation, in temperatures of 40 to 90 deg. F.
3. Grout shall be bleed-free.

B. Grout strengths:

1. Where installed beneath base plates for steel columns: Minimum 28-day strength of 7,000 psi.
2. At non-structural locations: Minimum 28-day strength of 4,000 psi.

PART 3 - EXECUTION – NOT USED

END OF SECTION 03 60 00

SECTION 03 73 00 - CONCRETE EPOXY ADHESIVE INJECTION

PART 1 - GENERAL

1.1 SCOPE

A. For Cracks up to ¼".

1. Requirements of the general conditions, supplementary general conditions and division 1 apply to work of this section.
2. Furnish all labor, materials, services equipment and appliance required to perform all work to complete the contract, including but not limited to, these major items:
3. Injection of concrete members with liquid epoxy adhesive in walls and architectural concrete members. Cracks that are at least .030 inches wide are to be epoxied.
4. All work shall conform to current standards for historical restoration.

B. RELATED WORK

1. Tests and inspections.
2. Repair of concrete and concrete finishes.

1.2 QUALITY ASSURANCE

A. Manufacturer qualifications: Provide epoxy injection system, which is the product of a manufacturer whose complete system has been approved by the architect. The manufacturer shall have a system that has been used for epoxy injection projects similar in nature for a minimum of fifteen (15) years. Pay all fees and obtain approval for material prior to commencing work.

B. Sub-contractor qualifications: The epoxy injection sub-contractor will have successfully performed previous installations similar in nature to the one involved in this contract. The epoxy injection sub-contractor shall have a minimum of the (5) years experience with epoxy injection work and shall be a trained and recommended applicator of the epoxy injection material manufacturer.

C. Qualifications of epoxy injection field superintendent: All work in the field shall be performed under the immediate control of a foreman or superintendent experienced in this type of work. This person shall exercise close check and rigid control of all operations as necessary for full compliance with all requirements.

D. Worker's qualifications: Contractors/Subcontractors workers in the epoxy injection process shall have completed a program of instruction in the methods of restoring concrete structures, utilizing the specific epoxy injection process indicated. The curriculum shall include theory in the nature and causes of cracking in concrete, methods of permanently repairing damaged concrete structures, he technical aspects of correct material selection and use, and the operation, maintenance and trouble shooting of equipment.

1.4 TESTING AND INSPECTION

A. Material Tests: Owner's testing laboratory will provide all material tests as required by architect and as specified herein. Owner will pay for any costs of testing.

B. Inspections: If necessary, owner will arrange and pay for the services of registered deputy building inspector for continuous inspections of all epoxy injection work. Inspector will be continuously present during the epoxy injection operations, and will make written reports to engineer, and certifications to architect as to compliance with building code requirements and contract drawings and specifications.

C. Field Quality Control:

1. Core Testing to verify penetration and strength. (Note: It is imperative that no rebar or tendons be cut. It may be necessary to use a pachometer to locate existing reinforcing).
2. Initial Cores: The contractors/subcontractor shall obtain one (1) 2" diameter initial core sample for each 100 lineal foot of crack repaired or as directed by the architect.
3. The cores shall be adequate in diameter to intersect the crack to the full depth of core and taken from locations as directed by the architect.

D. Methods of Testing Initial Cores

1. Penetration: Visual Examination
2. Bond Strength Compression Test: ASTM C 39

E. Test Requirements:

1. Penetration: A minimum of 90 percent of the crack shall be full of epoxy adhesive.
2. Bond Strength/Compression Test: concrete failure before adhesive failure, or 5,000 PSI with no failure either concrete or adhesive.

3. Evaluation and Acceptance of Tests: If the initial cores conform to the requirements of C.2 "Penetration" and "Bond Strength", epoxy adhesive injection work at the area represented by the cores shall be accepted.
4. If the initial cores do not conform to the requirements of C.2 "Penetration" above, the work shall not proceed further until the area represented by the cores is re-injected and retested for acceptance.
5. After rework of areas represented by failed initial cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.
6. If cores do not conform to the requirements for C.2 "Bond Strength" above, the work shall be re-injected.
7. After rework of areas represented by failed cores is complete, the contractor shall obtain verifying cores, the number and location to be determined by the engineer. Verifying cores shall be tested in accordance with paragraph C.2 and C.3 for compliance.

F. Payment for core testing:

1. Testing of initial core samples which have been taken by the contractor will be performed by the owner's representative at the owner's expense.
2. Additional cores, called verification cores, required as indicated in paragraph C.4 (rework) herein, will be tested by the owner at the contractor's expense in accordance with the established fee schedule.

G. Pressure Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and tow adhesive component delivery lines shall be attached to the pressure check device. The pressure check device shall consist of two independent valved nozzles capable of controlling back pressure by opening or closing valve. There shall be a pressure gauge capable of sensing the pressure build up behind each valve. The valves in the pressure check device shall be closed and the equipment operated until the gauge pressure on each line reads 160. The pumps shall be stopped and the gauge pressure shall not drop below 150 PSI within 2 minutes.
2. Frequency of Pressure Test: The pressure test shall be run for each injection unit at the beginning of the shift and every four hours of use for all shifts the unit is used on the work of delaminations/crack repair.

H. Ratio Test of Injection Equipment:

1. Method: The mixing head of the injection equipment shall be disconnected and the two adhesive components shall be pumped simultaneously through the ratio checkdevice. The ratio check device shall consist of two independent valved nozzles capable of sensing the back pressure behind each valve. The discharge pressure shall be adjusted to 160 PSI for both components. Both adhesive components shall be simultaneously discharged into separate the calibrated containers. The amounts discharged into the calibrated containers during the same time period shall be compared to determine that the volumes discharted deviate no more than 5% from the correct ratio as specified in the manufacturers product data sheet.
2. Proof of Ratio and Pressure Testing

I. At all Times during the course of the work the contractor shall keep complete an accurate record of the pressure and ratio tests specified above. These records shall be available to the architect. In addition, the architect/engineer, at any time without prior notification of the contractor, may request the contractor to conduct the tests specified above in the presence of the architect/engineer.

PART 2 - PRODUCTS

2.1 HIGH STRENGTH EPOXY RESIN ADHESIVE FOR INJECTION

A. Provide LARR reports for all products used for approval by architect/engineer.

B. Epoxy injection adhesive shall be Sikadur 53 as manufactured by Sika Corporation, tel (800) 933-7452, or ETI manufactured by Simpson Strong Tie, tel (562) 699-0543, or approved equal.

C. Surface Sealant: SikaTop 123 as manufactured by Sika Corporation, or ETR Epoxy Paste as manufactured by Simpson Strong Tie, or approved equal, and shall be sufficiently strong to resist injection pressures to prevent leakage during injection.

D. Provide other materials as required and recommended by manufacturers subject to approval by architect/engineer.

E. Equipment for injection type: The equipment used to meter and mix the two injection adhesive components, and inject the mixed adhesive into the crack shall be portable, positive displacement type pumps with interlock to provide ratio control of exact proportions

of the two components at the nozzle. The pumps shall be electric or air powered and shall provide in line metering and mixing.

F. Discharge pressure: The injection equipment shall have automatic pressure control capable of discharging the mixed adhesive at any pre-set-set pressure up to + 1-5 PSI and shall be equipped with a manual pressure control override.

G. Ratio tolerance: The equipment shall have the capability of maintaining the volume ratio for the injection adhesive prescribed by the manufacturer of the adhesive within a tolerance of + 1-5% by volume at any discharge pressure up to 160 PSI.

H. Automatic Shut-Off Control: The injection equipment shall be equipped with sensors on both the component A and the component B reservoirs that will automatically stop the machine when either reservoir becomes dry.

PART 3 - EXECUTION OF WORK – NOT USED

END OF SECTION 03 73 00

SECTION 04 22 00 – CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes unit masonry assemblies consisting of the following:

1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry joint reinforcement.
5. Ties and anchors.
6. Embedded flashing.

B. Related Sections:

1. 03 20 00 Concrete Reinforcing
2. 03 30 00 Cast-in-Place Concrete
3. 05 12 00 Structural Steel

1.2 ACTION SUBMITTALS

A. Product Data: For each masonry unit, accessory, and other manufactured product indicated.

B. Shop Drawings: For masonry reinforcing bars; comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.

C. Samples: Showing the full range of colors and textures available for exposed masonry units.

1.3 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each type of masonry unit, mortar, and grout required.

1.4 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements in ACI 530.1/ASCE 6/TMS 602.

E. Hot-Weather Requirements: When ambient temperature exceeds 100 deg F, or 90 deg F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Products: Subject to compliance with requirements, provide one of the following:

1) ACM Chemistries, Inc.; RainBloc.
2) BASF Aktiengesellschaft; Rheopel Plus.
3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

C. Concrete Masonry Units: ASTM C 90.

1. Density Classification: Medium weight.
2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
3. Type: I, moisture-controlled units.

D. Concrete Building Brick: ASTM C 55.
1. Density Classification: Medium weight.
2. Size (Actual Dimensions): 3-5/8 inches wide by 3-5/8 inches high by 7-5/8 inches long.

2.3 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from deep-cut U-shaped bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 REINFORCING

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M; ASTM A 616/A 616M, including Supplement 1; or ASTM A 617/A 617M, Grade 60.

2.5 TIES AND ANCHORS

A. Materials, General: As follows, unless otherwise indicated:

1. Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating for exterior walls and Class 1 coating for interior walls.
2. Galvanized Steel Sheet: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153, at exterior walls; and ASTM A 653/A 653M, G60, commercial-quality, steel sheet zinc coated by hot-dip process on continuous lines before fabrication at interior walls.

B. Bent Wire Ties: Rectangular units with closed ends and not less than 4 inches wide, made from 3/16 inch diameter, galvanized steel wire.

1. Where coursing between wythes does not align, use adjustable ties composed of 2 parts; 1 with pintles, the other with eyes.

C. Adjustable Anchors for Connecting to Steel Frame: Two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall.

1. Anchor Section: Crimped 1/4 inch diameter, galvanized steel wire anchor section for welding to steel.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.1875 inch diameter, galvanized steel wire.

D. Anchors for Connecting to Concrete: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

2.6 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Dovetail Slots in Concrete: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.034-inch, galvanized steel sheet.

C. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.7 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.
2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

3. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
4. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

B. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from high-density polyethylene incorporating chemical stabilizers that prevent UV degradation. Cell flashing pans have integral weep spouts that are designed to be built into mortar bed joints and weep collected moisture to the exterior of CMU walls and that extend into the cell to prevent clogging with mortar.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Mortar Net USA, Ltd.; Blok-Flash.

C. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Designed to fit standard sash block and to maintain lateral stability in masonry wall. Made from styrene-butadiene-rubber compound complying with ASTM D 2000, Designation M2AA-805 cross-shaped premolded rubber spacers that form the vertical joint and serve as backer for sealants.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.9 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2 cup dry measure tetrasodium polyphosphate and 1/2 cup dry measure laundry detergent dissolved in 1 gal. of water.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. Place 1/2 of water and sand in operating mixer. Then, add cement, lime, and admixture, and remainder of sand and water. After all ingredients are in the mixer, mix mechanically for not less than three minutes. Do not hand-mix ingredients.

C. Use admixtures as recommended by admixture manufacturer. Engage manufacturer or distributor supervision by a qualified field representative to ensure proper use of admixture.

D. Mortar for Unit Masonry: Comply with CBC Table(s) 2103.8(1), (2), or ASTM C 270 (cement-lime) for Type S mortar.

1. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.
2. For masonry below grade, in contact with earth, and where indicated, use Type M.
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for exterior veneer walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.

E. Grout for Unit Masonry: Comply with CBC Table 2103.12, or ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 5 of ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.
   a. Use grout as fluid as possible for placing without segregation of constituent parts.

F. Retempering:

1. Mortar may be retempered with water as required to maintain high plasticity.
2. Retemper on mortar boards only, by adding water within a basin formed with the mortar and reworking the mortar into the water.
3. Mix mortar and grout uniformly. Use admixture according to manufacturer's written instructions.
4. Discard mortar and grout that are unused after 90 minutes from initial mixing time.

PART 3 - EXECUTION – NOT USED

END OF SECTION 04 22 00

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SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Includes:
   1. Structural steel as indicated on the Drawings, consisting and defined and enumerated in Section 2 - Definition of Structural Steel, of AISC Specifications and Code of Standard Practice.
   2. Shop priming structural steel concealed in the finished work and where not indicated or required to receive sprayed on fireproofing.
   3. Fabrication and finishing (hot dip galvanizing) of Architecturally Exposed Structural Steel is specified in Section 05 12 13.

B. Products furnished but not installed under this Section:
   1. Anchors for casting into concrete.
   2. Loose bearing plates to receive structural steel.

C. Related work includes:
   1. Grouting beneath base and bearing plates: Section 03 30 00.
   2. Special requirements for Architecturally Exposed Structural Steel: Section 05 12 13.
   3. Metal stairs: Section 05 51 00.

D. Related work provided by Owner:
   1. Registered Deputy Inspector to inspect the fabrication, placement, welding, and high tensile bolting of structural steel in accordance with Building Code requirements.
   2. Testing Agency employed by the Owner shall provide all tests specified herein in accordance with Building Code requirements.

1.2 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:
   1. AISC "Code of Standard Practice for Steel Buildings and Bridges.
      a. Paragraph 4.2.1 of the above Code is hereby modified by deletion of the following sentence: "This approval constitutes the Owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as part of his preparation of these shop drawings.
      b. Paragraph 4.2.2 delete in its entirety.
      c. Paragraph 7.9.3 of the above code is hereby modified by deletion of the following words: "The contract documents specify the sequence and schedule of placement of such elements."
   2. AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings "and including the Commentary" and Supplements thereto as issued.
      a. Exterior structural steel exposed to public view including supports at canopies, shall comply with requirements of Section 10 "Architectural Exposed Structural Steel".
   3. AWS D1.1 & D1.8 "Structural Welding Code."
   4. ASTM-A6 "General Requirements for Delivery of Rolled Steel Plates,

Shapes. Sheet Piling and Bars for Structural Use."

5. SSPC - Steel Structures Painting Manual, Volume 2, Systems and Specifications.

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure."

C. Source Quality Control: Materials and fabrication procedures are subject to inspection and test in mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1. Promptly remove and replace materials or fabricated components which do not comply.

D. Structural General Notes shall apply to the work of this Section as though repeated verbatim herein.

1.3 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01 33 00.

B. Shop drawings:

1. Submit complete shop and erection diagrams required for the work of this Section.
2. Make erection diagrams as complete as possible before first submittal.
   a. Should more than one submittal be required, later submittals shall clearly identify material added or revised subsequent to previous submittal.
   b. Indicate all shop and erection details, including cuts, copes, connections, holes, threaded fasteners, and welds.
3. Identify welds, both shop and field, by AWS A2.4 Symbols for Welding and Non-Destructive Testing.
4. Coordinate shop drawings with the trades performing the work of Divisions 15 and 16. All holes and openings in beams for passage of ducts and pipes shall be shown on shop drawings and shall be made in the shop.

C. Review of shop drawings shall not relieve the Contractor from compliance with the requirements of the Structural Drawings and Specifications. The omission from shop drawings of any material shown of specified on the original Structural Drawings shall not relieve the Contractor of the responsibility for furnishing and installing such materials even though such shop drawings may have been returned with no exceptions observed.

D. Proof of compliance for materials: Submit mill test reports for all structural steel. Refer to paragraph 1.3.B.2.a for unidentified local stock steel.

E. Submit proposed sequence of field welding and obtain acceptance by Structural Engineer before beginning work. Field weld sequence shall be planned to minimize residual stress due to weld shrinkage.

F. Manufacturer's data: Submit manufacturer's data on paint primer to be used on structural steel, including evidence that primer used beneath sprayed fireproofing is acceptable to the sprayed fireproofing materials manufacturer.

1.4 HANDLING

A. Comply with the requirements of Section 01 65 00.

B. Storage:

1. Store steel members at the site above ground on platforms, skids or other approved supports.

2. Protect steel from mechanical damage and corrosion.
3. Comply with the combined recommendations of the AWS and the electrode manufacturer for their storage and care. Do not use electrodes that have been wetted.
4. Store other materials in a weather tight and dry place, until ready for incorporation into this work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rolled steel plates, shapes and bars: As indicated on the Structural General Notes.
B. Structural tubing: As indicated on the Structural General Notes.
C. Pipe columns: As indicated on the Structural General Notes.
D. Fastening materials:
   1. Bolts: ASTM A325 or A490, unless otherwise noted on the Drawings. High strength bolts shall be bearing type with threads excluded from the shear planes (I.E. A325-X) unless otherwise noted.
   2. Unfinished threaded fasteners, together with their nuts and washers: ASTM A307, Grade A, regular low carbon steel, hexagonal heads and nuts, where noted.
   3. Arc-welding electrodes: In accordance with Structural General Notes.
E. Anchor bolts: ASTM A307, non-headed type, or ASTM A449 as indicated on the Drawings.
F. Shop primer and field touch-up for concealed structural steel (non-fireproofed surfaces only): Series 10 Tnemec Primer, by Tnemec Co., or equal by Ameron.

2.2 FABRICATION

A. Workmanship equal to the best of standard practice in modern structural shops, and conforming to applicable provisions of the AISC Code of Standard Practice and Specifications.
B. All fabrication must be performed in shop of Building Department approved licensed fabricator. It is assumed that all fabrication will take place in one shop only. All additional inspection costs resulting form fabrication at more than one shop location will be back-charged to the Contractor.
C. Before being fabricated, or worked, wire-brush materials, clean of loose mill scale and rust, and straighten by methods that will not injure the steel.
   1. After punching or working a member, remove twists or bends before the parts are assembled.
   2. Finished members shall be free from twists, bends, and open joints when erected.
D. Punch or drill holes; burned holes will be unacceptable.
E. Prior to fabrication, perform ultrasonic inspections on the areas of column flanges and girder flanges specified in paragraph 3.5,C,3.
F. After fabrication surfaces of structural steel except those indicated or required to be fireproofing (Architecturally exposed structural steel shall receive a hot-dip galvanized finish and shall remain unpainted in the finished work, see Section 05 12 13):

   1. Shop Painting:

      a. Clean steel members, including their connections, in accordance with SSPC SP1, SP2, and SP3 as applicable, and the primer

manufacturer's printed recommendations, and apply primer immediately thereafter to clean, dry surfaces, to a minimum dry film thickness recommended by primer manufacturer.

b. Primer may be held 4" back from areas to be field welded where primer would interfere with good welding practices. Remove weld splatter from all welded joints, whether primed or not.

2. Shop Painting (NON-FIREPROOFED SURFACES ONLY):
   a Paint all structural steel with a shop coat of paint, except:
      1) Members encased in concrete.
      2) Contact surfaces of welded connections and areas within 2" of field welds except as noted.
      3) Surfaces receiving sprayed-on fireproofing.
      4) Surfaces receiving field welded steel studs.
   b Apply specified shop coat in accord with manufacturer's product data to provide a minimum dry film thickness recommended by paint manufacturer for each type of primer used. Apply shop coat of paint within four hours after cleaning and before rust-bloom occurs. Paint only in relative humidity below 85% and surface temperatures of 5 degrees Fahrenheit above dew point. Shop coat shall be applied using spray equipment on all structural steel exposed to public view.
   c. Apply lacquer to milled surfaces to dry film thickness of 0.5 mils.
3. Apply a heavy coat of bituminous paint to metal surfaces in contact with concrete or masonry. Do not apply on exposed surfaces.

PART 3 – EXECUTION – NOT USED

END OF SECTION 05 12 00

SECTION 05 30 00 - METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Principal work in this Section:

1. Metal decking.
2. Accessories, filler pieces and metal closure pieces.

B. Related work in other Sections:

1. Section 05 12 00 – Structural Steel
2. Section 05 50 00 – Metal Fabrications
3. Section 05 03 00 – Hot Dip Galvanizing
4. Section 03 30 00 – Cast-in-place Concrete

1.2 SUBMITTALS

A. Procedure: In accordance with Division 1.

B. Dimensioned shop drawings showing section profiles, trim, detailed layout showing type and gage of steel decking, openings, sump pans (when applicable), supports, connections, welds and erection instructions. Identify welds by the AWS welding symbols. Indicate temporary shoring of decking where required.

C. Manufacturer's calculations and supporting data demonstrating that each metal deck proposed for use conforms to the Drawings, these Specifications and the Building Code.

D. Manufacturer's Installation instructions indicating specific installation sequence and special instructions.

1.3 QUALITY ASSURANCE

A. Welders' qualifications:

1. Welding shall be done only by welders currently certified for welding of light gage metal.
2. Qualification of welders and duration of qualification period in compliance with applicable requirements of AWS D1.3. Recertify and replace, with qualified welders, welders producing unsatisfactory welds, even though they have passed qualification tests.
3. Testing for recertification is Contractor's responsibility.

B. Design criteria:

1. Fire rating: Be responsible for obtaining UL and Building Department approval of the decking, when used as a part of the assembly indicated on the Drawings in which fire resistive construction ratings are required.
2. Design: In compliance with the following reference standards.

    a. SDI, Design Manual for Composite Decks, Form Decks and Roof Decks.
    b. AISI, Specification for the Design of Cold-Formed Steel Structural Members, and AISC, Manual of Steel Construction.

C. Shoring: Unless noted otherwise on the Drawings, the decking doesn't require shoring, except that when the weight of the wet concrete fill is expected to exceed the deck manufacturer's published data for safe capacity and allowable deflection. The Contractor shall determine these locations and provide temporary shoring until concrete fill has attained its 28-day strength.

1.4 HANDLING

A. Procedure: In accordance with Section 01 60 00.

B. Labeling: Label each unit or bundle of metal decking, which is UL classified, to show manufacture, testing and Inspection.

C. Protection: Work showing dents, creases, burrs in cells, deformations, weathering or other defects affecting its use will not be accepted.

D. Storage: Store units off the ground with one end elevated to permit drainage. In wet or damp weather, cover with waterproof tarpaulins to avoid rusting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel for decking and closure strips: ASTM A 653, with minimum yield strength of 33,000 psi, with a G 60 zinc coating.

B. Miscellaneous steel shapes: ASTM A 36.

C. Galvanizing repair paint: Tneme-Zinc 90-97 by Tnemec Co., Amercoat 68HS by Ameron Protective Coating Division, or MZ-4 by Valspar Corp.

D. Welding rods:

1. Complying with the printed recommendations of the metal deck manufacturer and AWS D1.1.
2. Submit the manufacturer's recommendations to the Architect prior to starting the installation.

2.2 FABRICATION

A. Decking:

1. Of the types and profiles indicated on the Drawings formed in lengths to span 3 or more supports, unless otherwise indicated, with flush, telescoping, or nested ends, end laps and nesting side laps.
2. Composite decking shall have either mechanically fixed shear devices such as embossments, holes or welded buttons, or inverted triangular shaped ribs.
3. Fabricate decking supporting waterproofing membrane, roofing and elastomeric coating with vent tabs protruding and staggered in the low flutes, 12 in. maximum o.c., or other joint deformation, to provide a minimum 1.5% openings (uniformly distributed) of the total deck area for relief of vapor pressure; do not use vent tabs to support mechanical equipment.

B. Form end closures, column flashing, access hole covers and cover plates of sheet metal.

C. Hangers for suspended ceilings:

1. Lip tabs or integral tabs. Nothing shall be hung from metal decking itself or from tabs punched directly in metal decking.
2. Provide slots or holes punched in decking for installation of pigtail wires.

D. Form roof sump pans from a single piece of galvanized sheet steel of same quality as deck units.

1. Thickness shall be a minimum of 14 gage before galvanizing.

PART 3 - EXECUTION – NOT USED

END OF SECTION 05 30 00

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SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and GENERAL PROVISIONS of Contract, including GENERAL and SUPPLEMENTARY CONDITIONS, DIVISION 1 Specification Sections apply to this Section.

B. Structural Steel in Section 051200.

C. Metal Decking in Section 053000.

D. Metal Fabrications in Section 055000.

1.2 SUMMARY

A. Types of cold-formed metal framing units include the following:

1. Load-bearing punched channel studs.
2. C-shaped load-bearing steel studs.
3. C-shaped steel joists.

1.3 SUBMITTALS

A. General: Submit the following, complying with Provisions in the SECTION 01330 – SHOP DRAWINGS/SUBMITTALS in DIVISION 1 - GENERAL REQUIREMENTS of the Project Manual.

1. Product data and manufacturer's recommended installation procedures for each of the framing components and accessories, including structural calculations.
2. Coordinate and submit horizontal and vertical Fastener Schedule of gypsum wallboard on the framing members for each wall type.
3. Shop drawings from framing members indicating stud sizes and gages, locations and spacings, fire ratings, top and bottom tracks, track to stud connection; exterior, interior and curtain walls and structural supports such as concrete and metal deck, steel beams; horizontal stiffener, bridging details, details of bracing installation, backing or support for other attachments required for proper installation, roof framing and support, roof or ceiling opening and support, etc. Indicate welds by AWS symbols, show size, type and length of welds. Provide setting drawing templates and directions for installing fasteners and other required anchors. Identify details by references to applicable Drawing Sheet and Detail Number on the Contract Drawings.

   Unless specified otherwise, after Engineer’s review, Contractor shall incorporate all comments and correction prior to submitting to the governing agencies for approvals. The Contractor shall deliver 7 copies of the approved plans and permit to Engineer for record and distribution.

4. Manufacturer's Mill Certificate certifying that products meet or exceed specified requirements.

5. Welder's Certificate: Submit manufacturer's certificates certifying welders employed on the work verifying AWS qualifications within the previous 12 months.

1.4 QUALITY ASSURANCE

A. Component Design: Calculate structural properties of studs and joists in accordance with American Iron and Steel Institute (AISI) “Specification for Design of Cold-Formed Steel Structural Members.”

B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3, “Structural Welding Code - Sheet Steel.”

C. Fire-Rated Assemblies: Where framing units are components of assemblies indicated for a fire-resistance rating, including those required for compliance with governing regulations, provide units that have been approved by governing authorities that have jurisdiction.

D. Pre-Installation Conference: Prior to start of installation of metal framing systems, meet at project site with installers of other work including door and window frames and mechanical and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.
1. Coordinate with provisions of DIVISION 1 Section “Project Meetings”.

E. Engineering responsibility:
1. Certain metal assemblies are design/build and are not fully detailed on the Drawings that indicate desired profile and design intent.
2. It is the Contractor's responsibility to engineer, fabricate and install these assemblies to conform to the profiles indicated and other requirements of the Contract Documents, and to satisfy applicable Codes. If required by the authorities having jurisdiction, the Contractor shall obtain its approval and pay fees incurred thereby before start of installation.
3. Limit metal framing systems deflection under load to the following:
a. L/240 where supporting gypsum board only.
b. L/360 where supporting ceramic tile.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

B. Manufacturers: Subject to compliance with the requirements of the UBC, LABC and the latest City of Los Angeles Research Report Number, provide products of one of the following or an approved equal:

1. Cemco
2. Western Metal
3. Dietrich Industries, Inc.
4. United States Gypsum Company

2.2 METAL FRAMING

A. System Components: Manufacturers' standard load-bearing steel studs and joists of type, size, shape, and gage as indicated. With each type of metal framing required, provide manufacturer's standard, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories for applications indicated, as needed to provide a complete metal framing system.

B. Materials and Finishes:

1. For 16-gage and heavier units, fabricate metal framing components of structural quality steel sheet with a minimum yield point of 40,000 psi; ASTM A446, A 570, or A611.
2. For 18-gage and lighter units, fabricate metal framing components of commercial quality steel sheet with a minimum yield point of 33,000 psi; ASTM A446, A570, or A 611.
3. Provide galvanized finish to metal framing components complying with ASTM A525 for minimum G 60 coating.
4. Provide prime-coated finish with one coat of shop-applied red-oxide, zinc-chromate, or other similar rust-inhibitive primer.
   a. Finish of installation accessories to match that of main framing components, unless otherwise indicated.
5. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.
6. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.
7. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.3 FABRICATION

A. General: Framing components may be prefabricated into assemblies before erection. Fabricate panels plumb, square, true to line, and braced against racking with joints welded. Perform lifting of prefabricated units to prevent damage or distortion.

B. Fabricate units in jig template to hold members in proper alignment and position and to assure consistent component placement.

C. Fastenings: Attach similar components by welding. Attach dissimilar components by welding, bolting, or screw fasteners, as standard with manufacturer.

D. Wire tying of framing components is not permitted.

E. Fabrication Tolerance: Fabricate units to a maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

PART 3 – EXECUTION – NOT USED

END OF SECTION 05 40 00

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included:

1. Metal fabrications whether or not specifically mentioned herein or in other sections of these specifications, but which are required to complete the work, 12 gage or heavier.

2. Bolts, washers, brackets, sleeves, angles, clips, etc., required in assembly, erection and securing the work of this Section.

3. Elevator hoistway dividers.

B. Products furnished but not installed under this Section: Metal fabrications installed in concrete and masonry.

C. Related work:

1. Security gates and fences.

2. Structural steel.

3. Metal stairs.

4. Aluminum railings.

5. Painting, except shop prime coats.

6. Hot-dip Galvanizing

1.02 QUALITY ASSURANCE

A. Comply with requirements of Section 01 40 00.

B. Railings:

1. Structural performance of handrails and railing systems: Engineer, fabricate and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.
   a. Top rail of guardrail systems: Capable of withstanding a uniform load of 20 pounds per lineal foot (at private balconies) and 50 pounds per linear foot (at public areas) per lineal foot applied horizontally at right angles to the top rail and concentrated load of 250 pounds applied in any direction at any point on the rail.

   b. Infill area of guardrail systems: Capable of withstanding the following loads applied as indicated:

      1) Concentrated load of 25 pounds per square foot applied horizontally at right angles over the entire tributary area,

including openings and spaces between rails.
2) Reactions due to the above load need not be combined with those loads on the toprail of guardrail system.
3) Wind loads as required by Building Code.

c. Handrails: The mounting of handrails shall be such that the completed handrail and supporting structure are capable of withstanding the following loads:

1) Concentrated load of 250 pounds applied in any direction at any point on the handrail.
2) These loads shall not be assumed to act cumulatively with those loads on the infill area of the guardrail system.

2. Thermal movement: Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in engineering, fabricating and installing of joints, overstressing of components and connections, and other detrimental effects. Base engineering calculations on actual surface temperatures of materials due to both solar heat gain and night time sky heat loss. Temperature change (range): 120 deg. F ambient; 180 deg. F material surfaces.

3. Control of corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

4. Railings shall be free of rattles.

C. Standards:

1. American Institute of Steel Construction, Inc. (AISC):
a. "Manual of Steel Construction", Third Edition.
b. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
c. "Code of Standard Practice for Steel Buildings and Bridges".
d. "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts".

2. American Welding Society (AWS): "Structural Welding Code", D1.1.

1.03 SUBMITTALS

A. Comply with requirements of Section 01300.

B. Product data: Complete materials list showing items proposed to be provided under this Section.

C. Shop drawings: Submit layout drawings and details showing required material, gauges, accessories, openings, finishes, welding notes and all other conditions affecting the material and installation.

1.04 FIELD MEASUREMENTS

A. Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel sections: ASTM A 36.

B. Steel tubing:

1. Cold-formed: ASTM A 500, Grade B.

2. Hot-formed: ASTM A 501.

C. Plates: ASTM A 283.

D. Pipe: ASTM A 53, Grade B, Schedule 40.

E. Bars and bar-size shapes: ASTM A 663, Grade 65 and ASTM A 675.

F. Carbon steel sheets and strips:

1. Hot rolled: ASTM A 568 and ASTM A 569.

2. Cold rolled: ASTM A 366.

G. Bolts, nuts, and washers: ASTM A 307.

H. Welding materials: AWS D1.1; type required for materials being welded.

J. Shop paint:

1. Primer: Manufacturer's standard.

2. For repair of galvanizing, use a high zinc dust content paint complying with DOD-P-21035 or SSPC-Paint 20.

2.02 MISCELLANEOUS FRAMING AND SUPPORT

A. Provide miscellaneous steel framing and supports as necessary to complete the work.

B. Fabricate units to the sizes, shapes and profiles indicated, or if not indicated, of the necessary dimensions to receive adjacent work to be retained by the framing.

C. Except as otherwise indicated, fabricate using mitered corners, welded brackets and splice plates and a minimum number of joints for field connections.

D. Equip units with integrally welded anchor straps for casting into cast-in-place concrete wherever possible.

2.03 FABRICATION

A. Fit and shop assemble in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured, true to line and level.

C. Weld corners and seams continuously. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed mechanical fastenings: Flush countersunk screws or bolts, unobtrusively located, consistent with design of component, except where specifically noted otherwise.

E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

F. Allow for thermal movement resulting from the maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss for a temperature range of 120 deg. F.

2.04 GALVANIZING

A. Comply with requirements of Section 050300.

B. Galvanize exterior steel members, bolts, nuts, washers, hardware, fabrications and assemblies after fabrication by the hot dip process.

C. Handle all articles to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

2.05 FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact bond with concrete or where field welding is required.

C. Prime and finish paint items in compliance with requirements of Section 09900.

PART 3 EXECUTION – NOT USED

END OF SECTION 05 50 00

SECTION 05 51 00 – METAL STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal stairs of the following configurations:
      a. Interior metal exit stairs with painted steel stringers and risers, and concrete infill at pan.
   2. Stair drawings are diagrammatic and show only the design intent of finished profiles, shapes, and forms; organization and spatial relationships between items; location, identification, dimension, and size of items and accessories; and schematic attachment details, including diagrams of fasteners, anchors, attachments, and connectors.
   3. Stair specifications are the performance type and only establish minimum allowable criteria for materials, products, components and accessories; and minimum performance requirements for indicated portions of the work.

B. Related Sections
   1. Section 05 50 00 – Metal Fabrications.
   2. Section 05 52 13 – Pipe and Tube Railings.
   3. Section 09 65 00 – Resilient Flooring: Rubber stair tread and riser finish material.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 COORDINATION

A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

C. Metal stair surfaces furnished to the Project site primed and not scheduled or indicated to be covered by an applied floor covering will be painted as specified in Section 09 91 00. Primer shall be compatible with finish coat of paint. Coordinate selection of primer with finish paint requirements specified in Section 09 91 00.

1.4 SCHEDULING AND SEQUENCING

A. Ensure timely fabrication of items to be embedded or enclosed by other work.

B. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

1.5 ACTIONS SUBMITTALS

A. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Note: Test reports are not an acceptable substitute for calculations and will be returned to the Contractor without review or responsive action except to record nonconformance with this requirement.

1.6 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Regulatory Requirements: Comply with applicable provisions of California Building Code (CBC), ADAAG and ANSI A117.1 as applicable for stairs and handrails.

C. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.
   1. Preassembled Stairs: Commercial class.

D. Design Criteria:
   1. Work shall be designed to support normally imposed loads and conform to AISC requirements.
   2. Built-up parts shall not exhibit warp.

E. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."

F. Tolerances: Coordinate fabrication and installation of stair and railing systems with adjacent building construction and verify critical dimensions to ensure accurate installation

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design metal stairs, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance of Stairs: Provide metal stairs capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
   2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
   3. Uniform and concentrated loads need not be assumed to act concurrently.
   4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
   5. Limit deflection of treads, platforms, and framing members to L/240 or 1/4-inch (6.4 mm), whichever is less.

C. Seismic Performance: Provide metal stairs capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

D. Design stair units, platforms and supports for a live load of 100 psf, minimum and other load required by most current edition of CBC in effect in the jurisdiction where the project is located.

E. Stairs shall be designed to accommodate 1 1/2" of drift between floors in all directions without collapse. This may entail sliding connections at the top of the stairs.

2.2 STEEL MATERIALS

A. Steel Materials:
   1. Structural Steel Shapes: ASTM A36/A36M, conforming to AISC specifications.
   2. Architectural and Miscellaneous Steel Items: ASTM A283/A283M.
   3. Steel Sheets: ASTM A36/A36M.
   4. Steel Pipe: ASTM A53/A53M.
   5. Steel Bars: ASTM A36/A36M.
   6. Steel Tubing: ASTM A500/A500M, Grade A.
   7. Steel Plate: ASTM A36/A36M.

B. Stair Stringers: Steel channel.

C. Finish: Shop prime to receive field-applied finish coating; 100% acrylic semi-gloss.

D. Concrete Fill: Comply with requirements for Section 03 30 00 for normal weight, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (21 MPa), unless higher strength is indicated.

E. Abrasive Metal Nosings:
   1. Cast-Metal Units: Cast aluminum, with an integral abrasive finish consisting of aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.
      a. Nosings: Cross-hatched units, custom width as indicated with 1/4-inch lip, for casting into concrete steps.
      b. Color of Abrasive Finish: Contrasting color as required by CBC.

2.3 STEEL-FRAMED STAIRS

A. General: Construct stairs to conform to sizes and arrangements indicated with welded connections, unless otherwise indicated. Provide complete stair assemblies, including metal framing, hangers, columns, railings, newels, balusters, struts, clips, brackets, bearing plates,

and other components necessary for the support of stairs and platforms, and as required to anchor and contain the stairs on the supporting structure.

1. Fabricate treads and platforms of exterior stairs to accommodate slopes to drain in finished traffic surfaces.

B. Stair Framing:
   1. Fabricate stringers of steel channels or tubes.
      a. Provide closures for exposed ends of channel stringers.
   2. Finish: Shop prime paint, unless otherwise indicated.

C. Platforms:
   1. Finish: Shop prime paint, unless otherwise indicated.
   2. Provide sub-platforms of configuration indicated matching sub-treads. Weld sub-platforms to platform framing.
      a. Construct subplatforms with smooth soffits.

D. Metal-Pan Stairs:
   1. Steel Sheet: Uncoated cold-rolled steel sheet, unless otherwise indicated.
   2. Form metal pans of uncoated cold-rolled steel sheet, unless otherwise indicated.
   3. Finish: Shop prime paint, unless otherwise indicated.

PART 3 - EXECUTION – NOT USED

END OF SECTION 05 51 00

SECTION 05 52 13 – PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and tube handrails and fittings.
   2. Metal pipe guardrails at interior and exterior.
   3. Definitions in ASTM E985 for railing-related terms apply to this Section.

B. Related Sections:
   1. Section 09 91 00 - Painting: Primer and paint finish.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 ACTION SUBMITTALS

A. Structural Analysis: Provide calculations demonstrating compliance of pre-engineered handrail and infill system with ADA and local building codes, including structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.3, "Structural Welding Code--Sheet Steel."

C. Handrails and railings shall comply with ADA requirements and California Building Code (CBC) 11B-505.
   1. At 2" minimum high curb or barrier shall be provided to prevent the passage of a 4" diameter sphere rolling off the edges on a ramp or landing surface. Such a curb or barrier shall be continuous and uninterrupted along the length of a ramp. CBC Section 11B-405.9.2.

D. Ramp handrails shall comply with CBC 11B-505.

E. Ramp guardrails shall comply with CBC 11B-505.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASTM E985 based on Testing per ASTM E894 and E935.

B. Structural Performance: Provide handrails and guards complying with CBC 1607A.8 that are capable of withstanding the effects of gravity loads at any point without damage or permanent set for railing assemblies, wall rails, and attachments, and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
      b. Infill load and other loads need not be assumed to act concurrently.

2.2 MATERIALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Pipe: ASTM A53/A53M; Type F or Type S, Grade A, standard weight Schedule 40; unless another grade and weight are required by structural loads, finish as specified.

C. Tubing: ASTM A500/A500M (cold formed).

D. Ornamental Stock: ASTM A500/A500M, Grade A, round steel rods, size as indicated on Drawings.

2.3 EXTERIOR POSTS AND RAILINGS

A. Railings:
   1. Diameter: 1-1/2-inch outside diameter railings.
   2. Tube Wall Thickness: 5/64-inch.
   3. Infill: Steel pickets, 1/4” x 1-1/2” solid bars, unless indicated otherwise on Drawings.
   4. Finish: G90 galvanized, painted.

B. Posts: Steel tubes.
   1. Diameter: As indicated on Drawings.
   2. Finish: G90 galvanized, painted.

C. Wall Supports: 1/2-inch diameter supports designed to set handrail at 1-1/2-inches away from finished wall surface as indicated on Drawings.
   1. Fastening Base: 3-1/8-inch diameter rosette, painted steel with finish to match rails.

2.4 INTERIOR POSTS AND RAILINGS

A. Railings:
1. Diameter: 1-1/2-inch outside diameter railings.
2. Tube Wall Thickness: 5/64-inch.

B. Posts: Steel tubes.
1. Diameter: As indicated on Drawings.
2. Finish: Primed steel, painted.

2.5 PREPARATION FOR GALVANIZING (EXTERIOR RAILINGS)

A. Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Hot-dip-galvanize steel and iron railings, including hardware, after fabrication.
1. Comply with ASTM A123/A123M for hot-dip galvanized railings.
2. Comply with ASTM A153/A153M for hot-dip galvanized hardware.

2.6 PREPARATION FOR SHOP PRIMING (INTERIOR RAILINGS)

A. Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
1. Interior Railings (SSPC Zone 1A): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION – NOT USED

END OF SECTION 05 52 13

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SECTION 05 70 00 – DECORATIVE METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Shop-fabricated break metal.
   2. Column covers.
   3. Beam covers.

B. Related Sections:
   1. Section 05 50 00 – Metal Fabrications: Non-decorative metal fabrications.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.2, "Structural Welding Code--Aluminum."

PART 2 - PRODUCTS

2.1 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 ALUMINUM

A. Aluminum for Break Shapes: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H32.

2.3 COLUMN COVERS AND BEAM COVERS

A. Metal Column Covers: Pac-Clad; PAC-2000F; 0.125 thick aluminum
   1. Finish: 3-Coat Fluoropolymer.

B. Custom Sheet Metal Type: Form column covers to shapes indicated from metal of type and thickness indicated below. Return vertical edges to folded reveal for fastener connections concealed by sealant.
   1. Column covers may be fabricated from prefinished metal sheet in lieu of finishing after fabrication provided unfinished edges are concealed from view.
   2. Form returns at vertical joints to provide flush hairline soft vee joints.
   3. Fabricate column covers without horizontal joints.
   4. Apply a coating of heavy-build, sound-deadening mastic to backs of column covers.

2.4 CUSTOM BREAK SHAPE FABRICATION

A. Fabricate to profile indicated on Drawings.
   1. Aluminum Sheet: 0.063-inch (1.60 mm) minimum.

B. Miscellaneous Break Shapes: Provide headers, closures, anchors and supports as indicated and required.

C. Form metal to profiles indicated, in maximum lengths to minimize joints. Produce flat, flush surfaces without cracking or grain separation at bends. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.

D. Coordinate dimensions and attachment methods of break metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned unless otherwise indicated.

E. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness equivalent to stretcher-leveled standard of flatness and sufficient strength for indicated use.
   1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.

F. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce decorative formed metal items as needed to attach and support other construction.

G. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install break metal items.

H. Conceal fasteners where possible; otherwise, locate where they are as inconspicuous as possible. Size fasteners to support closures and trim, with fasteners spaced to prevent buckling or waviness in finished surfaces.

I. Drill and tap holes needed for securing break shapes and trim to other surfaces.

J. Incorporate gaskets where indicated or needed for concealed, continuous seal at abutting surfaces.

K. Miter or cope trim members at corners and reinforce with bent metal splice plates to form tight joints.

2.5 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (3-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
1. Color and Gloss: As selected by Architect from manufacturer's full range.

C. Where aluminum members are in contact with porous materials, masonry or concrete, the coat the contact surfaces of the aluminum members with a heavy coat of alkali resistant bituminous paint.

PART 3 - EXECUTION – NOT USED

END OF SECTION 05 70 00

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SECTION 06 10 53 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and nailers.
   2. Fire-retardant-treated plywood.
   3. Plywood backing panels.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2-inches nominal (38 mm actual) or greater but less than 5-inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NLGA - National Lumber Grades Authority.
   2. WCLIB: West Coast Lumber Inspection Bureau.
   3. WWPA: Western Wood Products Association.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For exposed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.

D. For concealed boards, provide lumber with 19 percent maximum moisture content and the following species and grades:
   1. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.

E. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.2 PLYWOOD BACKING PANELS

A. Telecommunications and Electrical Equipment Backing Panels: AWPA U1 for Type A use, free from defects, fire-retardant treated and bearing the Underwriters Laboratories label, or stamp, attesting to the FRS rating, in size indicated or, if not indicated, not less than 8’ by 4’ by 3/4-inch nominal.
   1. Provide kiln-dried plywood with maximum moisture content of 15 percent or less.
   2. Underwriters Laboratories FRS Rating:
      a. Surface-Burning Characteristics: ASTM E84.
         1) Flame-Spread Index: 25 or less.
         2) Smoke Developed: 25 or less.
   3. The fire-retardant chemicals used shall be halogen and sulfate free.
   4. Provide plywood that meets the surface burning characteristics testing requirements of NFPA 255.
   5. Do not paint backing panels unless approved by authorities having jurisdiction. Where painting is permitted, mask UL markings so that they remain visible after painting is complete.

PART 3 - EXECUTION – NOT USED

END OF SECTION 06 10 53

SECTION 06 41 00 – ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood veneer cabinets and casework.

B. Related Sections:
   1. Section 12 36 61.16 – Solid-Surfacing Countertops.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Exposed surfaces include all surfaces visible when:
   1. Drawers and opaque doors (if any) are closed.
   2. Areas behind clear glass doors.
   3. Bottoms of cabinets 42-inches or more above finished floor.
   4. Top of cabinets below 78-inches above finished floor.

B. Semi-exposed surfaces include the following:
   1. Open opaque doors or extended drawers.
   2. Bottoms of cabinets that are more than 30-inches and less than 42-inches above finished floor.

C. Concealed surfaces include the following:
   1. Surfaces not visible after installation.
   2. Bottoms of cabinets less than 30-inches above finished floor.
   3. Tops of cabinets over 78-inches above finish floor and not visible from an upper level.
   4. Stretchers, blocking, and components concealed by drawers.

1.4 QUALITY CONTROL

A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers.

B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

C. Forest Certification: Provide components made with not less than 50 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

D. NAAWS Quality Standard: Comply with the specified grade(s) of interior architectural woodwork indicated for construction, finishes, and installation, specified section(s), and applicable requirements of the current edition of the "North American Architectural Woodwork Standards – 3.0, United States Version".
   1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of NAAWS's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Hardwood and Softwood Lumber: Custom graded in accordance with NAAWS; average moisture content of 8 percent.
   1. Species: Any closed-grain hardwood. For use at concealed areas only.

C. Hardwood Plywood: ANSI/HPVA HP-1; veneer core material; type of glue recommended for application.
   1. Formaldehyde Emission Levels: No urea formaldehyde.
   2. Face Grade: Grade A.
   3. Species: Birch, with water-based solid stain by MinWax or accepted equivalent, color as indicated on Drawings.
   4. Thickness: 3/4-inch.
   5. Veneer Core: 5-ply.
   6. Cut: Sliced-vertical grain.
   7. Back Grade: Minimum Grade 2.

D. Plywood Subtops for Countertops: Meeting APA requirements and the following:
   1. Exposure: Exterior.
   2. Thickness: 3/4-inch minimum.
   3. Grade: APA A-A, EXT-APA, Group1, Marine.
   4. Treat any exposed edges with exterior paint primer designed for use on plywood.
   5. Paint any exposed surfaces as indicated in Section 099100.

E. MDF: ANSI A208.2, Grade 130, made with binder containing no urea-formaldehyde resin.

F. Wood Particleboard: ANSI A208.1, Grade M-2 composed of wood chips, medium density, made with high waterproof resin binders; of grade to suit application; sanded faces, made with binder containing no urea-formaldehyde resin.

G. Cabinet Interiors, Shelves, and Counter Substrate: 3/4-inch Medite II, interior grade wood-based composite panels manufactured from softwood fibers with minimum 100% pre-consumer recycled wood combined with formaldehyde-free synthetic resin, with clear sealer.

H. Thermoset Decorative Panels (Melamine): MDF as specified, finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.

1. Provide polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
2. Color: White, unless indicated otherwise on Drawings.

I. Wall-Hung Countertop Supports: Cold rolled steel supports.
1. Angle Support Brackets:
   a. Design: Straight gusset stiffener between support flanges of angle.
2. Floating Countertop Support Brackets:
   a. Thickness: 3/8-inch.
   b. Style: Flat.

J. Adhesive: FS MMM-A-130 contact adhesive; type recommended by laminate manufacturer to suit application.
1. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   a. Wood Glues: 30 g/L.
   b. Contact Adhesive: 80 g/L.

2.2 WOOD VENEER CABINET CONSTRUCTION

A. NAAWS Requirements:
1. Quality Standard: Comply with NAAWS Section 10.
2. NAAWS Grade: Custom.
3. Material: Veneer plywood, Birch, as specified.
4. Type: Type II single-length sections to fit across openings.
5. Edge Material: Same as veneer on faces.
6. Cabinet Style: Style A Frameless.
7. Construction Type: Type II single-length sections to fit across openings.
8. Door and Drawer Front Style: Flush overlay.
   a. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
   b. Matching of Veneer Leaves: Slip match.
9. Exposed Interior Surfaces: Melamine matching exposed exterior surfaces.
10. Shelf Thickness: As specified in Architectural Woodwork Standards (NAAWS) for a uniform load of 50-lb/sq ft.

B. Semiexposed Surfaces: Provide surface materials indicated below:
1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
2. Drawer Sides and Backs: MDF.
3. Drawer Bottoms: MDF.
4. Exposed Edges: Extruded PVC or self-edged plastic laminate

C. Countertop Support: 3/4-inch marine plywood.

D. Cabinet Hardware: ANSI/BHMA A156.9.

PART 3 - EXECUTION – NOT USED

END OF SECTION 06 41 00

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SECTION 06 68 13 – SOLID SURFACE PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid surface wall panels and base at Restrooms.

B. Related Sections:
   1. Section 12 36 61.16 - Solid Surfacing Countertops.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 WARRANTY

A. Provide manufacturer’s ten-year limited warranty against product defects when fabricated and installed by an approved, manufacturer-certified fabricator.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIAL

A. Solid Polymer Components:
   1. Basis-of-Design Product: The design for the solid surface paneling is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
      a. Basis-of-Design: Corian; DuPont Commercial Surfaces.
      b. Formica.
      c. Lotte Chemical, USA.
      d. Accepted equivalent.
   2. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
   3. Superficial damage to a depth of 0.010 inch (25 mm) shall be repairable by sanding and/or polishing.

B. Finish: Provide surfaces with a uniform finish.
   1. Gloss: Semigloss; gloss range of 20–50.

2. Color(s): As indicated on Drawings.

PART 3 - EXECUTION – NOT USED

END OF SECTION 06 68 13

SECTION 07 13 26 – SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Below-grade rubberized asphalt, self-adhering, sheet membrane waterproofing system.
   2. Prefabricated drainage panel composite.
   3. Protection board.

B. Related Sections:
   1. Section 03 30 00 – Cast-In-Place Concrete.
   2. Section 07 60 00 – Flashing and Sheet Metal.
   3. Section 07 92 00 – Joint Sealants.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to replace waterproofing material that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate exceeding 1/16 inch (1.6 mm) in width.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rubberized-Asphalt Sheet Waterproofing: One of the following:
   1. Bituthene 3000 by GCP Applied Technologies.
   2. Blueskin WP 200 by Henry.
   3. CCW MiraDri 860/861 by Carlisle Coatings and Waterproofing.
   4. Colphene 3000 by Soprema.
   5. MEL-ROL by WR Meadows, Inc.

6. Polyguard 650 by Polyguard Products, Inc.
7. TW-60 by Tamko Waterproofing

B. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Hydroduct 220 by GCP Applied Technologies; composite subsurface drainage panels consisting of 10 mm (0.375 in.) thick drainage core, a high-performance geotextile and a high strength backing film bonded to the other side of a studded, nonbiodegradable, molded-plastic-sheet drainage core, with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).

C. Protection Board:
1. Expanded Polystyrene Protection Board: 25 mm (1 in.) thick for vertical applications with the following characteristics. Adhere to waterproofing membrane with Bituthene Protection Board Adhesive.
a. Normal Density: 16 kg/m^3 (1.0 lb/ft^3)
b. Thermal Conductivity, K factor: 0.24 at 5°C (40°F), 0.26 at 24°C (75°F)
c. Thermal Resistance, R-Value: 4 per 25 mm (1 in.) of thickness

2.2 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of sheet waterproofing material.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by manufacturer of sheet waterproofing material.

D. Liquid Membrane: Bituthene Liquid Membrane; elastomeric, two-component liquid, cold fluid applied, trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, asphalt-modified coating.

F. Metal Termination Bars: Aluminum bars, approximately 1- by 1/8-inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 13 26

SECTION 07 14 13 – HOT FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Reinforced waterproofing assembly under Second Floor Terrace pavers.

B. Related Sections:
   1. Section 07 21 00 – Building Insulation: High-load rigid insulation.
   2. Section 07 76 00 – Roof Pavers.
   3. Section 07 92 00 - Joint Sealants: Joint-sealant materials and installation.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to repair or replace waterproofing and sheet flashings that do not comply with requirements or that do not remain watertight within specified warranty period.
   1. Warranty does not include failure of waterproofing due to failure of substrate prepared and treated according to requirements or formation of new joints and cracks in substrate that exceed 1/8 inch (3 mm) in width.
   2. Warranty includes removing and reinstalling protection board, drainage panels, insulation, pedestals, and pavers on plaza decks.
   3. Warranty Period: Ten years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water and complies with physical requirements in CAN/CGSB-37.50, "Hot Applied, Rubberized Asphalt for Roofing and Waterproofing."

B. Provide installed waterproofing membrane and membrane flashings that remain watertight; do not permit the passage of water; and resist thermally induced movement and exposure to weather without failure.

C. All materials used in, or in conjunction with, the waterproofing system shall be manufactured by, or acceptable to, the membrane waterproofing material manufacturer approved for use on this project.

2.2 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide the following product:
1. American Hydrotech, Inc.; Monolithic Membrane MM 6125 FR, fabric reinforced assembly.
a. Thickness: 215 mil.

2.3 MEMBRANE

A. Single-component; 100 percent solids; hot fluid-applied, rubberized asphalt with the following properties measured per applicable test methods in CAN/CGSB-37.50:
1. Flash Point: Not less than 260 deg C or not less than 25 deg C above manufacturer's maximum recommended application temperature.
2. Cone Penetration: 98 mm maximum at 25 deg C, and 187 mm maximum at 50 deg C.
3. Flow: 1 mm maximum at 60 deg C.
4. Toughness: Not less than 5.5 Joules.
5. Ratio of Toughness to Peak Load: Not less than 0.069.
6. Adhesion Rating: Pass.
7. Water-Vapor Permeance: 0.3 ng/Pa(s) x sq m.
8. Water Absorption: 0.11-g maximum mass gain.
9. Pinholing: Not more than one pinhole.
10. Low-Temperature Flexibility: No delamination, adhesion loss, or cracking.
11. Crack Bridging Capability: No cracking, adhesion loss, or splitting.
12. Heat Stability: Comply with requirements for penetration, flow, low-temperature flexibility, and viscosity when heated for five hours at manufacturer's recommended application temperature.
13. Viscosity Test: 11.0 seconds.

2.4 AUXILIARY MATERIALS

A. Primer: ASTM D41/D41M, asphaltic primer.

B. Surface Conditioner: Asphaltic surface conditioner for concrete surfaces.
1. American Hydrotech, Inc., Surface Conditioner.

C. Elastomeric Flashing Sheet: 60-mil (1.5 mm) thick, uncured neoprene flashing/(heavy duty) reinforcing sheet, American Hydrotech, Inc., Flex Flash UN.

D. Sealants and Accessories: Waterproofing manufacturer's recommended sealants and accessories.
1. Splicing Cement: Contact adhesive to bond elastomeric flashing together.
2. Bonding Adhesive: Contact adhesive to bond elastomeric flashing to an approved substrate.
3. Lap Sealant: Sealant to seal elastomeric flashing seam edge.

E. Protection Board: American Hydrotech, Inc., Perma-Board.

F. Membrane Flashing Reinforcement:
1. Uncured Neoprene, 60 mils thick; American Hydrotech, Inc. Flex Flash UN or equal.

2. Spun-bonded Polyester Fabric Reinforcing Sheet; American Hydrotech, Inc. Flex Flash-F or equal.

G. Membrane Protection:
1. Fiberglass reinforced rubberized asphalt sheet protection: Hydroflex 30 Protection Sheet, American Hydrotech, Inc. or equal.
2. High density polyethylene (HDPE) root barrier protection sheets at planters: Root Stop HD at horizontal surfaces, Root Stop Bamboo at vertical surfaces, and Root Stop Tape at overlaps, American Hydrotech, Inc. or equal.
3. Premolded, minimum 3/16-inch-thick, semi-rigid board consisting of mineral-stabilized asphalt core sandwiched between layers of asphalt-saturated felt, surface-coated with asphalt and sealed to core under heat and pressure, and provided with polyethylene film facings, American Hydrotech, Inc. Perma-Board or equal.

H. Sheet Metal Counterflashing at the Top Edge Termination of the Waterproofing Assembly: ASTM A240/A240M 24-gauge stainless steel, with minimum ¼ inch wide hem at bottom edge. Counterflashing to be fabricated with sufficient width to extend 2 inches minimum below grade at planters and 2 inches minimum below the wearing surface at other locations.

I. Sheet Metal Nosing at Flush Edge Termination of the Waterproofing Assembly: ASTM A240/A240M 24-gauge stainless steel, 4 inches by 4 inches, with minimum ¼ inch wide hem at bottom edge of vertical leg.

J. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8-inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

2.5 MOLDED-SHEET DRAINAGE PANELS

A. Molded-Sheet Drainage Panel: American Hydrotech, Inc., Hydrodrain 300; prefabricated, composite drainage panels, manufactured with a permeable geotextile facing laminated to a molded-plastic-sheet drainage core.
1. Drainage Core: Three-dimensional, nonbiodegradable, molded-plastic-sheet material designed to effectively drain water under backfill pressure; complying with the following properties determined according to tests indicated:
a. Compressive Strength: ASTM D1621, 30,000 lbf/sf. ft. (14.66 kg/ sq cm) minimum.
b. Flow Rate: 7 gpm per ft. (87 L/min. per m), minimum, at hydraulic gradient of 1.0 and compressive stress of 3600 psf; ASTM D4716/4716M.

2.6 INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Dow Chemical Company (The), Styrofoam Brand Plaza Deck.

B. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C578, square edged; of type, density, and compressive strength indicated below:
1. Type VI, or VII, 2.2-lb/cu. ft. (35-kg/cu. m) minimum density and 60-psi (414-kPa) minimum compressive strength.
2. Maximum water absorption by volume per ASTM C272/C272M, 0.1%.
3. Water vapor permeance for 1" product per ASTM E96/E96M, 1.0 perm (max.) (63 ng/Pa/s/m2).
4. Insulation shall have an R value of 5.0 F ft2 h/Btu/in. (0.88 K m2/W) of thickness when tested at 75°F (23.9°C) mean temperature in accordance with ASTM C518.
5. Provide product free of CFC's.

2.7 TERRACE PAVERS

A. Roof Pavers: See Section 07 76 00.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 14 13

SECTION 07 21 00 – BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulation in batt form of the following types:
      a. Thermal glass fiber insulation.
      b. Unfaced mineral fiber insulation for rated penetrations.
      c. Curtain wall insulation.

B. Related Sections:
   1. Section 07 14 13 – Hot Fluid-Applied Waterproofing: Rigid insulation installed as part of waterproofing system.
   2. Section 07 21 13 – Acoustical Batt Insulation.
   3. Section 07 54 19 – Polyvinyl Chloride (PVC) Roofing: Rigid insulation installed as part of roofing system.
   4. Section 09 24 00 – Portland Cement Plaster, 3-Coat Stucco: Rigid wall insulation installed with stucco system.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Provide insulation materials identical to those whose indicated fire performance characteristics have been determined per the ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting organization.
   1. Surface Burning Characteristic: ASTM E84.
   2. Fire Resistance Ratings: ASTM E119.
   3. Combustion Characteristics: ASTM E136.

B. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

PART 2 - PRODUCTS

2.1 GLASS FIBER INSULATION

A. Preformed Units: Sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

B. Thermal Insulation: ASTM C665, Type I; "Thermal Batts"; preformed, formaldehyde-free, glass fiber batts conforming to the following:
   1. Batt Width: Maximum width as required for application, sized for a friction-fit to be self-supporting.
   2. Facing: Unfaced; see Drawings for locations.
   3. Flame Spread Rating: Less than 25, as tested in accordance with ASTM E84.
   4. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
      a. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
      b. Low Emitting: Insulation tested according to ASTM D5116 and shown to emit less than 0.05-ppm formaldehyde.
   5. Under Steel Roof Decking: Minimum R-30.
   6. Walls: Formaldehyde-free by Owens Corning, Johns Manville, Knauf, or accepted equivalent; Minimum R-19.

C. Insulation for Sound Attenuation: ASTM C665; Type I, formaldehyde-free, unfaced preformed glass fiber batts conforming to the following:
   1. Batt Width: Maximum width as required for application.
   2. Thickness: 3-5/8-inches.
   3. Facing: Unfaced.
   4. Flame Spread Rating: Less than 25, as tested in accordance with ASTM E84.
   5. Smoke Developed: Less than 50, as tested in accordance with ASTM E84.
   6. Overall Sound Transmission: STC 50.
   7. Minimum density of 6 lb/cu ft (96 kg/cu m), thermal resistivity of 4.5 deg F x h x sq ft/Btu x in. at 75 deg F (31.2 K x m/W at 24 deg C).

2.2 MINERAL-WOOL BLANKET INSULATION

A. Unfaced, Slag-Wool-Fiber/Rock-Wool-Fiber Blanket Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.
   1. Where slag-wool-fiber/rock-wool-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt form with thermal resistances indicated:
      a. 1-1/2-inches (38 mm) thick with a thermal resistance of 6 deg F x h x sq ft/Btu at 75 deg F (1 K x sq m/W at 24 deg C).
      b. 3-1/2-inches (89 mm) thick with a thermal resistance of 13 deg F x h x sq ft/Btu at 75 deg F (2.3 K x sq m/W at 24 deg C).
      c. 4-inches (101 mm) thick with a thermal resistance of 16 deg F x h x sq ft/Btu at 75 deg F (2.8 K x sq m/W at 24 deg C).
      d. 5-1/4-inches (133 mm) thick with a thermal resistance of 19 deg F x h x sq ft/Btu at 75 deg F (3.3 K x sq m/W at 24 deg C).
      e. 6-inches (152 mm) thick with a thermal resistance of 22 deg F x h x sq ft/Btu at 75 deg F (3.9 K x sq m/W at 24 deg C).

2.3 CURTAIN WALL INSULATION

A. Board Insulation Material Standard: ASTM C612, Type IA or IB.
   1. Facing: FRK foil scrim vapor retarder.
   2. R-Value: ASTM C518; R-4.2/inch.
   3. Surface Burning Characteristics: ASTM E84:
      a. Flame Spread: 0.
      b. Smoke Developed: 0.
   4. Thickness: As indicated on Drawings.
   5. Material: Min 2 in. thick mineral wool batt insulation faced on one side with aluminum foil/scrim vapor retarder, supplied in min 36 in. wide batts.
   6. Performance Characteristics:
      a. Vapor Retarder Performance: 1.10 perms maximum.
      b. Combustion Characteristics (ASTM E136): Pass.
      c. Maximum Use Temperature (ASTM C411): 350 degrees F (177 degrees C).
      d. Water Vapor Sorption (ASTM C1104/C1104M): 5% or less by weight.
      e. Compressive Resistance (IS 300 and 600 Only) (ASTM C165): 25 psf (1.2 kPa) at 10%.
      f. Linear Shrinkage (ASTM C356): None.
      g. Odor Emission (ASTM C1304): Pass.
      h. Corrosiveness (ASTM C665, 13.8): Pass.
      i. Fungi Resistance (ASTM C1338): Pass.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 21 00

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SECTION 07 21 16 - ACOUSTICAL BATT INSULATION

PART 1 - GENERAL

1.1 WOR INCLUDED

A. Provide fiberglass batt insulation in partitions and wall cavities and above ceilings where shown on the drawings, as specified herein, and as needed for a complete and proper installation. Material shall meet the requirements of all applicable codes.

1.2 QUALITY ASSURANCE

A. Install acoustical insulation to the approval of the Acoustical Consultant, but make no change in the scope of the work on the contract without specific written approval from the Architect.

1.3 SUBMITTALS

A. Submit the following in accordance with pertinent provisions of the contract.
   1. Materials list of items proposed to be provided under this Section.
   2. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   3. Manufacturer's recommended installation procedures, which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Project.

1.4 PRODUCT HANDLING

A. Deliver the materials of this Section to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Store in a dry area, completely protected from moisture and other damage, and in strict accordance with the manufacturer's recommendations as approved by the Architect.

PART 2 - PRODUCTS

2.1 BATT INSULATION

A. Provide inorganic glass fiber material with a minimum density of 0.60 pounds per cubic foot, and in the minimum thicknesses shown on the Drawings.
   1. Select batt widths to match stud spacing and to be self-supporting between the studs.
   2. For application above ceilings, select batt widths to be supported on ceiling construction over the entire ceiling area.
   3. Do not provide paper or other combustible backing or facing on batts.
   4. Provide “plenum rated” fiberglass (minimum 1000fpm airflow per UL 181 Air Erosion Test) when exposed to air flow or when installing in an air plenum.

B. Acceptable Products
   1. Owens-Corning Fiberglass Corporation unfaced Sono-Batt Fiberglass Batt Insulation
   2. ohns Manville unfaced Sound Shield Fiberglass Batt Insulation.

3. Stic- lips shall be Insulation Hangers with Domed Caps (standard or special color as specified by Architect) as manufactured by Gemco and distributed by American Insulation Welding Products, Whittier, CA (800) 292-2215.
4. Equal products of other manufacturers when approved in advance by the Architect.

2.2 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the work of the Section where shown on the Drawings and in strict accordance with the manufacturer's recommendations as approved by the Architect, eliminating all gaps, butting all joints, tying or attaching fiberglass in place where it is not self supporting, and securing the approval of the Owner's Acoustical Consultant.

B. Provide multiple layers of insulation where necessary to achieve required thickness.

C. Where shown on the drawings or required, attach insulation to metal or concrete substrate with Stic- lips. Stic- lip fasteners shall be attached with hanger adhesive according to manufacturer’s written instructions. Use of self-adhesive tape to attach fasteners is not permitted.

D. Where shown on the drawings or required, attach insulation to gypsum board or plaster substrate with fender washers and drywall screws.

E. In exposed areas, including ceiling plenums, fasteners shall be constructed so that no sharp points or edges shall protrude through the insulation. Protective end caps shall be utilized over spindle fasteners. In visible areas, the fasteners shall be laid out in a regular grid pattern approved by the Architect.

F. Paint all exposed fasteners as directed by the Architect.

END OF SECTION 07 21 16

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Contact for Questions:

Linda Stansen
Stansen Specifications
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650.570.6411

SECTION 07 26 16 – BELOW-GRADE VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Heavy-duty under-slab vapor barrier system where required by conclusion of investigation of soils and substrate conditions on the Site.

B. Related Sections:
   1. Appendix A – Geotechnical Report.
   2. Appendix D - Soil Handling and Contamination Mitigation Recommendations.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Vapor Barrier Assembly: Under-slab vapor intrusion barrier comprised of three layers to form a barrier to soil contaminants which includes the vapor barrier and auxiliary materials applied over soil substrate, including the sealing of sheet laps, joints, and penetrations, forming an impermeable membrane to control movement of contaminant vapor permeation through the building slab and foundation.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm experienced in applying the specified vapor barrier system indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.
   1. Installer shall be trained by the manufacturer in the installation of the vapor barrier system. Installer will maintain trained installers and supervisors on site for the duration of the project.

B. Single-Source Responsibility: Obtain vapor barrier material and installation accessories from single source providing consistent quality in performance and appearance without delaying progress of the Work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide continuous vapor barrier under floor slab throughout the building, unless indicated otherwise on Drawings and ASTM E1643.

B. Vapor barrier shall have all of the following qualities:
   1. Maintain permeance of less than 0.01 Perms (grains/(ft^2 · hr · inHg)) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
   2. Other performance criteria:
      a. Strength: ASTM E1745 Class A.
      b. Thickness: 15 mils minimum
   3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.
   4. Puncture Resistance, ASTM D1709, Method B: 3,000 grams
   5. Tensile Strength, ASTM E154, Section 9: 67 lbf / in.
   6. Water Vapor Permeance, ASTM F1249: 0.1 perms.

2.2 MATERIALS

A. Manufacturer: TerraShield; Land Science™, San Clemente, CA. (949) 481-8118. System comprised of the following:
   1. TerraBase Plus sheet layer.
   2. Nitra-Core spray applied layer and Nitra-Core Detail.
   3. Land Science Protection Fabric layer.

B. TerraBase Plus: Patent-pending composite geomembrane comprised of 2 layers of LDPE reinforcing a flexible chemically-resistant metalized film, laminated to a tear resistant polyester fiber grid and a high puncture reinforcement polypropylene geotextile
   1. Sheet Course Usage
      a. As foundation base layer use TerraBase Plus and/or other base sheet as required or approved by the manufacturer.
      b. As top protective layer use Land Science Protection Fabric layer and/or other protection as required or approved by the manufacturer.
   2. Properties:
      a. Film Thickness: 25 mil.
      b. Tensile Strength: ASTM D751; Method A: 138 lbs., Method B: 120 lbs.
      c. Grab Tensile: ASTM D7004; Method A: 142 lbs., Method B: 129 lbs.
      d. Elongation: ASTM D751; Method A: 17%, Method B: 53%.
      e. Puncture Resistance: ASTM D4833; 47 lbs.
      f. Life Expectancy: ASTM E154; Indefinite.
      g. PCE Diffusion Coefficient: GeoKinetics Method;1.5 x 10-12 m2/day.
      h. Benzene Diffusion Coefficient: GeoKinetics Method ;2.9 x 10-13 m2/day.
      i. Methane Transmission Rate: ASTM 1434; <0.12 mL (STP)/m2*d*atm.

C. Nitra-Core: A single course, high build, polymer modified, advance asphalt/nitrile emulsion. Waterborne and spray applied at ambient temperatures. A nominal thickness of 40 dry mils, unless specified otherwise. Non-toxic and odorless. Nitra-Core Detail has similar properties with greater viscosity and is roller or brush applied. Manufactured by Land Science.
   1. Properties
   2. Application to TerraBase Plus: 40 mils (24 ft2/gal).
   3. Typical Uncured Properties:
      a. Specific Gravity: ASTM D244; 1.0.

b. Brookfield Viscosity: ASTM D2196; 75 – 90 centipoises.
c. pH: Oakton; 10 – 13.
d. Residue Content: ASTM D2939; 62 – 65%.
e. Color: Brown to Black.
f. Demulsibility: ASTM D6936; 35 – 40%
g. Non-Toxic: No Solvent.
h. Shelf Life: 6 months.

D. Land Science Protection Fabric Properties:
1. Color: Black Geotextile.
2. Mass/Unit Area (Typical): ASTM D5261; 8.0 oz/yd2.
3. Grab Elongation: ASTM D4632; 50%.
4. Grab Tensile Strength: ASTM D4632. 205 lbs.
5. Tear Strength (Trapezoidal): ASTM D4533; 80 lbs.
6. CBR Puncture: ASTM D6241; 525 lbs.
7. Puncture: ASTM D4833; 110 lbs.
8. Mullen Burst: ASTM D3786; 350 psi
9. UV Resistance (500 hrs.): ASTM D4355; 70%.
10. Permittivity: ASTM D4491; 1.5 sec-1.
11. Apparent Opening Size (AOS): ASTM D4751; 80 US Std Sieve
12. Water Flow Rate: ASTM D4491; 110 gpm/ft2.

2.3 ACCESSORIES

A. Sheet Flashing: 60-mil reinforced modified asphalt sheet good with double-sided adhesive.

B. Reinforcing Strip: Manufacturer’s recommended polypropylene and polyester fabric.

C. Gas Venting Materials: TerraVent and associated fittings.

D. Seam Detailing Sealant Mastic: Nitra-Core Detail, a high or medium viscosity polymer modified water-based asphalt material.

E. Backer Rod: Closed-cell polyethylene foam.

F. Pipe Boots: Solid 25 mil pre-manufactured peel and stick patching product with aggressive all-weather adhesive for direct adhesion to vapor barrier surface, pipes and penetrations.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 26 16

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SECTION 07 27 26 – FLUID-APPLIED MEMBRANE AIR BARRIERS – SPRAY & ROLL-ON

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Manufacturer's requirements for the proper design, use, and installation of a 100% acrylic based, vapor permeable, fluid-applied air & water-resistive barrier membrane.

B. Related Sections:
   1. Section 07 60 00 – Flashing and Sheet Metal.
   2. Section 07 92 00 – Joint Sealants.
   3. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts
   4. Section 09 29 00 – Gypsum Board: Exterior sheathing.
   5. Section 09 24 00 – Portland Cement Plaster, 3-Coat Stucco.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 "Sustainable Design Requirements" for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 SYSTEM DESCRIPTION

A. 100% acrylic based, vapor permeable, fluid-applied air and water-resistive barrier membrane engineered for spray or roller application. Designed for use as an air and water-resistive barrier behind EIFS and other claddings. This product is installed over glass mat gypsum sheathing, cement board sheathing, CDX plywood, OSB*, concrete or CMU. **The membrane is qualified for application to OSB (oriented strand board) sheathing only in areas shown in the manufacturer's Acceptable Substrates and Areas of use Technical Bulletin.*

B. Functional Criteria:
   1. General:
      a. Flashing: Flashing must be continuous and watertight. Flashing must be designed and installed to prevent water infiltration behind EIFS and other claddings. Refer to Division 07 Flashing Section for specified flashing materials.
      b. The configuration of the air & water-resistive barrier, drainage plane, flashing and cladding assembly materials must allow for the egress of incidental moisture.
   2. Performance Requirements:
      a. System to meet the performance and testing requirements of the International Code Council Acceptance Criteria AC 212 and ASTM E2570.

Parex USA Weatherseal Spray & Roll-on	Method	ICC and ASTM E2570 Criteria	Results
Accelerated Weathering	AC 212	25 Cycles followed by Hydrostatic Pressure Test: No water penetration on the plane of the exterior facing side of the substrate.	Pass: no water penetration
Air Infiltration	ASTM E2178	Calculated flow Rate at 75 Pa (1.57 lb/ft^2, 0.3 in H_2O) = < 0.02 L/m^2*s (< 0.004 cfm/ft^2)	< .00001 L/m^2*s (0.00001 cfm/ft^2) at 75 Pa (1.57 lb/ft^2, 0.3 in H_2O)
Air Leakage of Air Barrier Assemblies	ASTM E2357	Pass < 0.2 L / s·m2 at 75 Pa) (< 0.04 cfm / ft2 at 1.57 psf)	Pass
Air Leakage	ASTM E283	No Criteria	< 0.004 cfm/ft^2
Elongation	ASTM D412	No Criteria	360%
Flexibility	ASTM D522	No Criteria	No Cracking at 1/8" (3 mm)
Freeze-Thaw Resistance	ASTM E 2485	10 Cycles	Pass – No Deleterious Effects
Hydrostatic Pressure Test	AATCC 127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging	Pass: no water penetration
Nail Seal ability, Head of Water	ASTM D1970	Pass 5 inches of water	Pass
Racking	ASTM E72	Deflection at 1/8 in (3.2 mm)	Pass -No cracking at field, joints or flashing connection
Structural Loading	ASTM E1233 Procedure A	10 Cycles @ 80% design load	Pass -No cracking at field, joints or flashing connection
Restrained Environmental	ICC ES AC 212 / ASTM E2570	5 Cycles of wetting and drying	Pass -No cracking at field, joints or flashing connection
Surface Burning Characteristics	ASTM E84	ICC and ASTM E2568 Flame Spread <25 Smoke Developed <450	Flame Spread =0 Smoke Developed =0
Tensile Bond Strength	ASTM E 2134/ ASTM C 297	Minimum 15 psi (104 kPa)	Pass all listed substrates and flashing materials
Water Resistance	ASTM D 2247	14 Days	Pass – No Deleterious Effects.
Water Penetration	ASTM E331	2.86 psf (137 Pa) for 15 minutes	Pass 25.4 psf (1216 Pa) for 165 minutes
Water Penetration	ASTM E331	Tested after Structural Loading, Racking and Restrained Environmental Cycling at	No Water Penetration

		2.86 psf (137 Pa) for 15 minutes	
Water Vapor Transmission	ASTM E96 Procedure B	Vapor Permeable	12.0 perms
Weathering	ICC ES AC 212 / ASTM E2570	210 hours of UV Exposure, 25 cycles of accelerated weathering, 21.6 in (549 mm) water column for 5 hours	Pass
Wind Driven Rain	F.S. TT-C-555B	No Criteria	Pass
VOC	EPA Reference Test Method 24	US EPA, South Coast AQMD and GreenSeal Standard	10 g/L

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. All materials must be manufactured or sold by an active Manufacturer Member of ABAA and must be purchased from its authorized distributors.
   2. Manufacturer: Must be an active member of ABAA.
   3. Applicator:
      a. Must have attended manufacturer's Educational Seminar.
      b. Must possess a current manufacturer's certificate of education.
      c. Must be experienced and competent in installation of plaster-like materials and liquid-applied weather-resistive membranes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807 Contact: Andy Townes CSI, CCPR, Architectural Sales Manager (505.338.4433) andy.townes@parexusa.com.

B. Components: Obtain components from authorized distributors. No substitutions or additions of other materials are permitted without prior written permission from Parex USA for this project.

2.2 MATERIALS

A. Water-Resistive Membrane & Air Barrier Coating:
   1. Parex USA Weatherseal Spray & Roll-on™: a vapor permeable, 100% acrylic, elastomeric waterproof membrane and air barrier that can be either roller, brush or spray applied.
   2. Parex USA Weatherflash a single-component, paintable, self-leveling, moisture cured sealant designed for sheathing joint and rough opening treatment.
   3. Parex USA 396 Sheathing Tape: Non-woven synthetic fiber tape to reinforce the membrane at sheathing board joints, into rough openings and other terminations into dissimilar materials.

4. Parex USA 365 Flashing Membrane: Self-sealing, polyester faced, rubberized asphalt membrane, 30 mils (0.76mm) thick.

2.3 RELATED MATERIALS AND ACCESSORIES

A. Substrate Materials:
   1. Glass mat gypsum sheathing conforming to ASTM C1177.
   2. Cement Fiber Sheathing conforming to ASTM C1186.
   3. Gypsum Sheathing: Minimum 1/2" (13mm) thick, core-treated, weather-resistant, exterior gypsum sheathing complying with ASTM C79.
   4. Plywood: Minimum 7/16" (8mm) thick exterior grade or PS 1, Exposure 1, minimum 7/16" thick, C veneer facing out, panels gapped 1/8 " at all edges.
   5. Oriented Strand Board (OSB): 7/16" - 1/2" Wall-16 or Wall-24, approved by the APA, TECO, or PSI/PTL. Stamped as Exposure 1 or Exterior Sheathing with a PS2 or PRP-108 rating.
   6. Concrete Masonry Units (CMU): Non-painted (uncoated).
   7. Concrete (poured or pre-cast).
   8. Other approved by water-resistive & air barrier membrane manufacturer in writing prior to the project.

B. Flashing: Refer to Section 07 60 00 – Flashing and Sheet Metal for flashing materials.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 27 26

SECTION 07 46 46 – FIBER-CEMENT SIDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fiber-cement siding.

B. Related Sections:
   1. Section 07 27 26 - Fluid applied Weather and Air Barriers.
   2. Section 07 60 00 - Flashing and Sheet Metal: Flashing and other sheet metal work.
   3. Section 07 92 00 - Joint Sealants.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Labeling: Provide fiber-cement siding that is tested and labeled according to ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
   1. Siding shall conform with City of Los Angeles Research Report RR 24862.

B. Source Limitations for Cementitious Panels: Obtain each type, color, texture, and pattern of cementitious panel, including related accessories, through one source from a single manufacturer.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of shingle siding system that do not comply with requirements or that fail in materials, fabrication, or installation within specified warranty period.
   1. Warranty Period: 30 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials, fabrication, or installation within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIBER-CEMENT SIDING

A. General: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E136; with a flame-spread index of 25 or less when tested according to ASTM E84.
   1. Basis-of-Design Product: The designs for the metal wall panel systems are based on the manufacturer identified below:
      a. Basis-of-Design: James Hardie Inc.; ShingleSiding HZ10 – Straight-Edge Panel.
      b. CertainTeed Corp.
      c. Accepted equivalent.
   2. Exposure: 6.976-inch.
   3. Fiber-Cement Siding Compliance:
      a. ASTM C1186 Type A Grade II.
      b. ASTM E136 as a noncombustible material.
      c. ASTM E 84
         1) Flame Spread Index = 0.
         2) Smoke Developed Index = 5.
      d. City of Los Angeles, Research Report No. 24862.
   4. Factory Priming: Manufacturer's standard acrylic primer.
   5. Finish and Color: As indicated on Drawings (allow for 5 colors).

B. Trim: James Hardie Building Products, Inc.; HardieTrim HZ10 boards.
   1. Texture: Smooth.
   2. Compliance matching that specified for shingle siding.

2.2 ACCESSORIES

A. Fiber-Cement Siding Accessories: Provide starter strips, edge trim, corner cap, and other items as recommended by siding manufacturer for building configuration.
   1. Provide accessories made from same material as adjacent siding, unless otherwise indicated.
   2. Provide accessories matching color and texture of adjacent siding, unless otherwise indicated.

B. Elastomeric Joint Sealant: Single-component urethane joint sealant complying with requirements in Section 07 92 00 for Use NT (nontraffic) and for Uses M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

C. Fasteners:
   1. For fastening to wood, use siding nails ribbed bugle-head screws of sufficient length to penetrate a minimum of 1 inch (25 mm) into substrate.
   2. For fastening fiber-cement siding, use hot-dip galvanized or stainless-steel fasteners.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 46 46

SECTION 07 54 19 – POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
1. Roof Assembly Install an adhered 60 mil thick PVC roofing system over adhered 1/2-inch thickness Dens Deck Prime cover board and adhered 20 psi uniform and tapered insulation.
2. Section Includes
   a. Adhesive for cover board and insulation
   b. Tapered and flat polyisocyanurate rigid insulation
   c. Approved gypsum cover board
   d. Water based adhesive for membrane attachment
   e. Glass fiber reinforced PVC roof membrane
   f. Low VOC contact adhesive for flashings
   g. 60 mils glass fiber reinforced PVC flashing membrane
   h. Other metal flashings
   i. Sealants
   j. Conductive primer application and leak detection testing.

B. Related Sections
1. Section 06 10 53 Miscellaneous Rough Carpentry: For wood nailers, curbs, and blocking.
2. Section 07 21 00 – Building Insulation: For batt insulation beneath the roof deck.
3. Section 07 60 00 - Flashing and Sheet Metal: For metal roof penetration flashings, flashings, and counterflashings.
4. Section 07 72 00 - Roof Accessories
5. Section 07 92 00 - Joint Sealants: For joint sealants, joint fillers, and joint preparation.
6. Section 11 24 25 - Fall Arrest Systems

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
   a. WELL Building Standard v2 Certification.
   b. BLUE ZONES Certification.
2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Roofing Terminology: See ASTM D1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain components including fasteners and roof insulation for membrane roofing system from same manufacturer as membrane roofing or approved by membrane roofing manufacturer.

B. Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) in accordance with the California Building Code.
   1. Crickets and saddles shall be installed on the ridge side of any penetration greater than 24 inches wide.
      a. Roof drainage shall comply with the City of Los Angeles Plumbing Code.

C. All base flashings and penetrations must have a minimum 8 inch height above the finished roof assembly. Care must be taken to ensure this is possible when installing equipment pads and making allowances for associated crickets.

D. Exterior Fire-Test Exposure: ASTM E108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof pavers, and other components of membrane roofing system.
   2. Provide a “No Dollar Limit” non-prorated warranty that does not exclude ponding or standing water or contain time limits for standing water. No additional fees or roofing manufacturer inspections will be required to maintain the warranty. The System Warranty includes membrane, insulation, coverboard and attachment components of the roofing system provided by the Manufacturer.
   3. Warranty Period: 20 years from date of Substantial Completion.

B. Installer’s Special Warranty: Installer's standard form in which installer agrees to repair or replace roofing system that fails in materials, fabrication, or installation within specified warranty period.
   1. Warranty Period: 2 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

D. Fire Classification: UL Class A.

E. Energy Performance: Provide roofing system with initial solar reflectance (SRI) not less than 85 and emissivity not less than 0.74 when tested according to CRRC-1.

2.2 PVC MEMBRANE ROOFING

A. PVC Sheet: ASTM D4434, Type II, Grade 1, glass fiber reinforced membrane.
1. Basis-of-Design Product: The design for the PVC roofing system is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   a. Basis-of-Design: Sarnafil; Energy Smart G410-15.
   b. BondCote Corporation.
   c. Duro-Last Roofing, Inc.
2. Thickness: 60 mils (1.5 mm), nominal.
3. Exposed Face Color: White.

2.3 RIGID INSULATION

A. Roof Insulation: ASTM C1289, Type II, Class 2, Grade 2, glass-fiber mat facing on both major surfaces.
1. Product: Sika Sarnafil Sarnatherm.
2. Thermal Resistance: R-value: Minimum R-30.
3. Board Width: Maximum width as required for application.
4. Thickness: As required to meet R-value.
5. Flame Spread Rating: 25 or less.

B. Polyisocyanurate Foam Crickets: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facing on both major surfaces.
1. Provide crickets preformed to 45-degree angle; at roof parapet walls, skylights, and other vertical edges where indicated on Drawings; 4-inch high (5-inch face) minimum.
2. Use 3-inch-high cants only where clearance will not permit a 4-inch cant. Miter corners and tightly butt joints.

C. Cover Board provide the following: ASTM C518
1. Product: DensDeck Prime
2. Thickness: 1/2-inch.
3. Surfacing: Fiberglass mat.
4. Dimensions: 4’ x 4’.

D. Provide uniform thickness and tapered insulation as required. 4 feet by 4 feet boards installed in multiple layers to achieve the required LTTR value, and fabricated to slope of 1/4-inch per 12inches (1:48), unless otherwise indicated.

E. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

F. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48), unless otherwise indicated.

G. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

H. Separation Sheet: Fire resistant glass fiber mat used as a separation sheet over polystyrene foam insulation or beneath insulation over wood substrates.

2.4 COMPONENTS

A. Roofing System Manufacturer's Reglet: A heavy-duty, extruded aluminum flashing termination reglet used at walls and large curbs.

B. Universal PVC Prefabricated stack: A prefabricated vent pipe flashing made from 0.060 inch thickness PVC.

C. Prefabricated Corners: Prefabricated outside and inside flashing corners made of 0.060 inch thick PVC.

D. Provide base flashing membrane, membrane fasteners and plates appropriate for substrate, stainless steel hose clamps, pipe/conduit supports, and membrane cleaner.

E. Provide clad metal and liquid flashing materials where recommended by manufacturer for a complete, watertight roofing assembly.

F. Primers:
1. Deck Primer: Sarnavap Self-Adhered Primer WB; designed for use with Sarnavap Self-Adhered vapor barrier to promote adhesion to most substrates.

G. Vapor Barrier: Sika Sarnafil #SA-31 self-adhesive vapor/air barrier and temporary roof protection.

H. Vector Mapping Grid: Provide stainless steel grid and connection kits for LV-ELD testing of roof system installation as specified herein.

2.5 ATTACHMENT COMPONENTS

A. Membrane Adhesives
1. Sarnacol 2121 Adhesive: A water-based adhesive used to attach the membrane to horizontal or near-horizontal substrates. Consult Product Data Sheets for additional information.

B. Flashing Adhesive
1. Stabond U148A Adhesive: A low VOC reactivating-type adhesive used to attach membrane to flashing substrate.

C. Peelstop: An extruded aluminum, low profile bar used with certain fasteners to attach to the roof deck or to walls/curbs at terminations, penetrations and at incline changes of the substrate.

D. Insulation and Coverboard Adhesive: Sarnacol 2163/AD/OM Adhesive: Low-rise two component polyurethane foam used to attach insulation to approved compatible substrates.

E. Termination bars shall be manufacturer's standard, predrilled stainless steel termination bars, approximately 1 by 1/8 inch thick; with anchors. Formed steel shall be pre- punched with holes every 1 inch on center to allow various fastener spacing options.

F. Penetration flashing shall be field fabricated boots fabricated tight to penetration.

2.6 SEALANTS

A. Multi-Purpose Sealant (for termination details). Sika 1A or approved equal.

B. Approved two-component urethane adhesive sealant.

C. Depending on substrates, the following sealants are options for temporary overnight tie-ins:
1. Spray-applied, water-resistant urethane foam.
2. Mechanical attachment with rigid bars and compressed sealant.

2.7 MISCELLANEOUS FASTENERS AND ANCHORS

A. Provide only post-galvanized steel, aluminum or stainless-steel fasteners. Take precautions to avoid galvanic corrosion. Install expansion type fasteners with stainless steel pins for the attachment of metal to masonry.

2.8 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16 inch (5 mm) thick, and acceptable to membrane roofing system manufacturer.
1. Product: Sika, Sarnatred-V
2. Color: Light Grey.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 54 19

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SECTION 07 60 00 – FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal flashings of the following types:
      a. Metal flashing and counter flashings.
      b. Exposed metal trim/fascia units.
      c. Reglets.
      d. Copings.
      e. Roof drainage components including scuppers, downspouts, and splash pans.
      f. Through-wall flashings.
      g. Preformed flashing sleeves.
      h. Equipment support flashings.
   2. Miscellaneous sheet metal accessories.

B. Related Sections:
   1. Section 07 54 19 – Polyvinyl Chloride (PVC) Roofing.
   2. Section 09 24 00 - Portland Cement Plaster, 3-Coat Stucco.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Conform to profiles and sizes shown on drawings, and comply with "Architectural Sheet Metal Manual" by SMACNA, for each general category of work required.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install flashings and copings capable of resisting forces for the appropriate wind zone, per Factory Mutual's Loss Prevention Data Sheet 1-49.

C. Temperature Range: 120 deg F ambient; 180 deg F, material surface.

D. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the maximum range of ambient and surface temperatures provided above by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of sealant joints, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime sky heat loss.

E. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to the building interior.
1. Watertight and weatherproof performance of flashing and sheet metal work is required.

2.2 MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 (Z275) coating designation; structural quality, mill phosphatized where indicated for field painting.
1. Do not apply an acrylic passivator coating to galvanized sheet metal scheduled to be painted, or remove this coating mechanically before delivery to the project site.
2. Prime all surfaces of bonderized metal.
3. Finish: Standard (dull) mill finish; painted unless noted otherwise on Drawings.
4. Paint: Paint sheet galvanized sheet metal that is not coil-coated.

B. Bedding Compound: Rubber-asphalt type.

C. Plastic Cement: Asphaltic base cement.

D. Solder:
1. For Zinc-Coated (Galvanized) Steel Sheet: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide elastic, non-sag, nontoxic, non-staining tape.

F. Sealant: Type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight; see Section 079200.

G. Flux: FS O-F-506.

H. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

J. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

K. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329 or Series 300 stainless steel.

L. Sheet Membrane Underlayment at Flashings: Self-adhered, cold-applied composite rubberized asphalt sheet membrane consisting of rubberized asphalt bonded to a cross-laminated high-density polyethylene film with primers and seam sealers as required for a complete watertight installation; provide materials compliant with applicable regulations limiting VOCs.
1. Under Sheet Metal and Flashing: Minimum 40-mil thick, high temperature self-adhering, polymer-modified, bituminous sheet membrane, complying with ASTM D1970/D1970M, manufacturers and types as follows:
a. GCP Applied Technologies: Grace Ice and Water Shield HT or Grace Ultra.

2.3 PREFABRICATED CURBS AND EQUIPMENT SUPPORTS

A. Prefabricated Curb and Equipment Support Units:
1. Type: Designed for roof type and equipment.
2. Materials: Steel, 14 gauge (.0747 inch), hot dip galvanized.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
1. Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
a. Fry Reglet Corporation.
b. Heckmann Building Products, Inc.
c. Accepted equivalent.
2. Material: Aluminum, 0.024-inch thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers and with channel for sealant at top edge.
4. Accessories:
a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
b. Counterflashing Wind-Restrain Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
c. Finish: Mill

B. Drawbands: Stainless steel.

2.5 WINDOW AND STOREFRONT FLASHINGS

A. Flashing for aluminum components that are integral to the windows or storefront framing:
1. Aluminum, .090 minimum thickness, pre-finished where flashing is exposed to view.
2. Flashing for other Aluminum Components: Aluminum, .040 minimum thickness, prefinished where flashing is exposed to view.
3. Flashing for Steel Components/Penetrations: Hot dipped galvanized steel, 24 gauge minimum, pre-finished or field painted.

B. Sill Pans: Fabricate to profiles indicated and to provide proper water drainage at window and door openings. Include 1-inch end dams and 1/2-inch minimum upturn at all pans, typical.

Fabricate discontinuous lintel, sill, and similar flashings to extend 6-inches (150 mm) beyond each side of wall openings.

1. Galvanized Steel: 0.0276-inch (0.7 mm) thick, painted black.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Paint all exposed flashings throughout except those that are coil coated.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 60 00

SECTION 07 72 00 – ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Prefabricated roof hatches, with integral support curbs, operable hardware, and counterflashings.
2. Roof hatch safety posts.

B. Related Sections:
1. Section 05 50 00 – Metal Fabrications: Shop-fabricated ladders.
2. Section 07 54 19 – Polyvinyl Chloride (PVC) Roofing: Roof system.
3. Section 07 60 00 - Flashing and Sheet Metal: Counter flashing to roof system.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
a. WELL Building Standard v2 Certification.
b. BLUE ZONES Certification.
2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

B. Hatch Safety Railing System:
1. System top and mid rail provided in accordance with OSHA Standards - 29 CFR 1910.23 (a)(2).
2. Structural Load: 200 lb (90.7 kg), minimum, in any direction to all components in accordance with OSHA Regulation 29 CFR 1926.502.
3. Height: 42 inches (1067 mm), minimum.

PART 2 - PRODUCTS

2.1 ROOF HATCH

A. Roof Hatches:
1. Lid: Insulated metal lid.
2. Framing: Formed or extruded aluminum, mill finish.
3. Curb Type: Insulated double wall curb.

B. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Babcock-Davis.
   2. Bilco Manufacturing.
   3. Nystrom Building Products.
   4. Accepted equivalent.

C. Unit: 36” x 36” size, single leaf type; insulated lid and integral support curb; complete with integral counterflashings to roof flashing system and flanges on support curb for anchorage to roof deck.

D. Integral Aluminum Curb: 11-gauge mill finished aluminum with full welded corners; 1-inch rigid glass fiber insulation; integral cap flashing to receive roof flashing; extended flange for mounting.

E. Flush Aluminum Cover: 11-gauge, mill finish aluminum; 1 inch glass fiber insulation; sandwiched by 18 gage aluminum interior liner; continuous neoprene gasket to provide weatherproof seal.

F. Hardware:
   1. Compression spring operator enclosed in telescopic tubes;
   2. Positive snap latch pull handle for interior and exterior operation;
   3. Automatic hold open arm with vinyl covered grip handle for easy release and hand control of the cover to its closed and latched position.
   4. Components zinc plated and chromate sealed, mill finish;
   5. Padlock hasps inside and outside.

G. Hinges: Heavy duty pintle type.

2.2 LADDER SAFETY POST AND SAFETY RAILINGS

A. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.

B. Post: High strength square steel tubing. Provide a pull up loop at the upper end of the post to facilitate raising the post.
   1. Performance Characteristics:
      a. Tubular post: Automatic locking mechanism when fully extended.
      b. Controlled upward and downward movement.
      c. Release lever shall disengage the post to allow it to be returned to its lowered position.
      d. Adjustable mounting brackets to fit ladder rung spacing up to 14” oc and clamp brackets to accommodate ladder rungs up to 1-3/4” diameter.

C. Balancing Spring: Stainless steel balancing mechanism that provides smooth, easy, controlled operation when raising and lowering safety post.

D. Hardware: Type 316 stainless steel.

E. Post Finish: Hot-dip galvanized steel.

2.3 ROOF LADDERS

A. Pre-fabricated Ladder: O'Keeffe's 502, fixed access ladder, or accepted equivalent.
   1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
   2. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
   3. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
   4. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.
   5. Support each ladder at top and bottom and not more than 60 inches (1500 mm) oc with welded or bolted aluminum brackets.
   6. Provide minimum 72-inch- (1830-mm-) high, hinged security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.
   7. As-Fabricated Finish: AA-M12.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 72 00

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SECTION 07 76 00 – ROOF PAVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete roof pavers set on pedestals over hot-fluid applied membrane system above-grade at second floor balconies and third floor roof deck.
   2. Miscellaneous materials and accessories required for a complete installation.

B. Related Sections:
   1. Section 07 14 13 – Hot Fluid-Applied Waterproofing: Waterproofing and protection board under deck paver system.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of unit paver, joint material, and pedestal unit from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

B. Perimeter Walls and Containment:
   1. All decks must be restrained by perimeter blocking or walls on all sides, including “on-grade” installations. There should be no more than a 3/16” (4.5 mm) gap between deck tiles or pavers, or at any perimeter edge, and the deck should not exhibit any lateral movement.
   2. It is recommended that deck tiles or pavers sit above the waterproofing, integral flashing, and/or counter flashing. In situations where the perimeter of the deck comes into contact with the flashing material, a protective wall covering should be specified if deemed necessary

1.4 WARRANTY

A. Special Manufacturer's Warranty: Written warranty, signed by pedestal manufacturer agreeing to repair or replace defective materials that do not comply with requirements or that do not remain free of defects within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Written warranty, signed by paver manufacturer agreeing to repair or replace defective materials that do not comply with requirements or that do not remain free of defects within specified warranty period.
   1. Warranty that pavers will not dish or warp and will not crack, split, or disintegrate in freeze-thaw conditions.
   2. Warranty Period: Ten years from date of Substantial Completion.

C. Special Installer's Warranty: Written waterproofing Installer's warranty, signed by Installer, covering Work of this Section.
   1. Warranty includes removing and reinstalling pedestals and pavers on decks.
   2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROOF PAVERS

A. Wood Tile Deck Pavers: Subject to compliance with requirements, provide products by the following:
   1. Basis of Design: Bison Innovative Products; Bison Wood Tiles; Model WT-FSC-IPE-24.
   2. Dimensions: 23 7/8” x 23 7/8” x 1.69”
   3. Weight per tile: 25 lbs
   4. Weight per square foot: 6.25 lbs.
   5. Fire Rating: Class A – meets & exceeds ASTM E108 Spread of Flame Test.
   6. Color: Ipé with clear finish.
   7. Surface: Smooth
   8. Finish: As selected.

2.2 ACCESSORIES

A. Pedestals: Bison Versadjust FR Low-Height Pedestals.
   1. Height Range: 0-12 inches.
   2. Weight Bearing Capacity: Maximum 1250 lbs (567 kg) FoS:3 per pedestal.
   3. Material: 20% Talc Filled FR Polypropylene Homopolymer.
   4. Slope Compensation Products: LD4 base leveler disks.
      a. Slope: 1/4 inch per foot. Stack up to four LD4’s under one pedestal for up to 1 inch of slope compensation.

B. Wood Tile Fastening Kit:
   1. Model: FS1 Fastening Kit REQUIRED for use with Bison Deck Supports and Bison Wood Tiles ONLY.
   2. Install one at each corner of 4 tiles to fasten Wood tiles to the pedestals without penetrating or damaging wood.
   3. Materials: FS1 Washer and FS1 Pedestal Screw.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 76 00

SECTION 07 84 00 – FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items for the following, including at entrance and exit of the Project area:
      a. Penetrations through fire-resistance-rated floor and roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
      b. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
      c. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
      d. Sealant joints in fire-rated construction.

B. Related Sections:
   1. Section 07 92 00 – Joint Sealants: Electrical and pipe penetration, acoustical and fire sealants at walls.
   2. Section 09 81 01 – Outlet Box Pads.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility for Materials: Obtain firestopping materials from one manufacturer for entire Project.
   1. This does not restrict Contractor from subcontracting installation of firestopping to multiple subcontracts, but does require installers to use the same manufacturer throughout the Project and be licensed by that manufacturer for the installation of firestopping.

B. Fire-Test-Response Characteristics: Provide firestopping that complies Firestopping tests performed by a qualified testing and inspecting agency, including UL, Intertek, or another agency performing testing and follow-up inspection services, that is acceptable to authorities having jurisdiction.
   1. Through-penetration firestop systems are identical to those tested per ASTM E814 or UL 1479.
   2. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E1966 or UL 2079.
   3. Perimeter fire barrier (curtain wall firestop) systems are identical to those tested for fire-response characteristics per ASTM 2307 or, per IBC or CBC exception where the vision glass extends to the floor level, ASTM E119.
   4. Materials being applied in openings between elements of differing fire ratings shall conform to the most restrictive rating.
   5. Ratings of Firestopping: As indicated by reference to designations of UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
   6. Flame Spread: 25 or less per ASTM E84.
   7. Smoke Developed: 450 of less per ASTM E84.

C. Firestopping materials and systems shall be listed and labeled in accordance with requirements of Underwriters Laboratories, Inc. (UL) Building Materials Directory.

D. Firestopping materials and systems shall be listed and labeled in accordance with requirements of Underwriters Laboratories, Inc. (UL) Building Materials Directory, Intertek Directory of Building Products, or other certified testing agency recognized acceptable to the Authority Having Jurisdiction.

E. Form materials to remain in place in the completed work and sealant used for firestopping work shall be listed by the testing agency and labeled.

F. Firestopping materials shall be rated as required when tested in accordance with ASTM E119.

G. Firestopping materials shall be asbestos free and shall not incorporate nor require the use of hazardous solvents.

H. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surface.

I. Engage an experienced installer who is certified, licensed, FM Approved in accordance with FM 4991, Certified by UL as a Qualified Contractor, or otherwise qualified by the firestopping manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.

B. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.

C. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.

D. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings. Provide products appropriately tested for the thickness and type of insulation utilized.

E. Fire rated pathway devices shall be the preferred product and shall be installed in all locations where frequent cable moves, add-ons and changes will occur.

F. When mechanical cable pathways are not practical, openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products specifically designed for retrofit.

G. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words “Chase Wall Optional”.

H. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM E1399/E1399M, ASTM E1966 or ANSI/ UL 2079.

I. For penetrations and joints in Smoke Barriers, provide penetration firestop systems, fire-resistive joint systems, or perimeter fire barrier systems subjected to an air leakage test conducted in accordance with Standard ANSI/ UL1479 for penetrations and ANSI/UL2079 for joint systems with published L-Ratings for ambient and elevated temperatures as evidence of the ability of firestop system to restrict the movement of smoke.

J. Where required by applicable code, for penetrations in fire-resistance-rated floor/ceiling assemblies, provide firestop systems tested in accordance with ASTM E814 or ANSI/UL1479 for T-Ratings equal to the F-Rating of the assembly penetrated.

K. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E814:
   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. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
      a. Penetrations located outside wall cavities.
      b. Penetrations located outside fire-resistance-rated shaft enclosures.
      c. Where firestop systems protect penetrating items larger than a 4-inch diameter nominal pipe or 16 sq inch overall cross-sectional area.
      d. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.

L. Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E1966 or UL2079, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

M. Fire Rated Construction Design Requirements: Maintain barrier and structural floor fire resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

N. Smoke Barrier Construction Design Requirements: Maintain barrier and structural floor resistance to cold smoke at all penetrations, connections with other surfaces and types of construction and at all separations required to permit building movement and sound or vibration absorption, and at other construction gaps.

O. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
   1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
   2. For floor penetrations with annular spaces exceeding 4-inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
   3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

P. Assembly designs are specified generally under UL system categories by penetrating item. Manufacturers' product applications must have specific UL system designations.

Q. Duct Damper Penetrations: Comply with duct damper manufacturer's requirements.

2.2 MATERIALS

A. Through-Penetration Firestop Systems: Comply with the following requirements in providing system components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating firestops under conditions of service and application, based on testing and field experience.

B. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ or Intertek Directory of Building Products may be used, provided that they conform to the construction type, penetrant type, annular space requirements, and fire rating involved in each separate instance, and that the system is symmetrical for wall applications.
   1. Provide only asbestos-free systems or devices.
   2. Additional requirements: Prevent the passage of cold smoke either as an inherent property of the product, or by the use of a separate product included as a part of the UL system or device, and designed to perform this function.

2.3 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is 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. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

C. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

E. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
   a. Slag-wool-fiber or rock-wool-fiber insulation.
   b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
   c. Fire-rated form board.
   d. Fillers for sealants.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.4 FILL MATERIALS

A. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.

B. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

C. Pillows/Bags: Reusable heat-expanding pillows/bags. Where exposed or required by the applicable tested system, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

D. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

2.5 SEALANTS

A. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant.

B. Sealant Colors: As selected by Owner's Representative from manufacturer's full range of standard colors for products of type indicated.

2.6 ACCESSORIES

A. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and

approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

B. Firestop Devices: Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.

C. Fire Rated Cable Pathways: STI EZ-PATH™ Brand device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and capable of being ganged together and retrofit around existing cables.

D. Wrap Strips: Single component intumescent elastomeric strips designed for use around combustible penetrants.

E. Firestop Pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.

F. Composite Sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil.

G. Cast-In-Place Firestop Device: Single component molded firestop device installed on forms prior to concrete placement with totally encapsulated, tamper-proof integral firestop system and smoke sealing gasket.

H. Fire-Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.

I. Firestop Plugs: Re-enterable, foam rubber plug impregnated with intumescent material for use in blank openings and cable sleeves.

J. Firestop Putty: Nondrying, non-hardening, non-skinning, non-staining, single component fire-rated moldable putty designed to form a re-enterable seal allowing for future changes (for example around cable penetrations).

K. Fire-Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing individual cable penetrations up to 0.27 in. (7 mm) diameter.

L. Retrofit Device for overfilled cable sleeves: two-piece heavy gauge galvanized steel housing containing intumescent materials designed to be installed around existing cable bundles and extended sleeves through fire-rated walls and floors.

M. Elastomeric Firestop Spray Sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture and accommodate minimum ±25 percent movement.

N. Closet Flange Firestop Gasket: one-piece, molded rubber, intumescent pad that installs beneath a 3″ or 4″ (76 mm or 102 mm) closet flange to firestop the opening without the need for caulk or putty.

O. Smoke & Acoustic Sealants: Non-fire-rated acrylic latex sealant designed for sealing through-penetrations, membrane penetrations and joints in non-fire-rated walls and floors. Such sealants shall be tested per UL 1479 for air leakage < 1 cfm/sf and per ASTM E 90 or ASTM C919 for sound transmission rating of minimum 60 STC, depending on specific wall or floor construction.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 84 00

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SECTION 07 92 00 – JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior Joints in Vertical Surfaces and Horizontal Non-traffic Surfaces:
      a. At flashing and sheet metal.
      b. Construction joints in cast-in-place concrete.
      c. Perimeter joints around frames of storefronts, doors, windows, and louvers.
   2. Interior Joints in Vertical Surfaces and Horizontal Non-traffic Surfaces:
      a. Control and expansion joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints of exterior openings.
      c. Tile control and expansion joints.
      d. Vertical joints on exposed surfaces of concrete walls and partitions.
      e. Interior rated and non-rated sealants.
      f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
      g. Perimeter joints between plumbing fixtures and adjoining walls, floors, and counters.
      h. Control and expansion joints in ceiling and overhead surfaces.
   3. Interior Joints in Horizontal Traffic Surfaces:
      a. Isolation joints in cast-in-place concrete slabs.
   4. Joint sealant primers and accessories.

B. Related Sections:
   1. Section 07 60 00 - Flashing and Sheet Metal.
   2. Section 07 84 00 - Firestopping: Sealing of perimeter joint and through-wall penetrations.
   3. Section 07 92 19 – Acoustical Sealant.
   4. Section 08 81 00 – Glass Glazing: Sealants used in glazing.
   5. Section 09 29 00 - Gypsum Board: Sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission.
   6. Section 09 81 16 – Mechanical Room Acoustical Treatment.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
   1. Ensure that sealants selected are compatible with and will adhere to all surfaces with which they are to be in contact.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the Work.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated, as documented according to ASTM E548.
   2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.

D. Sealant manufacturer shall confirm in writing that all materials contacting the sealants, including joint backings, gaskets, spacers, and joint substrates, are compatible with the sealant to be installed. Schedule sufficient time to test these materials for compatibility with the sealant, as necessary. Compatibility tests shall be performed to the sealant manufacturer’s standards.
   1. Determine if priming and/or other preparation techniques are required.
   2. Determine compatibility of exterior joint sealant with stone material to be used. Verify that joint sealant oils do not migrate onto stone face causing visual banding while wet or dry. Manufacturer shall perform staining tests of sealant systems in accordance with ASTM C510 and ASTM D2203 methods for each joint substrate condition in the work.
   3. Testing for adhesion is not required if sealant manufacturer has performed previous testing of proposed sealants for adhesion to and compatibility with required joints substrates.

1.4 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Exterior Sealants: Furnish a written warranty against leaks or other defects of materials, fabrication, and installation. Defects include but are not limited to changes in the structural, physical or chemical properties of the sealant materials that impair function or require abnormal maintenance, changes in surface finish, color or texture, failure in adhesion or cohesion, weather resistance or durability, failure to prevent entry of water, do not cure, or failure to comply with specified requirements.
   1. This warranty shall not cover formation of cracks or defects in substrate materials adjacent to the seal, joint movement in excess of movement rating of sealant, or physical damage caused by others.
   2. Repair or replace defective materials, fabrication, and installation during warranty period without expense to Owner, including removal and replacement of other items as required.
   3. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
   4. Warranty Period: Ten years from date of Substantial Completion.

C. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

D. Failure of the materials, fabrication, and installation include leakage, hardening, cracking, crumbling, melting, shrinkage or running of the sealant or caulking, or the staining of adjacent materials.

E. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

2.2 MATERIALS

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

2.3 EXTERIOR JOINT SEALANTS

A. Exterior Silicone Weatherproofing and Control Joint Sealant: ASTM C920, also ASTM C1193 and tested under ASTM C719; Type S, Grade NS, Class 100/50, Use NT, M, G, A, and O; single component, low-modulus, non-sag sealant, use at exterior joints in vertical surfaces and non-traffic horizontal surfaces such as but not limited to:
   1. Butt joints between metal panels.
   2. Perimeter joints between materials listed above and frames of doors, windows, storefronts, louvers, and similar openings.
   3. Control and expansion joints in ceilings and overhead surfaces.
   4. Other exterior joints in vertical surfaces and non-traffic horizontal surfaces for which no other sealant is specified.

B. Reglets and Flashings Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, A, and O; single component elastomeric.

C. Weather Barrier Sealant: ASTM C920, Type S, Grade NS, Class 25, neutral-cure, single-component elastomeric; ASTM C719 +/- 25 movement.

D. Concrete Walkway Joint Sealant: Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C920, Type S, Grade NS, Class 100/50, for Use T.

2.4 INTERIOR JOINT SEALANTS

A. Interior Weatherproofing and Control Joint Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A, and O; single component, chemical curing, non-staining, non-bleeding, non-sagging type; color as selected; use in interior surfaces such as, but not limited to:
1. Control and expansion joints on exposed interior surfaces of exterior walls.
2. Perimeter joints on exposed interior surfaces of exterior openings.
3. Joints on precast beams and planks.
4. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
5. Other interior joints in vertical surfaces and non-traffic horizontal surfaces subject to movement for which no other sealant is specified.

B. Interior Latex Joint Sealant: Provide product complying with ASTM C834, Type S, Use O, Grade NS; use at interior joints in vertical surfaces and non-traffic horizontal surfaces such as, but not limited to:
1. Perimeters of interior door and window frames.
2. Interior wall surfaces scheduled to receive latex paints.
3. Control and expansion joints on exposed interior surfaces of exterior walls.
4. Perimeter joints on exposed interior surfaces of exterior openings.
5. Joints on precast beams and planks.
6. Perimeter joints between interior wall surfaces and frames of interior doors, windows, storefronts, louvers, elevator entrances and similar openings.
7. Trim or finish joints subject to movement.

C. Mildew Resistant Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25; Use NT, G, A, and O; use on non-porous interior surfaces under high humidity and temperature extremes. For use in the following:
1. Bathrooms, spas, and similar applications where joints need protection against fungi and bacteria.
2. Perimeters of plumbing fixtures.

D. Interior Food Contact Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, and O; USDA compliant, for use at the following:
1. Joints in kitchen countertops and work surfaces.
2. Joints between food service equipment and surrounding construction.
3. Other interior joints where incidental food contact may occur.

2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings and accessory materials, including primers, of material and type that are non-staining; are compatible with joint substrates, sealants, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Foam Joint Fillers: Non-gassing, preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of one of materials indicated below, as recommended by manufacturer for compatibility with their sealant; of size, shape, and density

to control sealant depth, prevent three-sided adhesion, provide a surface against which to tool, and otherwise contribute to producing optimum sealant performance:

C. Foam Joint Fillers: Non-gassing, preformed, compressible, resilient, non-staining, non-waxing, non-extruding strips of flexible plastic foam of one of materials indicated below, as recommended by manufacturer for compatibility with their sealant; of size, shape, and density to control sealant depth, prevent three-sided adhesion, provide a surface against which to tool, and otherwise contribute to producing optimum sealant performance:
   1. Cylindrical Sealant Backings: Of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance and as recommended by sealant manufacturer. Types:
      a. Types: ASTM C1330:
         1) Type C: Non-gassing, closed-cell material with a surface skin.
         2) Type O: Cylindrical flexible sealant backings composed of predominantly open cell material.
         3) Type B: Bicellular material with a surface skin.

PART 3 - EXECUTION – NOT USED

END OF SECTION 07 92 00

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SECTION 07 92 19 - ACOUSTICAL SEALANT

PART 1 - GENERAL

1.1 SCOPE

A. This specification defines the applicable requirements for the acoustical sealant throughout the project.

1.2 SUBMITTAL

A. Samples of the acoustical sealant materials to be utilized and catalog cuts shall be submitted to the Architect for approval.

B. LEED Submittals
   1. Credit MR 2 BPDO-Environmental Product Declarations
      a. For Product specific declarations, defined for this credit, as declarations that are based on a life-cycle assessment of a product but not constituting a full EPD. To document this claim, the project team must provide the following information:
         1) Name (declaration holder or producer, typically the manufacturer)
         2) Contact information
         3) Product type
         4) Product name
         5) Product description
         6) Summary of impact categories measured and overall values
         7) Functional unit
         8) Standards met
         9) Independent review entity's name and statement
      b. For industry-wide (generic) declarations and product-specific Type III declarations, the project team must provide the following:
         1) Declaration holder (the company, usually the manufacturer, that the EPD is attributed to)
         2) EPD program operator (the entity that creates and registers the EPD)
         3) LCA verifier (the third-party entity that verifies the life-cycle assessment)
         4) PCR reviewer (the third-party entity that has reviewed the product category rules)
         5) During the selection of products with EPDs, identify two items about the document: the type of EPD it is, and the summary that will be uploaded for credit compliance. Such a summary is preferred to the full document, and includes name of declaration holder, program operator, contact information, product type, product name, product description, product category rule, certification period, declaration number, summary of impact categories measured and overall values, functional unit, standards met, and independent verification body.
      c. Complete MR Building Product Disclosure and Optimization Calculator or equivalent tracking tool, providing information regarding the product and its cost.
   2. Credit MR 4 BPDO Material Ingredients: Documentation of chemical inventory through Health Product Declaration, Cradle to Cradle certification labels, manufacturers' lists of ingredients with GreenScreen assessment reports for confidential ingredients, or Declare Label.
      a. Complete MR Building Product Disclosure and Optimization Calculator or equivalent tracking tool, providing information regarding the product and its cost.

3. Credit IEQ 2 Low-Emitting Materials, Adhesives and Sealants: Provide manufacturers' or third-party certification that includes the following information:
   a. The exposure scenario used to determine compliance.
   b. The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.1:
      1) 0.5 mg/m 3 or less;
      2) Between 0.5 and 5.0 mg/m 3; or
      3) 5.0 mg/m 3 or more
   c. Claims of compliance for wet-applied products must state the amount applied in mass per surface area. Wet-applied adhesives and sealants must meet the applicable chemical content requirements of SCAQMD Rule 1168, uly 1, 2005.
4. Complete the Low-Emitting Materials Calculator or equivalent tracking tool, providing information regarding the product and the volume used.
5. Credit IEQ 2 Low-Emitting Materials, Paints and Coatings: Provide manufacturers' or third-party certification that includes the following information:
   a. The exposure scenario used to determine compliance.
   b. The range of total VOCs after 14 days, measured as specified in the CDPH Standard Method v1.1:
      1) 0.5 mg/m 3 or less;
      2) Between 0.5 and 5.0 mg/m 3; or
      3) 5.0 mg/m 3 or more
   c. Claims of compliance for wet-applied products must state the amount applied in mass per surface area. Wet-applied paints and coatings must meet the applicable VOC limits of the Suggested Control Measure (SCM) for Architectural Coatings, or the SCAQMD Rule 1113, effective une 3, 2011.
6. Complete the Low-Emitting Materials Calculator or equivalent tracking tool, providing information regarding the product and the volume used.

PART 2 - PRODUCTS

2.1 MATERIAL DESCRIPTION

A. Where indicated on the drawings and/or described in the specifications, acoustical sealant shall be provided to prevent the transmission of airborne sound through cracks in the construction.

B. The acoustical sealant compound shall be of the non-hardening polysulphide type, or elastic water-base type.
   1. Latex sealants shall be permanently non-hardening and classified Grade 0 per ASTM C834–10.
   2. Non-latex sealants shall be permanently non-hardening and meet Class 12.5 per C920.

C. Acceptable products include:
   1. Pecora Corp. AC-20 FTR Acoustical and Insulation Sealant.
   2. Tremco Acoustical Sealant.
   3. United States Gypsum Sheetrock Acoustical Sealant.

D. Backer Rod shall be equal to polyethylene type “Sof Rod” as manufactured by Applied Technologies, Inc. It shall be closed-cell polymeric type with a density of 2.5 PCF and a tensile strength of 35 PSI.

E. Removable expanding Silicone Foam shall be Dow Corning 3-6548 Silicone RTV Foam or equal.

F. Spray-on fireproofing shall be minimum 40 PCF high density cementitious type equal to Monokote Type Z-146 as manufactured by Grace Construction Products.

G. Pillow Pads shall be Metacaulk Firestop Pillows as manufactured by Rectorseal or equal.

H. LEED Requirements
1. Credit MR 2 BPDO-Environmental Product Declarations
   a. For Product-specific declarations, manufacturer must meet the following disclosure criteria that products have a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope are valued as one quarter (1/4) of a product for the purposes of credit achievement calculation.
   b. For industry-wide (generic) declarations and product-specific Type III declarations, manufacturer must meet the following disclosure criteria that products have environmental product declarations, which conform to ISO 14025, 14040, 14044, and EN 15804 or IS 21930 and have at least a cradle to gate scope. Specifically one of the following must be met:
      1) Industry wide (generic) EPD – products with a third-party Type III certification, including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator, are valued as one half (1/2) of a product for purposes of credit achievement calculation.
      2) Product-specific Type III EPD – products with a third party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as the participant by the program operator, are valued as one whole product for purposes of credit achievement calculation.
2. Provide products manufactured and extracted within 100 miles of the project site whenever possible.
3. Credit MR 4 BPDO Material Ingredients: Select materials that comply with one of the following programs:
   a. Manufacturer Inventory: Product must disclose the complete content inventory for the product identified by name and Chemical Abstract Service Registration Number (CASRN). Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but must disclose role, amount and GreenScreen benchmark, as defined in GreenScreen v1.2.
   b. Health Product Declaration
   c. Cradle to Cradle version 2 Basic level or Cradle to Cradle version 3 Bronze level
      1) Declare Label: labels designated as Red List Free or Declared.
4. Credit IEQ 2 Low-Emitting Materials, Adhesives and Sealants: For field applications that are inside the weatherproofing membrane: Adhesives/sealants must be tested and determined compliant in accordance with Arizona Department of Health Services, using the applicable exposure scenario. The default scenario is the private office scenario.
   a. All adhesives/sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, uly 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.
5. Credit IEQ 2 Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing membrane: Paints and Coatings must be tested and determined compliant in accordance with Arizona Department of Health Services,

using the applicable exposure scenario. The default scenario if the private office scenario.

a. All paints and coatings wet-applied on site must meet the applicable VOC limits of the Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective une 3, 2011.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Apply all sealants per manufacturer's written instructions.

B. Clean surfaces as required for proper adhesion of sealants.

C. All seals shall provide an "air tight" closure to the surface or material being sealed similar to that required for fire rated construction.

D. Seal all gypsum board to floor, ceiling, metal deck, concrete, etc.

E. Apply 1/4-inch minimum rounded bead around all penetrations and openings in gypsum board including, but not limited to, outlet boxes, cable penetrations, pipes, HVAC ducts, structural members, etc. so that the wall, partition or ceiling becomes an "air tight" enclosure to the adjacent space.

F. Provide continuous backer rod behind sealant at all joints 3/8-inch or larger.

G. Sealant shall be a minimum of 1/4-inch deep in joint.

H. All gaps larger than 1/2 inch shall first be covered with gypsum board, lapped a minimum of 2 inches and screwed before using acoustical sealant.

I. Where indicated on the drawings or approved in writing by the Acoustical Consultant, spray-on type fireproofing may be used in lieu of acoustical sealant.

. Provide fire-rated acoustical sealant where required in fire-rated assemblies. Fire-rated sealants must meet all requirements of acoustical sealants.

. At penetrations requiring access, such as cable trays or open conduit for signal wires, fill openings at point of penetration with a removable expanding silicone foam or pillow pads.

END OF SECTION 07 92 19

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard steel doors and frames indicated and scheduled on Drawings.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware.
   2. Section 09 91 00 – Painting: Finish painting of steel items.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames", ANSI A250, and as specified herein.

PART 2 - PRODUCTS

2.1 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
   1. Design: Flush panel.
   2. Non-Rated Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
   3. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
      a. Locations: Exterior doors and interior doors where indicated.
   4. Fire Door Core Construction: As required to provide fire-protection ratings indicated.
   5. Vertical Edges, for Single- and Double-Acting Doors: Square edge.
   6. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.

7. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Fabricate from galvanized steel sheet.
   2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush) or Model 2 (Seamless) composite construction where indicated on Drawings.
   3. Material: Galvanized steel sheet, 16-gauge, 0.053-inch (1.3 mm) thick.

C. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Fabricate from cold-rolled steel sheet.
   2. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) or Model 2 (Seamless) composite construction where indicated on Drawings.
   3. Material: Steel sheet, 0.042-inch (1.0 mm) thick.
   4. Cores: Manufacturer's standard as required for each type of rated and non-rated door and that meets rating requirements.

2.2 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from galvanized steel sheet.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
   2. Frames for Level 1 and Level 2 Steel Doors: 16-gauge, 0.053-inch- (1.3-mm-) thick steel sheet.
   3. Frames for Level 3 and Level 4 Steel Doors: 14-gauge, 0.067-inch- (1.7-mm-) thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
   2. Knocked-Down Frames: Not permitted.
   3. Frames for Level 1 and Level 2 Steel Doors: 16-gauge, 0.053-inch- (1.3-mm-) thick steel sheet.
   4. Frames for Level 3 and Level 4 Steel Doors: 14-gauge, 0.067-inch- (1.7-mm-) thick steel sheet.
   5. Frames for Wood Doors: 16-gauge, 0.053-inch- (1.3-mm-) thick steel sheet.
   6. Frames for Borrowed Lights: 16-gauge, 0.053-inch- (1.3-mm-) thick steel sheet.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
   2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
   3. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 14-gauge, 0.067 inch (1.7 mm) thick.
   4. All Other Surface-Mounted Hardware: Minimum 14-gauge, 0.067 inch (1.7 mm) thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:
1. Metal Stud Anchor: Z-type anchor, welded to frame, 16-gauge, 0.053-inch-thick steel, UL listed as required for fire rating.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
1. Used at all frames installed prior to walls. Where frames are installed after walls, install an additional jamb anchor within the lowest 6-inches of the door jamb, one each side.
2. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
3. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.3 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A780/A780M.
1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

E. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 11 13

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SECTION 08 11 16 – INTERIOR ALUMINUM DOOR AND WINDOW FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standard commercial interior aluminum door and sidelight frames indicated and scheduled on Drawings.

B. Related Sections:
   1. Section 08 11 13 – Hollow Metal Doors and Frames: Steel doors and door frames.
   2. Section 08 14 00 – Wood Doors.
   3. Section 08 71 00 – Door Hardware.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain aluminum frames from one source and from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of interior aluminum frames and are based on the specific system indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
   3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
   4. Structural Profiles: ASTM B308/B308M.

B. Carbon Steel Reinforcement: ASTM A36/A36M for structural shapes, plates and bars; ASTM A1008/A1008M for cold rolled sheet and strip, or ASTM A570 for hot rolled sheet and strip.

C. Anchors, Clips, and Accessories: ASTM A123/A123M, aluminum, non-magnetic stainless steel or hot-dip, zinc-coated steel.

D. Exposed Fasteners: Use exposed fasteners (Phillips flat-head screws) only to apply hardware. Match the finish of the member or hardware being fastened.

2.2 COMPONENTS

A. Door Frames: Reinforced for hinges and strikes.

B. Glazing Frames: For glazing thickness indicated.

C. Ceiling Tracks: Extruded aluminum.

D. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick, with removable snap-in casing trim, glazing stops, and door stops without exposed fasteners.

2.3 INTERIOR ALUMINUM STOREFRONT FRAMES

A. Framing Members: Manufacturer's standard extruded aluminum storefront-style framing members of thickness required and reinforced as required to support imposed loads.
1. Dimensions: 1-3/4- x 4-inch framing system.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

D. Framing System Gaskets and Sealants: Manufacturer's standard recommended by manufacturer for joint type.

E. Glazing: See Section 08 81 00.

2.4 INTERIOR ALUMINUM STOREFRONT DOORS

A. Stile-and-Rail Type Interior Doors: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts.

B. Design: Provide 1-3/4-inch-thick doors of design as follows.
1. Stile Design: Medium stile; 3-1/2-inch (88.9-mm) nominal width.

C. Hardware:
1. Pivot Hinges: BHMA A156.4, Grade 1.
2. Locking Devices, General: Do not require use of key, tool, or special knowledge for operation.
3. Mortise Auxiliary Locks: BHMA A156.5, Grade 1.
4. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1.
5. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
   a. Standard: BHMA A156.3, Grade 1.
6. Cylinders: As specified in Section 08710; BHMA A156.5, Grade 1.

7. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
8. Operating Trim: BHMA A156.6.
9. Removable Mullions:
   a. Standard: BHMA A156.3.
   b. When used with panic exit devices, provide removable mullions listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305. Use only mullions that have been tested with exit devices to be used.
10. Closers: With accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use, and adjustable to meet field conditions and requirements for opening force.
    a. Standard: BHMA A156.4, Grade 1.
11. Concealed Overhead Holders: BHMA A156.8, Grade 1.
12. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
13. Door Seals: Manufacturer's standard replaceable components.
    a. Compression Type for Rated Conditions: Made of ASTM D2000, molded neoprene, or ASTM D2287, molded PVC.
    b. Sliding Type for Non-rated Conditions: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 11 16

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SECTION 08 14 00 – WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid core wood doors, rated and non-rated, with plastic laminate faces.

B. Related Sections:
   1. Section 08 71 00 –Door Hardware: Installation of hardware in wood doors.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY STANDARDS

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. NAAWS Quality Standard: Comply with the specified grade(s) of interior architectural woodwork indicated for construction, finishes, and installation, specified section(s), and applicable requirements of the current edition of the "North American Architectural Woodwork Standards – 3.0, United States Version".
   1. Provide WI-certified compliance labels and certificates indicating that woodwork, including installation, complies with requirements of grades specified.

C. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252. Door label shall include hourly rating followed by the letter “S” indicating conformance with air leakage resistance testing, serial number, and the listing agency’s certification mark.

E. Temperature-Rise Rating: At exit enclosures and exitways, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure. In addition to the requirements specified for positive pressure test requirements specified above, the door label shall include temperature rise rating.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials, fabrication, or installation within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4-inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
   2. Warranty Period for Solid-Core Interior Doors: Life of the original installation, including costs of re-hanging.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces of each door; meeting requirements of NAAWS Section 9; unless otherwise indicated.

B. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.

C. Adhesives: NWWDA IS-1.6, Type II adhesive bond or better for cores, Type I adhesive bond for faces and cross bands. Do not use adhesives containing urea formaldehyde.

2.2 INTERIOR DOOR CONSTRUCTION

A. General Wood Door Product Requirements: Provide doors with same exposed surface material on both faces of each door; meeting requirements of NAAWS Section 9 unless otherwise indicated.

B. Interior, Solid-Core, Plastic-Laminate-Faced Doors:
   1. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
   2. NAAWS Grade: Premium.
   3. Adhesive: Type I or Type II
   4. Core: Particle board at non-rated conditions, mineral-core at rated conditions.
   5. Grade: Custom (Grade A faces).
   6. Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
      a. Color: As indicated on Drawings.
   7. Exposed Vertical and Top Edges: Impact-resistant polymer edging, applied after faces.
   8. WDMA I.S.1-A Performance Grade:
      a. Heavy Duty: At office, stairwell, mechanical service, hallway, storage doors.
      b. Extra Heavy Duty: At public bathrooms, assembly areas, and kitchens.

C. Particleboard Cores:
   1. Core (Solid, Non-Rated): NAAWS Section 9, HPVA Grade A, particleboard core.
   2. Particleboard: ANSI A208.1, Grade LD-1.
      a. Use particleboard made with binder containing no urea-formaldehyde resin.
   3. Blocking: Provide wood blocking in particleboard-core doors as follows:
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.

b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

4. Provide doors with glued-block cores instead of particleboard cores at locations where exit devices are indicated.

D. Mineral-Core Cores:
1. Core (Solid, Fire Rated): NAAWS Section 9, HPVA Grade A, noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
a. 5-inch (125-mm) top-rail blocking.
b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
d. 4-1/2-by-10-inch (114-by-250-mm) lock blocks.
e. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 LOUVERS

A. Metal Louvers:
1. Blade Type: Vision-proof, inverted V.
2. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.
a. Paint color to match door finish.

B. Louvers for Fire-Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire-protection rating of 1-1/2 hours and less.
1. Metal and Finish: Hot-dip galvanized steel, 0.040 inch (1.0 mm) thick, factory primed for paint finish.
a. Paint color to match door finish.

2.4 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 14 00

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SECTION 08 31 13 – ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Interior access panels and doors in walls and suspended drywall ceilings.
   2. Exterior access panels in exterior soffits.

B. Related Sections:
   1. Section 09 91 00 – Painting: Finish painting for metal surfaces.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

PART 2 - PRODUCTS

2.1 INTERIOR ACCESS DOORS

A. Furnish access doors of proper size for access to concealed equipment. Unless otherwise indicated, minimum size shall be 12-inch x 12-inch for hand access and minimum 18-inch x 18-inch for valve and actuator access and 24-inch x 24-inch for equipment access.

B. Flush, Non-Rated Access Doors and Frames with Exposed Flanges: Fabricated from stainless-steel sheet.
   1. Locations: Wall and ceiling surfaces in Toilet Rooms, Custodial Rooms, and other Wet Areas.
   2. Frame: Minimum 0.060-inch- (1.5-mm-) thick sheet metal with 1-inch (25-mm wide, surface-mounted trim.
   3. Hinges: Continuous piano hinge.
   4. Hardware: Screwdriver-operated cam latch.

C. GRG Units for Suspended Drywall Ceilings: ASTM C1335/C1335M and ASTM C1381

1. Product: Chicago Metallic; GRG Access Doors, 8500 Series; or Armstrong Ceiling Solutions, Plasterform.
2. Type: Lay-in panels; screwed to ceiling grid.
3. Access Door: Rounded edges.
4. Shell Thickness: 1/8” to 3/16”.
5. Fastener Test Pull Out (Metal Stud): 215 lb avg.
6. Fastener Push-Through Test: 350 lb avg.
7. Fuel Contribution: ASTM E84; 0.
8. Flame Spread: ASTM E84; 0.
9. Smoke Index: ASTM E84; 0.
10. Combustion: ASTM E84; Non-combustible.
11. Class A Non-Rated.

2.2 EXTERIOR ACCESS DOORS

A. Exterior Flush Access Doors:
1. Description: Weatherproof assembly, with face of door fit flush with frame and with exposed frame. Include extruded door gaskets and minimum 2-inch-thick (50-mm-thick) fiberglass insulation.
2. Locations: Wall.
3. Door Size: 24"30".
4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage, factory primed for paint finish.
5. Continuous hinge.
6. Latch and Lock: Cam latch operated by handle, with preparation for mortise lock.

2.3 STEEL FINISHES

A. Surface Preparation: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Exteriors (SSPC Zone 1B): SSPC-SP6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

B. Steel and Metallic-Coated-Steel Finishes:
1. Apply shop primer to uncoated surfaces of metal fabrications.
2. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 31 13

SECTION 08 44 13 – GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Prefinished aluminum curtain wall system, complete with glass and glazing and required structural anchors, attachments and shims.
   2. Entrance doors, frames, and hardware.
   3. Operable windows installed in curtain wall system.
   4. Perimeter weatherseals.

B. Related Sections:
   1. Section 05 70 00 – Decorative Metal.
   2. Section 07 21 00 – Building Insulation: Insulation materials field installed with glazed aluminum curtain-wall systems
   3. Section 07 92 00 – Joint Sealants: Installation of joint sealants installed with glazed aluminum curtain-wall systems and for sealants to the extent not specified in this Section.
   4. Section 08 81 00 – Glazing: Insulating-glass requirements.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Provide glazed aluminum curtain wall systems produced by a firm experienced in manufacturing systems that are similar to those indicated for this project and that have a record of successful in-service performance.

B. Installer Qualifications: Capable of assuming engineering responsibility and performing Work of this Section and who is acceptable to manufacturer.
   1. Engineering Responsibility: Preparation of data for glazed aluminum curtain-wall systems including the following:
      a. Shop Drawings based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project and submission of reports of tests performed on manufacturer's standard assemblies.

C. 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 glazed aluminum curtain walls that are similar to those indicated for this Project in material, design, and extent.

D. Single Source Responsibility: Obtain aluminum curtain wall systems from one source and from a single manufacturer.

E. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

F. Welding Standards: As follows:
1. AWS D1.2, "Structural Welding Code—Aluminum".
2. AWS D1.3, "Structural Welding Code—Steel Sheet".
3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.4 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials, fabrication, or installation within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration caused by thermal movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Adhesive or cohesive sealant failures.
e. Water leakage through fixed glazing and framing areas.
f. Failure of operating components.
g. Failure of glass seal on insulating glass units, including interpane dusting or misting.
2. Warranty Period:
a. Installation: Two years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.
1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. General: Provide glazed aluminum curtain-wall systems, including anchorage, capable of withstanding, without failure, the effects of the following:
1. Structural loads.
2. Thermal movements.
3. Movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
4. Dimensional tolerances of building frame and other adjacent construction.
5. Failure includes the following:
   a. Deflection exceeding specified limits.
   b. Thermal stresses transferred to building structure.
   c. Framing members transferring stresses, including those caused by thermal and structural movements, to glazing.
   d. Noise or vibration created by wind and thermal and structural movements.
   e. Loosening or weakening of fasteners, attachments, and other components.
   f. Sealant failure.

D. General Performance: Comply with performance requirements specified, as determined by testing of manufacturer's standard glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Glazed aluminum curtain walls shall withstand movements of supporting structure indicated on Drawings including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.
3. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
4. Structural Loads:
   a. Wind Loads:
      1) Basic Wind Speed: As indicated on Structural Drawings.
      2) Importance Factor: As indicated on Structural Drawings.
      3) Exposure Category: As indicated on Structural Drawings.
5. Structural-Test Performance: Test according to ASTM E330/E330M as follows:

a. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
b. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
c. Test Durations: As required by design wind velocity, but not less than 10 seconds.

6. Deflection of Framing Members: At design wind pressure, as follows:
   a. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.
   b. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.
   c. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.
7. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to two times the length of cantilevered member, divided by 175.
8. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   a. Component Importance Factor is indicated on Structural Drawings.
9. Story Drift: Accommodate design displacement of adjacent stories indicated.
   a. Design Displacement: As indicated on Drawings.
   b. Test Performance: Meeting criteria for passing based on building occupancy type when tested according to AAMA 501.4 at design displacement and 1.5 times the design displacement.
10. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E331 at a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
    a. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water controlled by flashing and gutters that is drained to exterior.
11. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
    a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
    b. Test Interior Ambient-Air Temperature: 75 deg F (24 deg C).
12. Energy Performance: Glazed aluminum curtain walls shall have certified and labeled energy performance ratings in accordance with NFRC for glazed curtain wall system, including frame, glazing and operable windows and doors.
13. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. (1.50 L/s per sq. m) of fixed wall area as determined according to ASTM E283 at a minimum static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).

2.2 FRAMING SYSTEMS

A. Basis-of-Design Curtain Wall System:
   1. Exterior Framing: Arcadia, Inc.; T500 Series (OPG6000) thermal with 12-inch cap extensions, (2 -1/4” x 6” deep).
   2. Operable Window Inserts: Arcadia T-200.
   3. US Aluminum (CR Laurence Co. Inc.).
   4. Kawneer North America.
   5. Wausau Window and Door.
   6. Accepted equivalent.

B. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B209.
   2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B221.
   3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
   4. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

C. Steel Reinforcement: With manufacturer's standard corrosion-resistant primer complying with SSPC-PS Guide No. 12.00 applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
   2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Where fasteners are subject to loosening or turn out from thermal and structural movements, wind loads, or vibration, use self-locking devices.
   2. Reinforce members as required to receive fastener threads.
   3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended by manufacturer.

F. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing Gaskets and Sealants: As recommended by manufacturer for joint type.
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 CURTAIN WALL SYSTEM COMPONENTS

A. Curtain Wall System; ASTM B221, 6063-T5 extruded aluminum framing with operable windows and extended cap covers.

B. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Front.

C. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

D. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

E. Anchorages: Anchorage attachments and shims required to secure window walls to building tube steel structural system; complete with matching flush stops of profile to suit frames and of adequate size to provide sufficient bite on glass panels; drilled holes, deflector plates and internal flashings to accommodate internal weep and drainage system.

F. Structural Steel Reinforcement and Tubular Framing: ASTM A653/653M, hot-dip galvanized after fabrication. Touch up abraded surfaces after installation.

G. Glazing Materials: Type recommended by window wall manufacturer to suit locations and applications. Tempered glass shall be manufactured by a tongless method.

H. Anchorage Devices: Type recommended by window wall manufacturer to suit locations and applications.

I. Spacers and Setting Blocks: Manufacturer's standard elastomeric type in hardness recommended by system and gasket manufacturer to comply with system performance requirements.
   1. Color: Black.

2.4 EXTERIOR OPERABLE WINDOW TYPES

A. Awning Windows:
   1. Operator: Gear-type rotary operator located on jamb at sill.
      a. Handle: Standard crank.
   2. Hinges: Concealed four- or six-bar friction hinge located on each jamb near top rail;
   3. two per ventilator.
   4. Provide with 2 balance-support arms.
   5. Latches; provide 2 for windows over 42 inches wide.
   6. Lock: Combination handle and cam-action lock and keeper.
   7. Pole Operators: As specified; for windows located higher than 8 feet above finished
   8. floor.
   9. Limit Device: As specified.
   10. Finish: Match curtain wall.

B. Casement Windows:
   1. Operator: Gear-type rotary single-arm operator located on jamb at sill.
   2. Hinge: Heavy-duty, concealed, four- or six-bar friction hinge with adjustable-slide friction shoe; designed to permit ventilator operation for inside cleaning of outside glass face; two per ventilator.
   3. Lock: Concealed multipoint lock operated by single lever handle or lift-type throw; three per ventilator.
   4. Friction Shoes: Manufacturer’s standard.
   5. Finish: Match curtain wall.

2.5 ENTRANCE DOOR SYSTEMS

A. Stile-and-Rail Type Entrance Doors: Arcadia, Inc.; WS512HD Series; heavy-duty wide stile, 1-3/4 in. deep x 0.188 in. thick walls or equal by one of the manufacturers specified above.
   1. Metal Thickness: 3/16-inch
   2. Stile Design: Wide stile. Narrow stiles not acceptable.

a. Vertical stiles: 5 in.
b. Top rail: 5-5/16 in.
c. Bottom rail: 10-1/2 in.
d. Glazing stop shape: Square.

3. Hardware Reinforcement: 1/4-inch-thick metal material
4. Finish: Match curtain wall.

2.6 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware for each entrance door to comply with requirements in this Section.
1. For installation of hardware components indicated to be provided by other than the aluminum entrance manufacturer, refer to Section 08 71 00
2. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA standard referenced.
3. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
4. Opening-Force Requirements:
a. Egress Doors: Not more than 5 lbf (22.2 N) to fully open door.

B. Provide heavy-duty hardware units as indicated, scheduled, or required for operation of each door, including the following items of sizes, number, and type recommended by manufacturer for service required; finish to match door.

2.7 GLAZING SYSTEMS

A. Glazing: As specified in Section 08 81 00.

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
1. Weatherseal Sealant: ASTM C920 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, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.
a. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Gass to Mullion Sealant Color: Black.
c. Butt-joint Glass Sealant Color: Clear.

D. Secondary Sealants and Joint Fillers: For use as weatherseal at perimeter of entrance and storefront systems, compatible with other system components with which it comes in contact, as listed in Section 07 92 00.
1. Color: As selected by Architect from manufacturer's full range of colors.

2.8 FINISHES

A. High-Performance Organic Finish: 3-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 44 13

SECTION 08 62 13 – DOMED UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Factory-assembled unit skylights for installation in flat roof areas.

B. Related Sections:
   1. Section 06 10 53 – Miscellaneous Carpentry: Wood framing and blocking at unit skylights.
   2. Section 07 60 00 - Flashing and Sheet Metal: Flashing at unit skylights.
   3. Section 07 72 00 - Roof Accessories: Roof hatches and smoke vents.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 COORDINATION

A. Coordinate unit skylight flashing requirements with roofing system.

B. Coordinate sizes and locations of prefabricated curbs with actual unit skylights provided.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

C. Source Limitations: Obtain unit skylights from single source from single manufacturer.

D. Fire-Test Response Characteristics of Plastic Glazing: Provide plastic glazing sheets identical to those tested for fire-exposure behavior per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Self-Ignition Temperature: 650 deg F (343 deg C) or greater for plastic sheets in thickness indicated when tested per ASTM D1929.

2. Smoke Production Characteristics: Comply with either requirement below:
   a. Smoke-Developed Index: 450 or less when tested per ASTM E84 on plastic sheets in manner indicated for use.
   b. Smoke Density: 75 or less when tested per ASTM D2843 on plastic sheets in thickness indicated for use.
3. Relative-Burning Characteristics: Tested per ASTM D635.
   a. Acrylic Glazing: Class CC2, burning rate of 2.5 inches (64 mm) per minute or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.
   b. Polycarbonate Glazing: Class CC1, burning extent of 1 inch (25 mm) or less for nominal thickness of 0.060 inch (1.5 mm) or thickness indicated for use.

E. Unit Skylight Standard: Comply with AAMA/WDMA 101/I.S.2/A440, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," most current version, for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
1. Provide AAMA-certified unit skylights with an attached label.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of unit skylights that fail in materials, fabrication, and installation within specified warranty period.
1. Failures include, but are not limited to, the following:
   a. Uncontrolled water leakage.
   b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
   c. Breakage of polycarbonate glazing.
   d. Deterioration of insulating-glass hermetic seal.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the unit skylights is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. Basis-of-Design: Velux High Performance Domes; Dynamic Dome Deck Mounted.
2. Bristolite Skylights.
3. Accepted equivalent.

2.2 UNIT SKYLIGHTS

A. Extruded Aluminum Frame: ASTM B221 alloy 6063-T5, mitered and heliarc welded corners, mill finish unless indicated otherwise.

B. Aluminum Finish: In accordance with AAMA 605.2 for corrosion resistance.

C. Glazing: Polycarbonate, double dome.

D. Unit Shape and Size: Rectangular, 48-by-96-inch (1200-by-2400-mm) , thermally broken frame.

E. Acrylic Glazing: ASTM D4802, thermoformable, monolithic sheet, Category as standard with manufacturer, Type UVA (formulated with UV absorber), Finish 1 (smooth or polished).
   1. Double-Glazing Profile: Dome, 25 percent rise with smooth outer dome and prismatic inner dome.
      a. Outer Glazing Color: Colorless, transparent.
      b. Inner Glazing Color: White, translucent.

F. Glazing Gaskets: Manufacturer's standard.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 62 13

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SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Door hardware required for swing doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

B. Related Sections:
   1. Section 08 11 13 – Hollow Metal Doors and Frames: Silencers integral with hollow metal frames.
   2. Section 08 44 13 – Glazed Aluminum Curtain Walls: Aluminum entrance door hardware, including cylinders.
   3. Section 10 44 00 – Fire Protection Specialties: Knox box.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Supplier Qualifications: Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor and Owner's Representative about door hardware and keying.

B. Single Source Responsibility: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer.

C. Regulatory Requirements: Comply with provisions of the following:
   1. Where indicated to comply with accessibility requirements, comply with CBC Chapter 11B as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
         2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.

3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

c. Thresholds: Not more than 1/2 inch (13 mm) high. Bevel raised thresholds with a slope of not more than 1:2.

2. NFPA 101: Comply with the following for means of egress doors:
   a. Latches, Locks, and Exit Devices: Not more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
   b. Delayed-Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds.
   c. Door Closers: Not more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.
   d. Thresholds: Not more than 1/2 inch (13 mm) high.
3. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only door hardware items listed that are identical to products tested by UL, Warnock Hersey, FM, or other testing and inspecting organization, acceptable to authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire- rated door and door frame labels.

PART 2 - PRODUCTS

2.1 LOCKSET AND LATCHSET STYLES AND FINISHES

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." and State of California Title 24.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Mortise Type: Schlage, L Series, 17 lever design with 'B' rose, or approved equal, function as scheduled.
   1. Finish: 630 Sating stainless steel finish UON.
   2. Backset: 2-3/4-inches, unless otherwise scheduled.

D. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
   2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
   3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

E. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

F. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

2.2 NUMBER OF HINGES

A. Provide number of hinges indicated but not less than 3 hinges per door leaf and as follows:
   1. For doors 90 inches or less in height: 3 hinges; one additional hinge for each 30 inches of additional height.
   2. For doors up to 36 inches wide: 3 hinges.
   3. For doors over 36 inches wide: 4 hinges.
   4. Hinge Type: Ball bearing type throughout, unless noted otherwise.

B. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Entrance Doors: Heavy-weight hinges.
   2. Doors with Closers: Antifriction-bearing hinges.
   3. Interior Doors: Standard-weight hinges.

C. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Stainless steel, with stainless-steel pin.
   2. Interior Hinges: Stainless steel, with stainless-steel pin.
   3. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.

D. Provide hinges with non-removable pins (NRP) at exterior doors and out-swinging interior doors.

E. Provide butts of proper width to clear trim projection when the door swings 180 degrees. Where partition layout permits, doors shall swing 180 degrees.

2.3 LOCK CYLINDERS AND KEYING

A. Review the keying system with the Owner's Representative and provide the type required (master, grandmaster or great-grandmaster), either new or integrated with Owner’s existing system.

B. Equip locks with manufacturer's standard 6-pin tumbler cylinders.

C. Equip locks with high-security cylinders that comply with performance requirements for Grade 1 cylinders as listed in ANSI/BHMAA156.5 and that have been tested for pick and drill resistance requirements of UL 437 and are UL listed.

D. Metals: Construct lock cylinder parts from brass or bronze, stainless steel, or nickel silver.

E. Comply with Owner's Representative's instructions for masterkeying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

F. Permanently inscribe each key with number of lock that identifies cylinder manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

G. Key Material: Provide keys of nickel silver only.

H. Key Quantity: Furnish 3 change keys for each lock, 5 master keys for each master system, and 5 grandmaster keys for each grandmaster system.

I. Deliver keys to Owner's Representative.

2.4 LOCKS, LATCHES, AND BOLTS

A. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
   1. Strikes for Bored Locks and Latches: BHMA A156.2.
   2. Strikes for Mortise Locks and Latches: BHMA A156.13.
   3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
   4. Strikes for Auxiliary Deadlocks: BHMA A156.5.

B. Provide dust-proof strikes for foot bolts, except where special threshold construction provides non-recessed strike for bolt.

C. Lock Throw: Provide 5/8-inch minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

D. Provide 1/2-inch minimum throw of latch for other bored and pre-assembled types of locks and 3/4-inch minimum throw of latch for mortise locks. Provide 1-inch minimum throw for all dead bolts.

E. Flush Bolt Heads: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 7'-0" in height. Provide longer rods as necessary for doors exceeding 7'-0" in height.

2.5 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit depending on size of door, exposure to weather, and anticipated frequency of use.
   1. Provide non-sized units to provide a full range (1 to 4) closing power for all sizes according to BHMA product standards (ANSI 156.4-1986, Table I) and listed in BHMA Certified Products Directory to provide minimum closing force required to properly latch the doors as tested by an independent testing lab. For barrier-free applications, furnish adjustable closer spring power, to provide less than 5 lbs opening force for doors 36- to 48-inches wide.
   2. Set opening force at 5 pounds for exterior and interior doors.
   3. When fire doors are required, the maximum effort to operate the door may be increased to the minimum allowable by the appropriate Administrative Authority, not to exceed 15 lbs, per 1133B.2.5.
   4. Adjust sweep period of closers so that from an open position of 70-degrees, the door will take at least 3-seconds to move to appoint 3-inches from the latch, measured to the landing edge of the door per CBC 1133B.2.5.1.

B. Provide integral smoke detector device in combination door closers and holders complying with UL 228.

2.6 EXIT DEVICES

A. General: No vertical rod or concealed rod devices will be accepted; only rim devices with keyed mullions are acceptable.

B. All moving parts shall be easily removable for repair and maintenance; moving parts that are riveted or swaged in place are not acceptable.

C. Provide dead latching latch bolts with wide stile devices to ensure safe and secure opening.

D. Supply outside trims of wrought construction.

E. Retain a factory service technician at the completion of installation to ensure proper adjustment and operation of devices. Obtain a written report upon completion of service inspection.

F. The entire length of the push bar shall act as one piece.

G. Finish: Stainless steel, plated or finished as specified; aluminum or brass are not acceptable.
   1. Not Acceptable: Moving parts made of die-cast "pot" or "white" metals.

H. Panic hardware shall comply with 1997 CBC Standard 10-4.

2.7 PUSH PLATES, PULL PLATES, AND ARMOR PLATES

A. Minimum Thickness: 1/16-inch; bevel 4 sides.

B. Pull Plates: Supply without screw holes when used with pulls. Bolt pulls through the door at the grip only.

C. Armor and Kick Plates: Countersunk installation.

D. Finish: Stainless steel.

2.8 SURFACE AND FLUSH BOLTS

A. Provide lever arm with the following characteristics:
   1. Arm not friction-operated.
   2. Arm that is connected to the bolt mechanism.

B. Shape face plates to match the door edge.

C. Provide dustproof strikes where bolts engage the floor, threshold or curb.

D. Operating Mechanism Locations: Bottom bolt not more than 12-inches from the floor; top bolt not more than 72-inches from the floor.

E. Surface Bolts: Provide with a dustproof strike or an easy-to-clean floor strike.

F. Lifting Handles of Surface Bolts: Mechanically fastened (not press fitted).

2.9 STOPS AND HOLDERS

A. General: Provide stops and holders fabricated from solid or forged bronze; wrought is not acceptable.

B. Do not locate stops in the path of travel (POT). Locate a maximum of 4-inches from walls in accordance with DSA Policy 99-08.

C. Wall-mounted Stops: Provide with concealed fasteners.

D. Rubber Bumpers: Fastened by a pin or screw that goes through the rubber and seats into the metal on the opposite side. A rubber bumper that is screwed into the metal holder is acceptable.

2.10 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.

B. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by manufacturer.

C. Weatherstripping at Jambs and Heads: Extruded aluminum with natural anodized finish, 0.062-inch minimum thickness of main walls and flanges and flexible vinyl hollow bulb or loop insert.

D. Weatherstripping at Door Bottoms: Extruded aluminum with natural anodized finish, 0.062-inch minimum thickness of main walls and flanges.

2.11 THRESHOLDS

A. General: Except as otherwise indicated, provide standard, single length, metal threshold unit of type, size, and profile as shown or scheduled.
1. Comply with requirements of CBC Section 1133B.2.4.1.
2. Provide with a reinforcing center leg.
3. Field-cut ends to fit jamb profile.
4. Provide standard metal thresholds of type, size and profile indicated or scheduled. Fabricate to accommodate door hardware.

B. Exterior Hinged or Pivoted Doors: Provide units not less than 4-inches wide, formed to accommodate change in floor elevation where indicated, fabricated to accommodate door hardware and to fit door frames, and as follows:
1. For in-swinging doors provide units with interlocking lip and interior drain channel; include hook on bottom edge of door and drain pan.
2. For out-swinging doors provide units with interlocking lip and with hook on bottom edge of door to act as weather bar.

2.12 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets (or push-pull units if no latch or lock sets).

B. Provide finishes that match those established by BHMA.

C. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

D. Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated.

E. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 71 00

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SECTION 08 81 00 – GLASS GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass in the following locations:
      a. Aluminum curtain wall system and operable windows.
      b. Interior aluminum-framed doors and windows.
      c. Exterior doors, including storefront doors.
      d. Exterior windows.
   2. Glass of the following types:
      a. Monolithic.
      b. Insulated.
      c. Fire rated.

B. Related Sections:
   1. Section 08 11 13 – Hollow Metal Doors and Frames: Glazing stops.
   2. Section 08 11 16 – Aluminum Doors and Frames.
   3. Section 08 44 13 – Glazed Aluminum Curtain Walls: Glazing stops.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

C. Manufacturer: A firm that produces primary glass or fabricated glass as defined in referenced glazing publications.

D. Sealed Insulating Glass Unit Surfaces:
   1. Surface No. 1: Exterior surface of outer lite.

2. Surface No. 2: Interior surface of outer lite.
3. Surface No. 3: Exterior surface of inner lite.
4. Surface No. 4: Interior surface of inner lite.

1.4 QUALITY ASSURANCE

A. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that required for this Project, with a record of successful in-service performance.

B. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. FGMA Publications: "FGMA Glazing Manual."
2. LSGA Publications: "LSGA Design Guide."
3. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

C. Single-Source Responsibility for Glass: Obtain glass from one source for each product indicated below:
1. Primary glass of each (ASTM C1036) type and class indicated.
2. Heat-treated glass of each (ASTM C1048) condition indicated.
3. Laminated glass of each (ASTM C1172) kind indicated.

D. Distortion Evaluation Criteria:
1. No visible strain pattern to the naked eye under various lighting conditions as judged solely by the Owner's Representative.
2. Peak-to-Valley Roll-Wave Distortion: No more than 0.003 inch at the center of the glass and 0.008 inch at the leading and trailing edges.

E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction
1. Label shall indicate manufacturer’s name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating Glass Certification Program: Provide insulating glass units permanently marked with appropriate Insulating Glass Certification Council (IGCC) certification label.

1.5 WARRANTY

A. Insulating Glass: Furnish written warranty signed by glass manufacturer, agreeing to furnish replacements for those insulating glass units developing manufacturing defects as defined.
1. Warranty Period: 10-years from date of Substantial Completion.

B. Fire Rated Glass: Furnish written warranty signed by glass manufacturer, agreeing to furnish replacements for those rated glass units which develop manufacturing defects as defined.
1. Warranty Period: 5-years from date of Substantial Completion.

C. These warranties shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
   1. Normal thermal movement is defined as that resulting from an ambient temperature range of 120-deg. F. and from a consequent temperature range within glass and glass framing members of 180-deg. F.

B. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. For laminated-glass lites, properties are based on products of construction indicated.
   4. Tempered Glass Coatings: Apply Low-E, frit, and other specified coatings to glass only after tempering to minimize quench pattern visibility.

C. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E1300 by a qualified professional engineer, using the following design criteria:
   1. Wind Loads:
      a. Basic Wind Speed: 115 mph.
      b. Importance Factor: 1; Category II.
      c. Exposure Category: C.
   2. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.

2.2 PRIMARY FLOAT GLASS PRODUCTS

A. Uncoated Clear Float Glass: ASTM C1036, Condition A (uncoated surfaces), Type I (transparent glass, flat), Quality q3 (glazing select), class and kind as required.

2.3 HEAT-TREATED FLOAT GLASS

A. Heat-Treated Float Glass: ASTM C1048, Type I (transparent glass, flat), Quality q3 (glazing select), class and kind as required.
   1. Heat Treated Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed and meeting ASTM C1651 requirements.
   2. Maximum peak to valley rollerwave 0.003” (0.08mm) in the central area and 0.008” (0.20mm) within 10.5” (267mm) of the leading and trailing edge
   3. For clear or low-iron glass ≥ 5mm thick without ceramic frit, maximum + or – 125 mD (millidiopter) over 95% of the glass surface.
   4. Maximum bow and warp 1/32” per lineal foot (0.79mm).

B. Tempered Safety Glass: ASTM C1048, fully tempered with horizontal tempering, Condition A uncoated, Type 1 transparent flat, Class 1 clear, Quality q3 glazing select; conforming to ANSI Z97.1; thickness as indicated.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190, and complying with other requirements specified.
   1. Basis-of-Design Product: The design for the system is based on the manufacturer identified below.
      a. Basis-of-Design: Vitro Architectural Glass, Solarban 70 (2) Clear; https://www.vitroglazings.com/products/low-e-glass/solarban-70-glass/.
         1) SHGC: 0.27.
         2) VT: 0.64.
   2. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   3. Spacer: Thermally broken aluminum with black, color anodic finish or black powdered metal paint finish.
   4. Desiccant: Molecular sieve or silica gel, or blend of both.

2.5 ELASTOMERIC GLAZING SEALANTS

A. Elastomeric Glazing Sealants: Comply with ASTM C920, Class A, and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class, and uses related to exposure and joint substrates capable of water immersion without loss of properties; cured Shore A hardness of 15-25; color as selected.
   1. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to South Coast Air Quality management District (SCAQMD) Rule 1168, Adhesive and Sealant Applications, amended November 2022.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tape: Preformed, butyl-based elastomeric tape with a solids content of 100 percent, non-staining and non-migrating in contact with nonporous surfaces, with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.7 GLAZING GASKETS

A. Dense Elastomeric Compression Seal Gaskets: Molded or extruded neoprene, EPDM, or silicone gaskets of profile and hardness required to maintain watertight seal; complying with ASTM C864, D.S. Brown Co., Maloney, Tremco or approved equal.

B. Soft Compression Gaskets: Extruded or molded closed cell, integral-skinned neoprene, EPDM, or silicone of profile and hardness required to maintain watertight seal; complying with ASTM C509, Type II, black; D.S. Brown Co., Maloney, Tremco or approved equal.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 81 00

SECTION 08 91 00 – WALL LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed metal louvers and frames at exterior locations.
   2. Blank off panels.

B. Related Sections:
   1. Section 09 22 16 - Non-Structural Metal Framing.
   2. Section 09 24 00 Portland Cement Plaster, 3-Coat Stucco.
   3. Division 23 – HVAC Fans.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).

C. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents through one source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. Welding: Qualify procedures and personnel according to the following:
   1. AWS D1.1, "Structural Welding Code--Steel."
   2. AWS D1.2, "Structural Welding Code--Aluminum."
   3. AWS D1.3, "Structural Welding Code - Sheet Steel."
   4. AWS D1.6, "Structural Welding Code - Stainless Steel."

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.5 WARRANTY

A. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials, fabrication or installation within specified warranty period. Warranty does not include normal weathering.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of metals, metal finishes, and other materials beyond normal weathering in a marine environment.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
   1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on Structural Drawings.
   2. Component Importance Factor: 1.5.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.2 FIXED, FORMED-METAL LOUVERS

A. Continuous Blade Storm-Resistant Design: Factory welded assembly complete with extruded aluminum storm-resistant blades, bird screen, extruded aluminum sills, integral structural supports and blade braces.
   1. Blade Profile: Single, drainable.
   2. Frame and Blade Nominal Thickness: As required to comply with structural performance requirements, but not less than 0.081-inch (2.0 mm) for blades and frames.
   3. Material: Aluminum.
   4. Finish: Baked-enamel, color to be selected.
   5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

B. Blank-off Panels: Manufacturer's standard insulated panels of same material and finish as louver.
   1. R-value of Blank-off Panels: Match R-value of adjacent wall construction.

C. Gasketing: PVC compression gaskets, 1/2- by 1/2-inch, or 1/4-inch bead of silicone sealant.

2.3 LOUVER SCREENS

A. General: Provide screen at each exterior louver.
   1. Screen Location for Fixed Louvers: Interior face.
   2. Screening Type: Bird screening.

B. Secure screens to louver frames with stainless-steel machine screws, spaced a maximum of 6-inches (150 mm) from each corner and at 12-inches (300 mm) oc.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same kind and form of metal as indicated for louver to which screens are attached.
   2. Finish: Mill finish, unless otherwise indicated.
   3. Type: Non-rewirable, U-shaped frames for permanently securing screen mesh.

D. Louver Screening for Galvanized-Steel Louvers:
   1. Bird Screening: Galvanized steel, 1/2-inch- (13-mm-) square mesh, 0.041-inch (1.04-mm) wire.

2.4 FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil (0.025 mm) for topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils (0.05 mm).
   1. Color and Gloss: Match adjacent finish color.

PART 3 - EXECUTION – NOT USED

END OF SECTION 08 91 00

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SECTION 09 22 16 – NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing members for the following applications:
      a. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
      b. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).
      c. Resilient channel installation for acoustical construction.
      d. Flat strap and backing plate for support of wall mounted equipment and fixtures.

B. Related Sections:
   1. Section 05 40 00 - Cold-Formed Metal Framing: Exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
   2. Section 09 29 00 – Gypsum Board: Application of gypsum board over non-load bearing steel framing.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Performance Requirements:
   1. Loads: Comply with CBC and LABC requirements for design of metal framing systems for gypsum board wall assemblies.
   2. Deflection:
      a. Partitions to Receive Gypsum Board: L/240.
      b. Partitions to Receive Cementitious Backer Board: L/360.

c. Framed Ceilings: L/360. L/240 maximum, typical.

3. Seismic Requirements: Comply with code requirements for seismic bracing.

PART 2 - PRODUCTS

2.1 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
   1. Steel Studs and Runners: Comply with ASTM C645 requirements for metal and profiles shown on Drawings, unless otherwise indicated.
   2. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
      a. If stud thickness is not indicated, provide thickness as required for specified deflection criteria, based on stud depth and spacing indicated and partition height required.
      b. If stud spacing is not indicated, space studs at 16-inches oc.
   3. Flange Edges of Studs: Bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the requirements indicated on Drawings for depth indicated.
   4. Protective Coating: ASTM A653/A653M, G60 (Z180) minimum, hot-dip galvanized zinc coating, unless otherwise indicated.

B. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Slotted Slip Track: ASTM C645 top runner with 2-1/2-inch- (63.5-mm-) deep flanges in thickness not less than indicated for studs; with 1-1/2-inch x 1/4-inch vertical slots.
   2. Single Long-Leg Runner System: ASTM C645 top runner with 2-inch- (50.8-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
   3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

C. Interior and Exterior Headers: ASTM A653/A653M and ASTM C645, where indicated.
   1. Product: ClarkDietrich, ProSTUD Drywall Framing System.
      a. ProSTUD 25:
         1) Strength: 25 Gauge: Grade 50 with a minimum yield point of 50,000 psi (345 MPa).
         2) Minimum Thickness: 0.0150 inches (0.3810 mm).
         3) Design Thickness: 0.0158 inches (0.4013 mm).
      b. ProSTUD 20:
         1) Strength: 20 Gauge: Grade 65 with a minimum yield point of 65,000 psi (448 MPa).
         2) Minimum Thickness: 0.019 inches (0.4826 mm).
         3) Design Thickness: 0.0200 inches (0.5080 mm).
   2. Width: As required for opening width indicated on Drawings.
   3. Finish: Galvanized, Class G90 in accordance with ASTM A1003/A1003M with coating weight in accordance with ASTM C645.
   4. Internal Clip: ProX Clip Series:
      a. Thickness: 16 gauge (54 mils).
      b. Width: As indicated on Drawings.
   5. Fasteners: Sheet metal screws in accordance with ASTM C954 or SAE J78:
      a. Interior: No. 8 screws.
      b. Exterior: No. 10 screws.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated and where required by Owner's Representative for Owner-installed items. Where backing is not indicated on Drawings comply with the following:
   1. Minimum Base-Metal Thickness: 0.0312 inch (0.79 mm).
   2. Install continuous plate across minimum 3 studs, attaching to each stud.
   3. Notch channel at studs.
   4. For Loads Under 50 lbs/ft:
      a. Plate Size: 6" x 1-1/4", 16 gage track channel.
      b. Attachment: No. 8 flat head screws, three at each stud.
   5. For Loads 51 lbs/ft to 100 lbs/ft:
      a. Plate Size: 6" x 1-1/4", 16 gage track channel.
      b. Attachment: Welding.
   6. For Loads 101 lbs/ft to 250 lbs/ft:
      a. Plate Size: 6-inch wide 14 gage plate with 4" x 1-1/4" 16 gage track channel stiffeners welded to back.

E. Resilient Furring Channels and Clips: 1/2-inch- (12.7-mm-) deep, steel sheet members designed to reduce sound transmission.
   1. Manufacturer: ClarkDietrich Building Systems; RC Deluxe (RCSD) Resilient Channel or accepted equivalent.
   2. Configuration: Single leg.

F. Isolation Clips: Kinetics IsoMax.
   1. Configuration: Hat shaped.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.0625-inch-(1.59-mm-) diameter wire, or double strand of 0.0475-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.162-inch (4.12-mm) diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.37 mm) and minimum 1/2-inch- (12.7-mm-) wide flanges.
   1. Depth: 2 inches (51 mm).

D. Furring Channels (Furring Members): As specified herein.

E. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Acceptable Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; 640 Drywall Ceiling Suspension.
      c. USG Corporation; Drywall Suspension System.

2.3 AUXILIARY MATERIALS

A. Acoustical Gasket at Window System/Framing Interface: Provide sound barrier mullion trim caps of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Basis-of-Design Product: MULL-it-OVER Products; Mullion Trim Cap.
   2. Sound Transmission:

a. Double-Sided Installations: STC 55 or higher.

3. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   a. Mullion trim cap to be sized to accommodate thermal movement.
4. Profile: 55 Classic Mullion Trim Cap
5. Components:
   a. Aluminum Extrusions:
      1) Thickness: 0.125 inches.
      2) Profile: As selected and approved by Owner's Representative to allow solid attachment and fastening to the partition wall framing.
   b. Sound Absorbing Foam:
      1) Resistant to smoke, flame, and microbial growth.
      2) Fire Rating: ASTM E 84 Class 1.
      3) Fungi Resistance: Zero rating per ASTM G 21.
   c. Compressible Foam: Between edge of extrusion and interior face of curtain wall glass.
      1) Thickness: Standard 1/2 inch (12.7 mm), or 1 inch (25.4 mm) to accommodate a larger mullion deflection.
      2) Color: Light gray.
   d. Fasteners:
      1) Self-Tapping or appropriate threaded fastener.
      2) Compatible with all materials fasteners will contact with and not causing galvanic corrosion.
   e. Snap Cover: Snap-on fastener cover.
   f. Acoustical Sound Sealant: Acrylic latex based.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 22 16

SECTION 09 22 19 – CAVITY SHAFT-WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel shaft-wall framing and gypsum liner board for the following:
      a. Shaft enclosures.

B. Related Sections:
   1. Section 09 22 16 – Non-Structural Metal Framing.
   2. Section 09 29 00 - Gypsum Board: Application and finishing of gypsum board assemblies in other than shaft-wall assemblies.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory." or GA-600, "Fire Resistance Design Manual”.

PART 2 - PRODUCTS

2.1 ASSEMBLY MATERIALS

A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.

B. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.

C. Provide auxiliary materials complying with gypsum board shaft-wall assembly manufacturer's written recommendations.

D. Steel Shaft Wall Framing: C-H studs, 20 gage minimum or as indicated on Drawings.
   1. Steel Sheet Components: Comply with ASTM C645 requirements for metal, unless otherwise indicated.
   2. Protective Coating: ASTM A653/A653M, G60 (Z180) minimum, hot-dip galvanized zinc coating, unless otherwise indicated.

E. Gypsum Liner Panels: ASTM C442/C442M, manufacturer's proprietary Type X liner panels in 25.4-mm thickness and with moisture-resistant paper faces.
   1. Edges: Square.
   2. Size: 48- inches wide by lengths that will result in minimum footage of joints.

F. Gypsum Wallboard: As specified in Section 09 29 00.

G. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 09 29 00 that comply with gypsum board shaft-wall assembly manufacturer's written recommendations for application indicated.

H. Gypsum Wallboard Joint-Treatment Materials: ASTM C475 and as specified in Section 09 29 00.

I. Steel Drill Screws: ASTM C1002, unless otherwise indicated.

J. Track (Runner) Fasteners: Powder-driven fasteners of size and material required to withstand loading conditions imposed on shaft-wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

K. Acoustical Sealant: As specified in Section 07 92 00.

L. Sound Attenuation Blankets: See Section 07 21 00.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 22 19

SECTION 09 24 00 – PORTLAND CEMENT PLASTER, 3 COAT STUCCO

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. A code complying water resistive barrier, Continuous Insulation, metal lath, Scratch & Brown Concentrate (3/4 in (19 mm)) embedment of a fiberglass mesh for crack suppression and an acrylic or elastomeric based finish coat.

B. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete
   2. Section 07 60 00 - Flashing and Sheet Metal.
   3. Section 07 92 00 - Joint Sealants.
   4. Section 09 91 00 – Painting.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 ASSEMBLY DESCRIPTION

A. A code complying water resistive barrier, Continuous Insulation, metal lath, Scratch & Brown Concentrate (3/4 in (19 mm)) embedment of a fiberglass mesh for crack suppression and an acrylic or elastomeric based finish coat.

B. Functional Criteria:
   1. General: Stucco application shall be to vertical substrates or to substrates sloped for positive drainage according to ASTM C926. Substrates sloped for drainage shall have additional protection from weather exposure that might be harmful to coating performance.

C. Substrate Conditions:
   1. Substrate materials and construction shall conform to the building code having jurisdiction.
   2. Substrates shall be sound, dry and free of dust, dirt, laitance, efflorescence and other harmful contaminants.
   3. Substrate Dimensional Tolerances: Flat with 1/4 in (6.4 mm) within any 4 ft (1.22 m) radius.
   4. Maximum deflection of substrate system under positive or negative design loads shall not exceed L/360 of span.

D. Expansion and Control Joints: Continuous expansion and control joints shall be installed at locations in accordance with ASTM C1063 and ASTM C926.
   1. Substrate movement, and expansion and contraction of El Rey Fiber-47 300 Stucco and adjacent materials shall be taken into account in design of expansion joints, with proper consideration given to sealant properties, installation conditions, temperature range, coefficients of expansion of materials, joint width to depth ratios, and other material factors. Minimum width of expansion joints shall be as shown on the project drawings.
   2. In accordance with ASTM C1063, expansion or control joints shall be installed in walls not more than 144 ft² (13.4 m²) in area, and not more than 100 ft² (9.3 m²) in area for all non-vertical applications. The distance between joints shall not exceed 18 ft (5.5 m) in either direction or a length-to-width ratio of 2-1/2 to 1.
   3. For direct application to concrete or masonry, stucco joints are requried only at control/expansion joints in the underlaying concrete or masonry.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Parex USA, Inc., 4125 E. La Palma Ave., Suite 250, Anaheim, CA 92807. Brands include: Parex, Lahabra, El Rey Stucco and TEIFS are all brands of Parex USA and are approved for use under this specification. Please contact Andy Townes CSI, CCPR Architectural Sales Manager Rocky Mountain Region at 505.338.4433 direct or email andy.townes@parexusa.com.

B. Components: Obtain components manufactered by Parex USA for the 300 HE Stucco Assembly from authorized distributors. No substitutions or additions of other materials are permitted. Single Source Requirement.

C. Other manufactures must be submitted through the Prior Approval process and proven equal or superior to the Parex USA basis of design 10 days prior to bid date.

2.2 MATERIALS

A. Stucco Base Coat Assembly Materials:
   1. Amourwall 300/Fiber-47 Scratch & Brown Stucco Base Concentrate: A factory blended portland cement, fibers, hydrated lime and proprietary ingredients, cement scratch and brown coat mixed in the field with sand, conforming to ASTM C926.

B. Acrylic Additive: Adacryl, and acrylic polymer additive for use in Portland cement-based stucco basecoats. To be field mixed at a ratio of one (1) gallon per sack of basecoat concentrate, and used as a primer for direct bonding applications to Concrete, CMU and masonry substrates.

C. Crack Suppression, Crack Shield Fiber Glass Mesh:
   1. Stucco Level Coat™: Copolymer based, factory blend of cement and proprietary ingredients requiring addition of water.
   2. 355 Standard Mesh: Weight 4.5 oz/yd^2 (153 g/m^2) reinforcing mesh.

D. Water Proof Basecoat: – Weather Dry. For use on all horizontal slopes/parapets/window sills etc.
   1. Tinted Primer: 100% acrylic-based coating to prepare surfaces for acrylic finishes.

E. Acrylic based elastomeric finish:
   1. Primer: 100% acrylic primer that is tinted to the same color as the finish coat.
   2. Perma-Flex E'Lastic Factory-blended, 100 % acrylic polymer based textured finish.
      a. Finish Texture: 20/30 fine sand.
      b. Finish: Painted.

F. Exterior Walls: Continuous rigid insulation on exterior walls assembly:
   1. Class A fire-rated polyisocyanurate foam insulation faced on both faces with coated glass facers.
   2. Products:
      a. Basis-of-Design: EnergyShield CGF Pro by Atlas or equal by one of the following:
      b. Dow Chemical Co.
      c. Hunter Panels.
      d. Owens Corning.
   3. Insulation panels shall be supplied or cut into 24 in. wide widths.
   4. Insulation shall be able to be exposed to UV light for no more than 180 days.

2.3 RELATED MATERIALS AND ACCESSORIES

A. General: Stucco Assembly and its related materials shall conform to ASTM C926, this specification and Product Data Sheets.

B. Substrate Materials:
   1. Continuous Insulation: Expanded Polystyrene or Dupont Panel 20 extruded polystyrene, in thickness required to achieve specified R-value for continuous insulation. To be adhesively or mechanically attached over the fluid applied weather and air barrier.
   2. Gypsum Sheathing: Minimum ½ in (13 mm) thick, core-treated, weather-resistant, exterior gypsum sheathing complying with ASTM C79 or ASTM C1177.
   3. Cement Board Sheathing, Minimum ½ in thick, conforming to ASTM C1186.
   4. Fiberboard: Minimum ½ in (13 mm) thick fiberboard complying with ANSI/AHA A194.1 as a regular density sheathing.
   5. Plywood: Minimum $^{5}/_{16}$ in (8 mm) thick exterior grade or Exposure I plywood for studs spaced 16 in (406 mm) o.c. and ⅜ in (9.5 mm) thick exterior type plywood minimum for studs spaced 24 in (610 mm) o.c. Plywood shall comply be exterior grade or Exposure 1 and comply with DOC PS-1
   6. Oriented Strand Board (OSB): $^{7}/_{16}$ - ½ in Wall-16 or Wall-24, approved by the APA, TECO, or PSI/PTL. Stamped as Exposure 1 or Exterior Sheathing with a PS2 or PRP-108 rating. The system is qualified for application to OSB (oriented strand board) sheathing only in areas shown in the Parex USA "Acceptable Substrates and Areas of Use" Technical Bulletin.
   7. Concrete Masonry Construction: Painted (coated) and non-painted (uncoated). Shall be in conformance with the building code. Mortar joints to be struck flush and not tooled or grooved.

C. Water-Resistive Barriers:
   1. Weather Seal: A Fluid Applied Weather and Air Barrier by Parex USA. See Section 07 27 26.
   2. Dupont Tyvek®, Stuccowrap® or DrainWrap™ or other sheet good Water resistive barrer, incorporating in itself a means of drainage, and maintaining a current ICC Evaluation Report Optional Drainage covered by Flat Insulation board.

D. Lath and Accessories: Conform to ASTM C847, ASTM C933, ASTM C1032, ASTM C1063 and Appendix
   1. Accessories: Manufacturer's standard steel products with minimum G60 galvanizing
   2. Metal Plaster Bases: Field to be a minimum 3.4 lb/yd^2 (1.8 kg/m^2) expanded metal diamond lath.
   3. Weep Screeds: 7/8" grounds, foundation weep screed with minimum 3-½ inch vertical attachment flange.
   4. Control joints, plaster stops, corner aid etc… to be galvanized and a minimum of 7/8" grounds.
   5. Fasteners: To be galvanized and suitable to substrates specified. Must be long enough for a minimum penetration into studs or CMU of ¾"
   6. Crack Suppression Reinforcing Mesh
      a. Parex USA Standard Mesh: Weight 4.5 oz/yd^2 (153 g/m^2) #355 reinforcing mesh.

E. Seals, Sealants and Bond Breakers: Sealants shall conform to ASTM C 920, Grade NS, Class 25, Use NT. Backer rod shall be closed-cell polyethylene foam.
   1. Single Component, Sikasil - WS 290, Sikasil – WS 295, Sika Silbridge 300, or Sikasil 728 NS.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 24 00

SECTION 09 29 00 – GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Gypsum wallboard, Type X at all ceilings.
2. Cement wallboard under solid surface panels.
3. Abuse-resistant Type X wallboard.
4. Gypsum board trims and accessories.

B. Related Sections:
1. Section 05 40 00 - Cold-Formed Metal Framing: Load-bearing steel framing.
2. Section 07 84 00 – Firestopping.
3. Section 07 92 00 - Joint Sealants: Acoustical sealant.
4. Section 09 22 16 – Non-Structural Metal Framing.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
a. WELL Building Standard v2 Certification.
b. BLUE ZONES Certification.
2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Gypsum Board Construction Terminology: Refer to ASTM C11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For gypsum board with fire-resistance ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

B. Sound Transmission Characteristics: For gypsum board with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by a qualified independent testing agency.

PART 2 - PRODUCTS

2.1 GYPSUM BOARD PRODUCTS

A. Acceptable Manufacturers: Provide gypsum board materials manufactured by one of the following:
1. Gold Bond Building Products Div., National Gypsum Co.
2. United States Gypsum Co.
3. Accepted equivalent.

B. General: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.

C. Interior Gypsum Wallboard: ASTM C1396/C1396M except where noted otherwise:
1. Gypsum Board: ASTM C1396/C1396M; Type X.
2. Gypsum Ceiling Board: ASTM C1396/C1396M; Type X, High-strength, sag-resistant type for ceiling surfaces.
3. Long Edges: Tapered.
4. Thickness: ASTM C840, 5/8-inch throughout unless indicated otherwise on Drawings.

D. Rated Exterior Wall Board: Provide one of the following:
1. Georgia Pacific 5/8” Densglass Fireguard Sheathing.
2. CertainTeed Gypsum 5/8” Certainteed Glassroc Sheathing Type X.

E. Abuse-Resistant Fiber Board: ASTM C1629/C1629M, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels.
1. Acceptable Products: Fiberock VHI (very high impact) by US Gypsum or Hi-Impact XP Wallboard by National Gypsum Co.
2. Core: 5/8 inch (15.9 mm), Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10.
5. Level 2
6. Surface Abrasion: Meets or exceeds Level 2 requirements.
7. Surface Indentation: Meets or exceeds Level 2 requirements.
8. Single-Drop Soft-Body Impact: Meets or exceeds Level 2 requirements.

F. Cementitious Backer Units: Complying with ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints.
1. Thickness: 5/8-inch.
2. Width: Manufacturer's standard width, but not less than 32 inches.
3. Manufacturer: Durock, Cement Board; include interior tape, reinforcing mesh, trim and bead.
4. Locations: At Restroom wet walls under solid surface wall panels.

G. Exterior Gypsum Sheathing: ASTM C1177/C1177M, Georgia-Pacific, Dens-Glass Gold Exterior Sheathing, 5/8-inch- (15.8-mm-) thick water-resistant treated gypsum core board with inorganic glass mats both sides and long edges, gold color alkali resistant surface coating, for exterior applications.

2.2 TRIM ACCESSORIES

A. Accessories for Interior Installation: Corner beads, edge trim, and control joints complying with ASTM C1047.

1. Material: Formed metal or metal combined with paper, with metal sheet steel zinc-coated by hot-dip or electrolytic processes, or with aluminum or rolled zinc.

B. Square Corner Bead Reinforcement: One of the following or accepted equivalent:
   1. Dur-A-Bead as manufactured by USG or accepted equivalent.
   2. Wallboard corner bead with 1 1/4-inch flanges as manufactured Gold Bond Building Products Div., National Gypsum Co. or accepted equivalent.

C. Metal Casing Bead: One of the following or accepted equivalent:
   1. No. 200A Metal Trim manufactured by USG or accepted equivalent.
   2. No. 100 wall board casing manufactured by Gold Bond National Gypsum Company.

D. Control Joints: One of the following or accepted equivalent:
   1. No. 093; as manufactured by USG or accepted equivalent.
   2. E-Z expansion joint 0.093 zinc control joint, manufactured by Gold Bond National Gypsum Company.

2.3 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: ASTM C475 and as follows:
   1. Interior Gypsum Board: Paper reinforcing tape, one grade for bedding tapes and filling depressions, and one for topping and sanding, unless otherwise indicated.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. Setting-Type Joint Compounds for Gypsum Board:
   1. Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
   2. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

D. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by the gypsum board manufacturer for this purpose.

E. For topping compound, use sandable formulation.

F. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
   2. Cementitious Backer Units: As recommended by backer unit manufacturer.
   3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

G. Drying-Type Joint Compounds for Interior Gypsum Board: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
   1. Ready-Mixed Formulation: Factory-mixed product.
   2. All-purpose compound formulated for both taping and topping compounds.

2.4 AUXILIARY MATERIALS

A. Spot Grout: ASTM C475, setting-type joint compound recommended for spot grouting hollow metal door frames.

B. Fastening Adhesive for Metal: Special adhesive recommended for laminating gypsum panels to steel framing.
   1. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Multipurpose Construction Adhesives: 70 g/L.

C. Steel Drill Screws: ASTM C1002, unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
      a. Gold Bond, Type-S, 1-inch drywall screws.
      b. U.S. Gypsum Type-S, panhead, 1-inch.

D. Other Fasteners: As required and recommended by gypsum wallboard manufacturer and in accordance with the specified Standards. Space fasteners in accordance with CBC Table 47 G and 47 H.

E. Acoustical Accessories:
   1. Acoustic Insulation: See Section 07 21 00.
   2. Acoustical Sealant: See Section 07 92 00.
   3. Rated Acoustical Sealant: See Section 07 92 00.

F. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C840:
   1. Level 0: In areas of temporary construction, no taping or accessories are required.
   2. Level 1: Ceiling plenum areas and concealed areas. Provide higher level of finish as required to comply with fire-resistance ratings and acoustical ratings.
   3. Level 2: Gypsum board substrate at tile, except remove tool marks and ridges.
   4. Level 3: Gypsum board surfaces, where textured finishes will be used.
   5. Level 4: Gypsum board surfaces, except where another finish level is specified.
      a. Finish Texture: Smooth.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 29 00

SECTION 09 30 00 – TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Unglazed quarry tile.
   2. Waterproofing at second floor restrooms.

B. Related Sections:
   1. Section 07 92 00 - Joint Sealers: Sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   2. Section 09 29 00 - Gypsum Board: Gypsum backing board and cementitious backing board installed as part of gypsum wallboard systems for use under tile installations.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Floor tile shall have a minimum dry coefficient of friction (DCOF) of 0.42 determined in accordance with ANSI A137.1 DCOF AcuTest.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: Achieve the following for level floor surfaces as determined by quality control testing according to ANSI/NFSI B101.1:
   1. Dry Surface: 0.80.
   2. Wet Surface: 0.74.

B. Floor Surface Profile, ASTM E 1155:
   1. Floor Flatness Number (FF): 50.
   2. Floor Levelness Number (FL): 35.

C. Confirm flatness requirements within 72 hours of finishing the slab.

2.2 TILE PRODUCTS

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.

B. Unglazed Quarry Tile: ASTM C1028, and the following:
1. Coefficient of Friction, Dry (DCOF): 0.42 or greater per ANSI A137.1.
2. Product: DalTile, Arid Flash Square.
3. Nominal Facial Dimensions: 6” x 6”.
4. Thickness: 1/2-inch.
5. Face: Plain with cushion edge.

C. Shapes and Trim: Selected from manufacturer's standard shapes and trim units:
1. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with following requirements:
a. Size: As indicated, coordinated with sizes and coursing of adjoining flat tile where applicable.
b. Base: Coved.
1) Color: Match floor tile.
c. Internal Corners: Field-butted square corners, except use coved base and cap angle pieces designed to member with stretcher shapes.

2.3 SETTING MATERIALS

A. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
3. Color: To be selected by Architect from manufacturer’s full range.

B. Water: Clean, potable.

2.4 GROUTING MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

B. Color Admixture: Cementitious type, color as specified from manufacturer’s full color range including premium colors.

C. Application: Use commercial Portland cement grout combined with latex additive for grouting joints in floor tile unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Thresholds: Solid surfacing material fabricated to sizes and profiles indicated or required to provide transition between adjacent floor finishes
1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
2. ASTM C503, with a minimum abrasion resistance of 12 per ASTM C1353 or ASTM C241 and with honed finish; color to coordinate with floor tile.
a. Size: 1/2 inch high by width of jamb by full width of wall or frame opening.

b. Edges: Beveled one side as indicated on Drawings, radiused edges from bevel to vertical face.

3. Finish: As selected by Architect.

2.6 WATERPROOFING FOR TILE INSTALLATIONS

A. Latex Rubber Waterproofing (on Interior Concrete Floors): Manufacturer's standard factory-prepackaged, job-mixed proprietary two-part formulation consisting of liquid latex rubber and powder for trowel application and glass fiber fabric reinforcing.

1. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:

a. Laticrete International, Inc., 'Laticrete 9235 Waterproof Membrane'.

PART 3 - EXECUTION

3.1 INSTALLATION SCHEDULE

A. General: Install tile according to most current edition of the TCNA Handbook using method numbers as indicated below.

B. Floor Tile Thin-Set over Waterproof Membrane: TCNA Handbook, No. F122.

C. Floor Tile Thin-set over Concrete Slab with Epoxy Grout: TCNA Handbook, No. F115.

D. Thresholds: TCNA Handbook, No. TR611.

E. Expansion Joints: TCNA Handbook, No. EJ171.

1. Exterior: Provide expansion joints at 12- to 16-feet on center in both directions, over cold joints and saw-cut control joints, and where tile abuts restraining surfaces. Joint width shall be minimum 3/8-inch wide for joints spaced 12-feet on center and 1/2-inch wide for joints spaced 16-feet on center.
2. Interior: Provide expansion joints at 24- to 36-feet on center in both directions, over cold joints and saw-cut control joints, and where tile abuts restraining surfaces. Joint spacing for tile exposed to direct sunlight or moisture shall be 12-to 16-feet on center. Joint width for paver tile shall be minimum 1/4-inch wide; ceramic mosaic tile and glazed wall tile shall be minimum 1/8-inch.
3. Sealant Materials: As specified in Section 07 92 00.

END OF SECTION 09 30 00

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SECTION 09 51 23 – ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Suspended acoustical tile ceilings.

B. Related Sections:
   1. Section 09 29 00 – Gypsum Board: Gypsum board ceilings.
   2. Division 21: Sprinkler heads in acoustical ceilings.
   3. Division 23: Grilles, registers, and diffusers in acoustical ceilings.
   4. Division 26: Lighting fixtures in acoustical ceilings.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of acoustical ceiling tile and adhesive through one source from a single manufacturer.

B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E1264 for Class A materials.
   2. Smoke-Developed Index: 50 or less.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Ceiling Tile: Armstrong World Industries, Inc., Canyon.
   1. Item Number: 1490.
   2. Classification: Type IV, Form 2, Pattern E; Fire Class A.
   3. Size: 24” x 24”.
   4. Thickness: 5/8-inch.
   5. Composition: Wet-formed mineral fiber.
   6. Acoustics NRC: 0.65.
   7. CAC: 35.

8. Edge: Square lay-in.
9. Surface Color: White.
10. Surface Finish: Acoustically transparent membrane with factory-applied latex paint.
11. Grid System: 15/16-inch.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Suspension System: ASTM C635/C635M, Armstrong World Industries, Inc., Prelude Exposed Tee.
1. Exposed Grid Surface Width: 15/16.
2. Finish: White, low gloss baked enamel finish, color to match ceiling tiles exactly.
3. Main Runners: Flange width to match exposed grid surface, 1-11/16-inch high, double web construction.
4. Cross Runners: Flange width to match exposed grid surface, double web construction.
5. Wall Angle, Reveals, and Miscellaneous Trim: Roll-formed from electro-galvanized steel strip to profiles indicated.

B. Attachment Devices: Size for 5 times design load indicated in ASTM C635/C635M, Table 1, Direct Hung, double web, Intermediate-Duty System, unless otherwise indicated.

C. Wire for Hangers and Ties: ASTM A641/A641M, Class 1 zinc coating, soft temper.
1. Gage: Provide wire sized so that stress at 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 0.106-inch diameter (12-gage).

D. Support Hangers and Channels: Mild steel, zinc coated, or protected with rust-inhibitive paint, size and shape to suit application and seismic requirements.
1. Hanger Wires: Connection device capable of carrying not less than 100-pounds.
2. Bracing Wires: Connection device capable of carrying not less than 200-pounds or the actual design load, whichever is greater, with a safety factor of 2 without yielding.

E. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical tiles in-place.

H. Hold-Down Clips: Armstrong World Industries, Inc., BERC2; where indicated, provide manufacturer's standard hold-down clips spaced 24-inches (610 mm) oc on all cross tees.

I. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E90.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 51 23

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SECTION 09 65 00 – RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Luxury vinyl tile flooring.
   2. Rubber stair tread and risers with contrasting nosing.
   3. Resilient wall base, reducer strips, and other accessories.

B. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete: Moisture content of concrete for flooring installation.
   2. Section 09 81 30 – Acoustical Floor Matting.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility for Flooring: Obtain each type, color, and pattern of resilient flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Fire Performance Characteristics: Provide resilient flooring with the following fire performance characteristics as determined by testing products per ASTM test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux: 0.45 watts per sq.cm or more per ASTM E648.
   2. Smoke Density: Less than 450 per ASTM E662.

PART 2 - PRODUCTS

2.1 LUXURY VINYL TILE

A. Luxury Vinyl Tile: ASTM F1700; Class III, printed vinyl plank.
   1. Product: Interface Northern Grain.
   2. Gauge: 0.080" (2.00 mm) overall thickness.
   3. Size: 25cm x 1m x 4.5mm thick.

4. Wearing Surface: Embossed.
5. Layout: Ashlar.
6. Slip Resistance: ASTM D2047; >0.55 wet/dry, ADA-compliant.
7. Color(s): As selected by Owner's Representative.

B. LVT must meet the following (documentation demonstrating compliance the following needs to be provided):
1. Certified under the Resilient Floor Covering Institute Floor Score Program.
2. Compliant with VOC emissions limits and testing requirements specified in California Department of Public Health 2017 Standard Method, version 1.2.
3. Compliant with the Collaborative for High Schools California (CHPS) criteria for EQ 7 and 7.1 dated July 1012
4. Products certified under the UL Greenguard Gold.

C. Static Coefficient of Friction: Resilient flooring shall be stable, firm and slip resistant CBC Section 11B-302.1. For tile installed with the applied finish, provide products with the following values as determined by testing identical products per ASTM D 2047:
1. Level Surfaces: Minimum 0.6.
2. Step Treads: Minimum 0.6.
3. Ramp Surfaces: Minimum 0.8.

D. Edging and reducer strip:
1. Aluminum: Reno-U by Schluter Systems with satin anodize finish.
2. Vinyl: Rigid vinyl, tapered edging strip made specially for termination of resilient flooring, Series CRS-XX-A by Johnsonite or equal. Color selected by Owner's Representative.

2.2 RUBBER STAIR TREADS AND RISERS

A. Resilient Stair Treads: One of the following:
1. Mannington Linear Stair Tread Commercial 250.
2. Mohawk Group Rubber.
a. Color: As indicated on Drawings.
b. Contrasting Nosing Strips: As required by local building code.

B. Resilient Stair Treads Standard: ASTM F2169.
1. Material Requirement: Type TS (rubber, vulcanized thermoset).
2. Surface Design: Hammered.
3. Manufacturing Method: Group 2, tread with contrasting color for the visually impaired.

C. Nosing Style: Square, adjustable to cover angles between 60 and 90 degrees.
1. Nosing Height: 1-1/2 inches (38 mm).
2. Thickness: 1/4 inch (6 mm) and tapered to back edge.
3. Size: Lengths and depths to fit each stair tread in one piece.

D. Risers: Smooth, flat, coved-toe, 7 inches (178 mm) high by length matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
1. Thickness: 0.125 inch (3.2 mm).

2.3 RUBBER BASE

A. Resilient Wall Base: ASTM F1861, Type TP (thermoplastic).

1. Basis-of-Design Product: The design for the rubber base is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   a. Basis-of-Design: Mannington Collection Burkebase.
   b. Burke Flooring Products.
   c. Flexco Co.
   d. Johnsonite.
   e. Roppe Rubber Corp.
2. Group (Manufacturing Method): I (solid, homogeneous).
3. Style: Cove (with top-set toe).
4. Minimum Thickness: 0.125-inch (3.2 mm).
5. Height: 4-inches (102 mm).
6. Lengths: Coils in manufacturer's standard length, but not less than 100 feet.
7. Outside Corners: Premolded.
8. Inside Corners: Premolded.
9. Surface: Smooth.
10. Color(s): Match wall color as selected by Architect.

2.4 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Adhesives (Cements): Water-resistant type recommended by tile manufacturer to suit resilient floor tile products and substrate conditions indicated.
   1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24 and South Coast Air Quality Management District Rule #1168).
      a. VCT and Asphalt Tile Adhesives: 50 g/L maximum.
      b. Cove Base Adhesives: 50 g/L maximum.
      c. Rubber Floor Adhesives: 60 g/L maximum.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 65 00

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SECTION 09 67 23 - RESINOUS EPOXY FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Static dissipative epoxy floor coating in Telecom Room.
   1. Provide preparation of substrate as recommended by the resinous flooring manufacturer.
   2. Provide and install cove base with trims and accessories as specified in this Section.
   3. Provide and install multi-part resinous floor system as specified in this Section.
   4. Provide and install sealant joint material for the Work of this Section as specified in this Section.
   5. Provide treatment of substrate cracks and control/construction joints as needed and specified in this Section.

B. Related Sections:
   1. Section 03 30 00 – Cast-in-Place Concrete.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer shall be ISO 9001 and ISO 14001 Certified, and provide copy of Certification document upon request.
   2. No request for substitution shall be considered that would change the generic type or thickness (i.e.: seamless, low VOC, elastomeric) of the flooring system.

B. Applicator Qualifications:
   1. Applicator shall be approved in writing by the material manufacturer to install the floor system.
   2. Applicator Experience: Contractor shall submit a list of five projects (with contact information) of similar size, scope and complexity. Contractor shall submit letter attesting that Floor Contractor and Field Personnel have been properly trained to perform work per specifications and contract.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING

A. Basis of Design: Sherwin Williams High Performance Flooring; Resutile SDS, Static Control Dissipative Urethane.

B. System Components: Manufacturer's standard components that are compatible with each other and are as follows:
   1. Primer (Urethane Primer):
   2. Formulation: Light-stable urethane that contains a conductive filler to yield static dissipative properties.
      a. Part A: Clear.
      b. Part B: Hardener.
      c. Part C: Aggregate.
   3. Application Method: Squeegee and medium nap roller

4. Application Thickness: 8 mils minimum.
5. Sheen: Satin.

C. Performance Characteristics:
1. Electrostatic discharge control - meets ANSI/ESD S20.20-2007 for resistance <1x109 ohms and <100 volts Body Voltage Generation.
2. Complies with SCAQMD VOC regulations.
3. Abrasion Resistance: ASTM D4060, CS-17 wheel, 1000gm load, 1000 cycles, 38 mg loss.
4. Body Voltage Generation: ANSI/ESD STM 97.2 (ANSI/ESD S20.20 - Method 2) 12 volts with ESD shoes; 32 volts with heel straps.
5. Body Voltage Decay (with ESD shoes or heel straps): AATCC 134-1979 (modified) 1,000 volts to <10 volts in <1.0 second.
6. Coefficient of Friction: ASTM D2047 0.50.
7. Flammability (topcoat resin): ASTM D635 182 mm/min.
8. Koenig Hardness, 3 Mil Film (resin only): ASTM D4366 171.3.
9. Resistance to Ground in Combination with a Person: ANSI/ESD STM 97.1
10. (ANSI/ESD S20.20 - Method 1), <3.5 x 107 ohms (ESD shoes or heel straps).
11. Surface Resistance Point to Point / Point to Ground ESD Assoc.: ANSI/ESD STM 7.1-2013 1x105 ohms to 1x109 ohms.
12. Water Absorption, 24-hour immersion: ASTM D570 1.81%.
13. Wet Static Coefficient of Friction, BOT 3000: ANSI/NFSI B101.1, 0.95.

D. Grounding: Copper tape.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 67 23

SECTION 09 68 13 – TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Modular, fusion-bonded, tufted carpet tile.

B. Related Sections:
   1. Section 09 65 00 – Resilient Flooring: Resilient wall base and accessories installed with carpet tile.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Carpet Surface Burning Characteristics: Provide carpet identical to that tested for the following fire performance characteristics, per test method indicated below. Identify carpet with appropriate markings of applicable testing and inspecting organization.
   1. Test Method: ASTM E84.
   2. Flame Spread: 75 or less.
   3. Fire Hazard Classification: Class I floor finish.
   4. Minimum critical flux limit of 0.45-watts/square centimeter when tested in accordance with NFPA 253.

B. Static electricity generation of installed carpet shall not exceed 3.5 KV at 70-deg. F and 20-percent R.H. for life of carpet tile.

A. Modular Tile Carpet: Carpet tile systems shall not exceed the target emissions factors of the Carpet and Rug Institute’s following programs:
   1. Carpet: Green Label Plus Program and Testing Procedures.
   2. Carpet Adhesive: Green Label Program and Testing Procedure.
   3. Handicapped Requirement - 4500 (min) = (yarn weight) (36) divided by pile height.

1.4 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials, fabrication, or installation within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, dimensional stability, excess static discharge, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Product: One of the following:
   1. Carpet Tile – Interface Woven Gradience Collection
   2. Color and Pattern: As selected by Owner's Representative from manufacturer's full range.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 68 13

SECTION 09 72 00 – WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Felt wall coverings.

B. Related Sections:
   1. Section 09 29 00 – Gypsum Board.
   2. Section 09 91 00 – Painting: Priming wall surfaces.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide wall coverings and adhesives with the following fire-test-response characteristics as determined by testing identical products applied with identical adhesives to substrates per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Surface-Burning Characteristics: As follows, per ASTM E84:
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 25 or less.

B. Regulatory Requirements: Material shall conform to CBC Section 801 requirements, with flame spread and smoke developed ratings in accordance with Tables 8-A and 8-B.

PART 2 - PRODUCTS

2.1 FELT WALL COVERING

A. Product: FilzFelt Wall Panels.
   1. Style: ‘Façade’.
   2. Color(s): As selected by Owner’s Representative.
   3. Product: 100% wool design felt.
      a. Thickness: 1/2-inch.
      b. Panel Profile: As indicated on Drawings.
      c. Panel Depth, Length, and Spacing: As indicated on the Drawings.

d. Panel Edges: Chamfered.
e. Panel Finish: Manufacturer's standard factory-applied 100 percent wool felt.

4. Performance Criteria:
   a. Acoustics: ASTM C423: NRC – 1.20, SAA – 1.18.
   b. Thickness Tolerance: ±0.3 mm (±1/10 in)
   c. Backing: None
   d. Composition: 100% biodegradable, contains no formaldehyde, 100% VOC free, no chemical irritants, free of harmful substances.
   e. Colorfastness to Light: Class 4–5 (40 hours)
   f. Colorfastness to Crocking: Class 3–4 (wet), Class 4–5 (dry)
   g. Flammability: ASTM E 84: Class A (unadhered).

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 72 00

SECTION 09 81 01- OUTLET BOX PADS

PART 1 - GENERAL

1.1 SCOPE

A. Install outlet box pads over all junction boxes within all partitions and gypsum board ceilings containing sound insulation including but not limited to demising walls, corridor walls, walls adjacent to stairwells, shafts, etc. Use fire rated box pads where required to maintain the fire rating of the partition, wall or ceiling assembly.

PART 2 - PRODUCTS

2.1 MINIMUM BOX PADS MATERIAL COMPOSITION

A. Minimum thickness - 1/8 inch.

B. Adhesion - adheres readily to metal or plastic.

C. Service temperature - 30o to 200o F.

D. Shall contain no asbestos.

E. Minimum shelf life - 1 year.

2.2 ACCEPTABLE PRODUCTS

A. Non-Fire Rated
1. Lowry's Outlet Box Pads as manufactured by Harry A. Lowry Associates, Inc., 11684 Tuxford Street, Sun Valley, CA 91352 (800) 225-8231.
2. Sound Pad 68 as manufactured by L.H. Dottie Co., 6131 South Garfield, City of Commerce, CA 90040 (323) 725-1000.

B. Fire Rated
1. Flamesafe FSP 1077 Putty Pads as manufactured by W.R. Grace Co., 1330 Industry Road, Hartfield, PA 19440 (800) 334-8796.
2. Putty Pads as manufactured by Specified Technologies Inc., 200 Evans Way, Suite 2, Somerville, N 08876 (800) 992-1180.
3. “Hilti CP617 Putty Pads” as manufactured by Hilti, Tulsa, Oklahoma, (800) 879-6000.
4. “3M Fire Barrier Moldable Putty Pads type MPP-X” to fit box size as manufactured by 3M, St. Paul, MN, (800) 328-1687.
5. Metacaulk Putty Pads as manufactured by RectorSeal, 2601 Spenwick Drive, Houston, TX 77055 (800) 231-3345.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install box pads according to manufacturer's written instructions.

B. Brush or wipe construction dust and dirt from box surface. If surface is contaminated with oil, etc., wipe with Xylene or Toluene to remove residue.

C. Center outlet box pad on the back of the junction box. Mold around conduit and cable entering the box. Mold cover around box sides covering all openings and press firmly into place.

END OF SECTION 09 81 01

SECTION 09 81 16 - MECHANICAL AND GENERATOR ROOM ACOUSTICAL TREATMENT

PART 1 - GENERAL

1.1 SCOPE

A. Work under this section consists of furnishing and installing all materials necessary for the execution and completion of all acoustical treatment for mechanical and generator rooms.

1.2 QUALITY ASSURANCE

A. In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work including preparation of substrate, installation of anchors and application of materials.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's product data and installation instructions for each material and component part. Include methods of installation for each type of substrate to receive units.

B. Samples: Submit 3 samples 12 X 12 .

C. Test Reports: Submit certified copies of test reports from an independent NVLAP-accredited acoustical testing laboratory showing compliance with the standards and requirements listed below.

1.4 APPLICABLE STANDARDS AND TEST CONDITIONS

A. All acoustical measurements shall be performed in accordance with ASTM C-423 and shall be performed in Type A mounting per ASTM E 795. The test shall be performed by an independent acoustical testing laboratory accredited under the National Voluntary Laboratory Accredited Program (NVLAP).

B. Each component of the panel shall have a Class A rating supported by tests from Underwriter's Laboratory in accordance with ASTM E 84.

1.5 SOUND ABSORPTION COEFFICIENT REQUIREMENTS

A. The sound absorption coefficients of the material shall not be less than the following tabulated values:

Thickness (in.)	Frequency (Hz)					
	125	250	500	1000	2000	4000
2	.20	.50	.80	.95	.95	.95
4	.70	.99	.99	.99	.99	.99

1.6 PRODUCT HANDLING

A. Pack all units as required to prevent damage or staining in transit to or storage and handling at the site.

B. Time deliver to site ensure uninterrupted progress of the work.

C. Store material to provide easy access for inspection and identification.

D. Inspection: Inspect the material upon delivery. Notify the Contractor of any damaged or stained units. Procure replacements immediately so as not to disrupt schedule.

1.7 OB CONDITIONS

A. Space Enclosure: Do not install work until space has been enclosed and is nominally dry, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The rigid insulation board supplied in the thickness as indicated on the drawings shall be inorganic glass fiber material with a minimum density of 1.5 lbs/ft3 and with a non-erosive coating on the face to satisfy the air flow requirements in the room. The material shall be provided in a minimum size of 24 in. by 48 in. unless larger sizes are more suitable for the application. The material shall be ohns Manville Coated Insul-Shield Black, Owens-Corning Select Sound Black Acoustic Blanket, or approved equal. Material shall be free of all logos or other markings with the face finish continuous black in color and the core material gray/black in color.

B. Hardware cloth shall be minimum 16 gauge vinyl-coated or galvanized. Galvanize steel after it is woven or welded.

C. Fasteners shall be Gemco insulation hangers or approved equal, with aluminum domed cap (unpainted aluminum standard; color available on special order) as distributed by American Insulation Welding Products (800) 292-2215.

D. Hanger adhesive shall be equal to Tuff-Bond Hanger Adhesive for bonding metal insulation hangers to concrete, masonry or drywall walls and ceilings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Attach to walls and ceiling surfaces by mechanical fasteners. The fasteners shall be constructed so that no sharp points or edges shall protrude through the acoustical material. Protective end caps shall be utilized over spindle fasteners.

B. Prepare surface and attach fasteners with an adhesive according to manufacturer's written instructions. Use of self-adhesive tape to attach fasteners is not permitted.

C. Fasteners shall be laid out in a regular grid pattern approved by the Architect.

END OF SECTION 09 81 16

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SECTION 09 81 30 - ACOUSTICAL FLOOR MATTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical floor matting products to improve impact sound insulation
   1. Types:
      a. Flat rebonded recycled rubber matting
      b. Dimpled rebonded recycled rubber matting
      c. Entangled nylon mesh matting

B. Related Sections: Section(s) related to this section include:
   1. Concrete Substrate
   2. Plywood Substrate
   3. Tile
   4. Carpeting

1.2 REFERENCES

A. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. American Society for Testing and Materials (ASTM):
   1. ASTM E492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
   2. ASTM C627 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester
   3. ASTM E989 Standard Classification for Determination of Impact Insulation Class (IIC)
   4. ASTM E1007 Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures
   5. ASTM E2179 Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors
   6. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
   7. ASTM E336 Standard Test Method for Measurement of Airborne Sound Insulation in Buildings

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide acoustical floor matting material which has been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 submittal procedures.

B. Product Data: Submit product data, including manufacturer's published literature, for specified products.

C. Shop Drawings: Manufacturer's specifications, catalog cuts and other items needed to demonstrate compliance with the specified requirements. Also the manufacturer's recommended installation procedures, which, when approved by the architect, will become the basis for accepting or rejecting actual installation procedures used on the work.

D. Samples: Submit a verification sample of the matting and perimeter isolation.

E. Quality Assurance Submittals: Submit the following:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
      a. Laboratory Impact Insulation Class (ASTM E492): Specified floor-ceiling assembly must be tested in a NVLAP-certified laboratory, comply with ASTM standards, and meet requirements specified herein.
      b. Field Impact Insulation Class (ASTM E1007): Specified floor-ceiling assembly must be tested by a NVLAP-certified agency, comply with ASTM standards, and meet requirements specified herein.
   2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
      a. ICC-ES certified
      b. UL listed
   3. Manufacturer's Instructions: Manufacturer's installation instructions.

F. Closeout Submittals: Submit the following:
   1. Warranty: Warranty documents specified herein.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
      a. Certificate: Submit certificate indicating qualification.
   2. Manufacturer's Qualifications: Manufacturer capable of approving application method.

B. Regulatory Requirements

C. Mock-Ups: Install at project site a job mock-up using acceptable products and manufacturer-approved installation methods. Comply with workmanship standard. Comply with Division 1 requirements.
   1. Mock-Up Size: As determined by acoustical consultant.
   2. Maintenance: Maintain mock-up during construction for workmanship comparison; remove and dispose of mock-up when no longer required.
   3. Incorporation: Mock-up may be incorporated into final construction upon Owner's approval.

D. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's instructions and manufacturer's warranty requirements. Comply with Division 1 requirements.

1.6 DELIVERY, STORAGE HANDLING

A. General: Comply with Division 1 requirements.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials at temperature and humidity conditions recommended by manufacturer and protect from exposure to harmful weather conditions.

1.7 PRO ECT CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products will be installed for time period before, during and after installation as recommended by manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.8 WARRANTY

A. Project Warranty: Refer to conditions of the contract for project warranty provisions.

1.9 MAINTENANCE

A. Extra Materials: Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Division 1 requirements.
   1. Quantity: Furnish quantity of materials as requested on purchase order.
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

PART 2 - PRODUCTS

2.1 FLAT REBONDED RECYCLED RUBBER ACOUSTICAL FLOOR MATTING

A. Location
   1. Below hard surface flooring (wood, laminate, vinyl, tile, etc.) as indicated on the drawings.

B. Acceptable Products:
   1. Ecore International QTscu
   2. Pliteq Geniemat RST

C. Material thickness:
   1. 2 mm thick

D. Adhesive. Material approved by manufacturer.

E. Performance Requirements
   1. Laboratory Sound Transmission Class per ASTM E90 and E413 on a minimum 8" thick concrete slab with no ceiling: STC 58.

2. Laboratory Impact Insulation Class per ASTM E492 and E989 on a minimum 8” thick concrete slab with no ceiling:
   a. Manufactured Wood: IIC 56
   b. Tiling or Stone Tiling: IIC 52
3. All measurements shall be performed by an independent NVLAP-accredited acoustical laboratory.

2.2 PERIMETER ISOLATION STRIP

A. Foam Perimeter Isolation Strip
   1. Minimum thickness 1/4 inch.
   2. Material per manufacturer's recommendations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions are acceptable for product installation in accordance with manufacturer’s instructions.

3.2 INSTALLATION

A. Comply with manufacturer’s installation instructions.

B. Related Products Installation: Refer to other sections listed in Related Sections paragraph herein for related products installation.

C. Areas to receive the acoustical floor matting should be weather tight and maintained at a minimum uniform temperature of 65°F for 48 hours before, during and after the installation.

3.3 FIELD QUALITY REQUIREMENTS

A. Manufacturer’s Field Services: Upon Owner’s request, provide manufacturer’s field service consisting of product use recommendations in accordance with manufacturer's instructions.

B. The cost for all field acoustical testing, corrective work associated with the installation of the acoustical floor matting and flooring to meet the minimum requirements, shall be borne by the flooring contractor(s).
   1. Field Tests should be performed by an independent acoustical laboratory accredited by the U.S. Department of Commerce, National Institute of Standards and Technology under the National Voluntary Laboratory Accreditation Program for the specified test procedure.
   2. Testing must meet minimum performance requirements as specified herein.

3.4 CLEANING

A. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to Owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

3.5 PROTECTION

A. Protection: Protect installed product and finish surfaces from damage during construction.

END OF SECTION 09 81 30

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SECTION 09 91 00 – PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop-priming and surface treatment specified under other Sections.
3. Painting exposed surfaces whether or not colors are designated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Owner's Representative will select from standard colors or finishes available.
4. Painting includes field-painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
5. Painting is not required on prefinished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
6. Labels: Do not paint over Underwriters Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

B. Related Sections:
1. Section 05 50 00 – Metal Fabrications: Shop-priming ferrous metal.
2. Section 05 52 13 – Pipe and Tube Railings: Shop-priming ferrous metal.
3. Section 06 41 00 – Architectural Woodwork: Shop finishing.
4. Section 08 11 13 – Hollow Metal Doors and Frames: Shop-priming ferrous metal.
5. Section 08 31 13 – Access Doors: Shop-primed doors for field painting.
6. Section 09 24 00 – Portland Cement Plaster.
7. Section 09 29 00 – Gypsum Board.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
   a. WELL Building Standard v2 Certification.
   b. BLUE ZONES Certification.
2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering interior 0-low VOC paint products that may be incorporated into the Work include, but are not limited to, the following:
   1. Benjamin Moore; EcoSpec WB.
   2. Dunn-Edwards; SPARATAZERO Zero VOC.
   3. Glidden Professional; Lifemaster No VOC.
   4. PPG Architectural Finishes; Pure Performance.
   5. Sherwin-Williams; Promar Coating System.

B. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering exterior paint products that may be incorporated into the Work include, but are not limited to, the following:
   1. Benjamin Moore.
   2. Dunn-Edwards.
   3. Glidden Professional.
   4. PPG Architectural Finishes.
   5. Sherwin-Williams.

2.2 PAINT MATERIALS

A. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.

B. Material Quality: Provide the manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

C. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.

D. Colors: Match colors indicated by reference to the manufacturer's standard color designations.

E. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Flat Paints and Coatings: 50 g/L.
   2. Non-Flat Paints and Coatings: 100 g/L.
   3. Non-Flat, High-Gloss Paints and Coatings: 150 g/L.
   4. Dry-Fog Coatings: 150 g/L.
   5. Primers, Sealers, and Undercoaters: 100 g/L.
   6. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   7. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   8. Pretreatment Wash Primers: 420 g/L.
   9. Floor Coatings: 100 g/L.
   10. Shellacs, Clear: 730 g/L.

11. Shellacs, Pigmented: 550 g/L.

2.3 LIFE OF FILM

A. The color of surfaces finished under this Section shall, at the end of one year, remain free from serious fading and the variation, if any, shall be uniform. The original adherence of materials shall be maintained for one (1) year and during this period there shall be no evidence of any blisters, running, peeling, scaling, chalking, streaks or stains. Washing with alkali-free soap and water shall remove surface dirt without producing the above or other deteriorating effects.

2.4 EXTERIOR PAINTING SCHEDULE

A. Concrete: Acrylic Finish: Two finish coats over a primer.
1. Primer: Exterior concrete and masonry primer.
2. Finish Coats: Exterior flat acrylic paint.

B. Cement Plaster: Integral color, no paint.

C. Selected Metal Fabrications as Indicated.

D. Metal Doors and Frames, Flashings, and Other Miscellaneous Metal:
1. Ferrous Metal: Acrylic Finish: Two finish coats over a rust-inhibitive primer.
   a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).
   b. Finish Coats: Exterior semigloss acrylic enamel.
2. Zinc-Coated Metal: Acrylic Finish: Two finish coats over a galvanized metal primer.
   a. Primer: Exterior galvanized metal primer.
   b. Finish Coats: Exterior semigloss acrylic enamel.

2.5 INTERIOR PAINTING SCHEDULE

A. Gypsum Board:
1. Typical Walls and Ceilings: 100% Acrylic finish, two finish coats over a primer.
   a. Primer: Interior zero VOC/low odor gypsum board primer.
   b. Finish Coats: Interior low-luster (eggshell) zero VOC/low odor acrylic enamel.
2. Typical Toilet Room and Janitor Closet Walls and Ceilings: 100% Acrylic finish, two finish coats over a primer.
   a. General: 100% Acrylic finish, two finish coats over a primer.
   b. Primer: Interior zero VOC/low odor gypsum board primer.
   c. Finish Coats: Interior zero VOC/low odor acrylic enamel, semi-gloss.
3. Acrylic Finish: General: 100% Acrylic finish, two finish coats over a primer.
   a. Primer: Interior gypsum board primer.
   b. Finish Coats: Interior 100% Acrylic finish.

B. Metal Stairs and Metal Railings Indicated to be Painted:
1. Primer: Shop-applied metal primer.
2. Intermediate Coat: Epoxy modified primer.
3. Topcoat: Semi-gloss acrylic polyurethane.

C. Metal Doors and Frames Indicated to be Painted, and Other Miscellaneous Metal: Acrylic finish, two finish coats over a primer.
1. Ferrous Metal:
   a. Acrylic Finish: Two finish coats over a primer.
      1) Primer: Interior zero VOC/low odor ferrous-metal primer.

2) Finish Coats: Interior semigloss zero VOC/low odor acrylic enamel.

2. Zinc-Coated Metal:
   a. Acrylic Finish: Two finish coats over a primer.
      1) Primer: Interior zero VOC/low odor zinc-coated metal primer.
      2) Finish Coats: Interior semigloss zero VOC/low odor acrylic enamel.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 91 00

SECTION 09 96 23 – GRAFFITI-RESISTANT COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Non-sacrificial graffiti-resistant and water repellent coating system applied to the following painted or un-painted substrates:
      a. Concrete and Portland cement plaster.
      b. Galvanized steel.
      c. Painted metal.
      d. Minimum Coverage: As indicated on Drawings.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 SYSTEM DESCRIPTION

A. Complete graffiti-resistant system includes the following:
   1. Base coat.
   2. Top coat.
   3. Cleaner (graffiti remover).

B. Properties:
   1. Zero VOC.
   2. 20-25 years life expectancy.
   3. Permanent coating.
   4. Withstands excessive removals.
   5. FDA/USDA, State and City approved.
   6. Non-Yellowing, non-chalking.

C. Performance requirements for the applied graffiti-resistant system:
   1. Show no signs of deterioration or change of appearance after graffiti materials removal during the warranty period.
   2. Withstand 100 percent removal of all types of paint and graffiti materials without damaging the coating or the substrate. No evidence of graffiti shall remain on the surface.
   3. Withstand a minimum of 200 cleaning cycle without measurable coating deterioration.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Installation shall be performed by applicators with satisfactory experience in the application of the material to be used and trained for the application of the specified coating materials.

1.5 WARRANTY

A. Warrant graffiti-resistant coatings to be free from defects in material, fabrication, and installation. Graffiti-resistant coatings shall continue to repel graffiti after repeated cleaning during the warranty period.
   1. Defects are defined to include failure to withstand complete graffiti removal, ghosting, shadowing, chemical staining, yellowing, and normal environmental effects.
   2. Protection against future graffiti shall remain intact without need to re-apply any top coat or other coatings.
   3. This warranty shall be in addition to and not a limitation of other rights the CITY may have against the Contractor under the Contract Documents.
   4. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide graffiti-resistant coating system complying with the following:
   1. Permanent coating system. Coating shall not require re-application regardless of number of graffiti taggings during the life of the 10-year performance warranty period.
   2. Show no signs of deterioration or change of appearance after graffiti removal during the warranty period. No ghosting, staining or shadowing.
   3. Capability of removing 100-percent of all types of paint and graffiti materials from treated surfaces without damaging the coating or the substrate.
   4. Upon graffiti removal, no evidence of graffiti shall remain.
   5. Capable of withstanding a minimum of 120 cleaning cycles over the same area without measurable coating deterioration.
   6. Shall not increase dirt pick-up of substrate.
   7. Meet the following test results for the following chemicals:
      a. MEK No effect after 5-days.
      b. Carboxylic Acid No effect after 5-days.
      c. 75% Phosphoric Acid No effect after 5-days.
      d. 37% HCL 3 hours blister.
      e. 50% Sulfuric Acid No effect after 5-days.
      f. 20% NIT 68 hours blister.

B. Time-Tested:
   1. Graffiti resistant system shall have been in successful commercial use for at least 12-years.
   2. Furnish documentation of performance of the graffiti-resistant coating system by written report from a nationally recognized and certified protective coating specialist. Documentation shall include type of substrate, location, length of service, testing performed and results.

2.2 MATERIALS, GENERAL

A. Material Characteristics: ASTM D6578/D6578M; and the following:

1. Silicone elastomer graffiti control coating.
2. Compliant with California VOC regulations.
3. Clear, single component.
4. Non-yellowing.
5. Non-glossy penetrating liquid forming a durable invisible barrier.
6. Specifically designed for porous masonry and plaster to provide protection against water and waterborne staining.
7. Vapor permeable.
8. Non-sacrificial type coating.
9. Efflorescence-inhibiting.

B. Material Quality: Provide manufacturer's best-quality material for each coating material specified.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 96 23

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SECTION 09 97 29 – CONCRETE FLOOR SEALING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete floor sealer/hardener.

B. Related Sections:
   1. Section 03 30 00 – Cast-In-Place Concrete: Procedures for curing concrete.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Product: High solids, solvent based, non-yellowing, acrylic copolymer concrete curing, sealing and dustproofing compound.
   1. Meeting the applicable requirements of ASTM C1315 Type 1, Class B; ASTM C309; AASHTO M-148.
   2. VOC Content: 0 g/l.
   3. Gloss: Low sheen.
   4. Coefficient of Friction: 0.5 or better.

PART 3 - EXECUTION – NOT USED

END OF SECTION 09 97 29

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SECTION 10 11 00 – VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Markerboards.
   2. Tackboards.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide fabrics with the surface-burning characteristics indicated, as determined by testing identical products per ASTM E84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Provide anchorage of display cases capable of withstanding the effects of earthquake motions determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

2.2 MATERIALS, GENERAL

A. Hardboard: AHA A135.4, tempered.

B. Particleboard: ANSI A208.1, Grade 1-M-1, made with binder containing no urea formaldehyde.

C. Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

D. Natural Cork Sheet: MS MIL-C-15116-C, Type II; seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish.

E. Extruded-Aluminum Bars and Shapes: ASTM B221, Alloy 6063.

F. Aluminum Tubing: ASTM B429/B429M, Alloy 6063.

2.3 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly:
1. Porcelain-Enamel Face Sheet: Porcelain-enamel-clad, ASTM A463/A463M, Type 1, stretcher-leveled aluminized steel, with 0.0236-inch (0.60-mm) uncoated thickness; with porcelain-enamel coating fused to steel at approximately 1000 deg F (538 deg C).
2. Manufacturer's Standard Core: Minimum 1/4 inch (6 mm) thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant, thermoplastic, low VOC type.
4. Gloss Finish: Low gloss; dry-erase markers wipe clean with dry cloth or standard eraser. Suitable for use as projection screen.

B. Markerboard Sheet Assembly: Fabricated from 0.0209-inch- (0.55-mm-) thick, porcelain-enamel face sheets for direct application to wall surface.

2.4 MARKERBOARD ACCESSORIES

A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
1. Factory-Applied Trim: Manufacturer's standard.

B. Chalktray: Manufacturer's standard, continuous.
1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

C. Marking Implements: Provide two new boxes of approved markers and one new eraser for each markerboard.

2.5 TACK ASSEMBLIES

A. Tackboards:
1. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
a. Factory-Applied Trim: Manufacturer's standard.
2. Natural-Cork Tack Assembly: 1/4-inch- (6-mm-) thick, natural cork sheet with burlap backing factory laminated to 1/4-inch- (6-mm-) thick hardboard backing.

B. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch- (1.57-mm-) thick, extruded aluminum; of size and shape indicated.
1. Factory-Applied Trim: Manufacturer's standard.

C. Natural-Cork Tack Assembly: 1/4-inch- (6-mm-) thick, natural cork sheet with burlap backing factory laminated to 1/4-inch- (6-mm-) thick hardboard backing.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 11 00

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SECTION 10 14 00 – SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exterior signage for the following:
      a. Building accessibility signage.
      b. Dimensional characters.
      c. Parking stall accessibility symbols and signs.
      d. Unauthorized vehicle signs.
   2. Interior signage for the following:
      a. Directional signage.
      b. Elevator lobby maps.
      c. Stairway floor number signs.
      d. Area of refuge signs.
      e. Tactile egress signs.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 REGULATORY REQUIREMENTS

A. Off-Street Parking Space Identification:
   1. Entry Drive Accessibility Notification: Provide one 17” x 22” sign at each entry drive.
   2. Disabled Parking Spaces: Identify each parking space with a permanently affixed reflectorized sign on a post immediately adjacent to and visible from each space, graphics.
   3. Signage Size: 70 square inches minimum, posted at 60 inches minimum from the bottom of the sign to the parking space finished grade.
   4. Van-Accessible Signage: Mount on post below the disabled parking sign.

B. CBC and ADA Requirements: Compliance applies to interior signage, including Braille lettering.

C. Provide signage at public toilet rooms.

D. Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1. Interior Code Signage: Provide signage as required by accessibility regulations and requirements of authorities having jurisdiction. These include, but are not limited to, the following:
   a. Fire doors.
   b. Room capacity.
   c. Elevator signs.
   d. Stairway identification.
   e. Live load capacity.
   f. Signs for accessible spaces.
   g. Area of refuge signs.

1.4 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials, fabrication or installation within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Deterioration of embedded graphic image.
      c. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Fabricate sign plates of the size, thickness and configuration indicated. Precision-engrave the required letters, numbers or figures with uniform margins, in the letter style and size indicated, or as selected by the Architect from the manufacturer's standard fonts.
   1. Protect finished metal surfaces with 2 coats of clear, non-yellowing lacquer.
   2. Finish and Contrast. The characters and background of signs shall be eggshell, matte, or other non-glare finish.
   3. Characters and symbols shall contrast with their background –either light characters on a dark background or dark characters on a light background.

B. Exterior Signage: Complying with ADA, 18 gage bonderized steel screen painted blue with white international disabled symbol.

C. Interior Signage: Cast acrylic sheet, transparent, clear, semi-matte or non-glare, 0.125-inch thick, frameless signs, color as selected by Architect.

D. Pictograms, General:
   1. Pictograms (where provided) shall be accompanied by the equivalent verbal description placed directly below the pictogram. Pictograms are figures that depict what the words are stating.
   2. The border dimension of the pictogram shall be 6 in (152 mm) minimum in height (i.e. graphics enclosed within a maximum 6-inch square border).

E. Engraved Copy: Machine engrave letters, numbers, symbols, and other graphic devices into panel sign on face indicated to produce precisely formed copy, incised to uniform depth.
   1. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.
   2. Engraved Metal: Fill engraved copy with enamel.
   3. Engraved Opaque Acrylic Sheet: Fill engraved copy with enamel.

4. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with enamel. Apply opaque background color coating to back face of acrylic sheet.
5. Copy Height: 5/8-inch minimum, 2-inch maximum as recommended by sign manufacturer for required copy.

F. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with 2022 CBC 11B Division 7 requirements 11B-703.3. Text shall be accompanied by Contracted Grade 2 Raster Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Panel Material: Opaque acrylic sheet.
2. Raised Characters: At least 5/8 in (16 mm) high, but no higher than 2 in (50 mm).
3. Raised Letters and Numerals: 1/32 in, upper case, SANS SERIF or SIMPLE SERIF type.
4. Characters: 1/10-inch is required between each dot within a cell, measured from the dot centers. 3/10-inch is required between each cell within a word. Measure from the center of the dots in the second column of the first cell to the center of the dots in the first column of the next cell. Dots must be a minimum of 1/40-inch high at the apex.
5. Braille dots to be 0.025 to 0.037 inches in height per table 11B-703.3.1.
6. Distance between corresponding dots in adjacent cells is to be 3/10 inch

G. Colored Coatings for Acrylic Sheet: For copy and background colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for application intended.

H. Symbols of Accessibility: Provide 6-inch- (150-mm-) high symbol fabricated from opaque non-reflective vinyl film, 0.0035-inch (0.089-mm) nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Characters: Fabricate letters and numbers to required sizes and styles, using metals and thicknesses indicated. Form exposed faces and sides of characters to produce surfaces free from warp and distortion. Include internal bracing for stability and attachment of mounting accessories. Comply with requirements indicated for finish, style, and size.
1. Stainless-Steel Sheet: Type 302 or Type 304, complying with ASTM A666, not less than 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.80 mm) thick for returns.
2. Character Height: 14 inches minimum or as indicated on approved shop drawings.
3. Character Style: To be selected.

B. Standoffs:
1. Basis-of-Design: Monarch Metal Fabrication
2. Metal: Stainless steel.
3. Barrel Height: 1-inch.
4. Barrel Diameter: 1-inch.
5. Cap: Standard cap.

2.3 PANEL SIGNS

A. Message Panel Materials:
1. Aluminum Sheet: 0.125 inch (3.18 mm) thick.
   a. Panel Finish: Baked enamel.
   b. Color: As selected by Architect from manufacturer's full range.

B. Sign Message Panels: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
   1. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.
   2. Increase metal thickness or reinforce with concealed stiffeners or backing materials as needed to produce surfaces without distortion, buckles, warp, or other surface deformations.
   3. Continuously weld joints and seams unless other methods are indicated; grind, fill, and dress welds to produce smooth, flush, exposed surfaces with welds invisible after final finishing.

2.4 POSTS

A. General: Fabricate posts to lengths required for mounting method indicated.
   1. Direct-Burial Method: Provide posts 36 inches (910 mm) longer than height of sign to permit direct embedment in concrete foundations.

B. Aluminum Posts: Manufacturer's standard 0.125-inch- (3.18-mm-) thick, extruded-aluminum tubing, with vertical slots to engage sign panels. Provide stop blocks in slots to hold panels in position. Include post caps, fillers, spacers, junction boxes, access panels, and related accessories required for complete installation.
   1. Square Posts: 2 inches (50 mm) square.
   2. Post Finish: Natural anodized aluminum.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 14 00

SECTION 10 26 23 – IMPACT-RESISTANT WALL PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flush mount retainer corner guards, aluminum, full wall height, flanges to receive drywall.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain impact-resistant wall-protection units through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall-protection units and are based on the specific system indicated.
   1. Do not modify intended aesthetic effects, as judged solely by Owner’s Representative, except with Owner Representative's approval. If modifications are proposed, submit comprehensive explanatory data to Owner’s Representative for review.

C. Fire-Test-Response Characteristics: Provide impact-resistant, plastic wall-protection units with surface-burning characteristics as determined by testing identical products per ASTM E84, NFPA 255, or UL 723 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Wall Protex: https://www.wallprotex.com/product/flush-mount-retainer-corner-guards.
   2. IPC Door and Wall Protection Systems; Division of InPro Corporation.

2.2 PERFORMANCE REQUIREMENTS

A. Provide components identical to those tested in accordance with ASTM E84 for fire performance characteristics indicated. Identify components with appropriate markings from the testing organization.
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 450 or less.
   3. Impact Strength: Provide components with minimum impact resistance of 25.4 ft. lbs per sq. ft. when tested in accordance with ASTM D256 (Izod impact, ft. lbs per inch notch).

2.3 MATERIALS

A. Extruded Rigid Plastic: ASTM D1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.
   1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D256, Test Method A.
   2. Chemical and Stain Resistance: Tested according to ASTM D543.
   3. Self-extinguishing when tested according to ASTM D635.
   4. Flame-Spread Index: 25 or less.
   5. Smoke-Developed Index: 450 or less.

B. Colors and Textures of Plastic Material: Basis-of-Design; Protex, White 11929.

C. Aluminum Extrusions: Alloy and temper recommended for use and finish indicated, but with not less than strength and durability properties in ASTM B221 for 6063-T5.

D. Fasteners: Aluminum, nonmagnetic stainless steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with components, hardware, anchors, and other items being fastened. Use theft-proof fasteners where exposed to view.

2.4 CORNER GUARDS

A. Flush-Mounted, Plastic-Cover Corner Guards: Manufacturer's standard, PVC-free assembly consisting of snap-on, resilient plastic cover that is flush with adjacent wall surface, installed over continuous retainer and intumescent fire barrier; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition; full wall height.
   1. Cover: Extruded rigid plastic, minimum 0.078-inch (2.0-mm) wall thickness; in dimensions and profiles indicated on Drawings.
      a. Profile: Nominal 3-inch- (75-mm-) long leg and 1/4-inch (6-mm).
      b. Height: Custom.
      c. Color and Texture: As selected by Architect from manufacturer's full range.
   2. Retainer: Minimum 0.060-inch- (1.5-mm-) thick, 1-piece, extruded aluminum.

3. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 26 23

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SECTION 10 28 13 – COMMERCIAL TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Toilet room accessories of the following types:
      a. Toilet tissue dispensers.
      b. Seat-cover dispensers.
      c. Sanitary-napkin disposal units.
      d. Hand soap dispensers.
      e. Roll hand towel dispensers.
      f. Grab bars.
      g. Mirror units.
      h. Trash receptors.
      i. Diaper-changing stations.
      j. Electric hand dryers.
      k. Shower curtains, rods, and hooks.
      l. Clothes hooks.
   2. Underlavatory guards.
   3. Custodial Accessories:
      a. Mop and broom holders.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: AISI Type 302/304, with polished No. 4 finish, 0.034-inch (22-gage) minimum thickness.

B. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

C. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

D. Galvanized Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.2 FABRICATION

A. General: Only a maximum 1-1/2-inch-diameter, unobtrusive stamped manufacturer logo, as approved by Owner's Representative, is permitted on exposed face of toilet or bath accessory units. On either interior surface not exposed to view or back surface, provide additional identification by either a printed, waterproof label or a stamped nameplate, indicating manufacturer's name and product model number.

B. Surface-Mounted Toilet Accessories, General: Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled. Hang doors or access panels with continuous stainless steel piano hinge. Provide concealed anchorage wherever possible.

C. Recessed and Semi-Recessed Toilet Accessories, General: Except where otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors or access panels with full-length, stainless steel piano hinge. Provide anchorage that is fully concealed when unit is closed.

D. Framed Mirror Units, General: Stainless-steel sheet with fiberboard backing; enclosed in a frame formed from 0.064-inch (1.63-mm) nominal-thickness, zinc-plated steel sheet; with round corners. Fabricate frame with welded and ground corners or from one piece of metal. Provide No. 8 finish for mirror, chrome plating for frame.

E. Mirror Unit Hangers: Heavy-duty wall brackets of galvanized steel, equipped with concealed locking devices requiring a special tool to remove that will permit rigid, tamperproof, and theftproof installation.

F. Keys: Provide universal keys for access to toilet accessory units requiring internal access for servicing, resupply, etc. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 28 13

SECTION 10 43 13 - DEFIBRILLATOR CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. AED cabinets.
   2. Defibrillators.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Provide cabinets and accessories produced by a single manufacturer.

B. Reference Standards: Most current version of each document specified.
   1. American Heart Association (AHA): American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care - current Edition.
   2. Intertek Testing Services/Warnock-Hersey International (ITS/WHI).
   3. National Fire Protection Association (NFPA): NFPA 70, National Electrical Code.

PART 2 - PRODUCTS

2.1 DEFIBRILLATOR CABINETS

A. Basis-of-Design Product: The design for the defibrillator cabinet and AED is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Basis-of-Design: Activar, Inc./JL Industries.
      a. Modern Metal Products.
      b. General Medical Devices/Zoll AED.
      c. Accepted equivalent.

B. Cabinet with Steel Trim and Door:
   1. Cabinet Style: Recessed.
   2. Components:
      a. Tub: Cold-rolled steel.
         1) Finish: Factory-applied powder coat paint finish.

2) Standard Color: White.

b. Door and Trim Construction: Cold-rolled steel; flush doors with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with zinc-plated with roller catch.
1) Finish: Factory-applied powder coat paint finish.
2) Standard Color: White.

c. Door Style: Vertical Duo; Acrylic, SAF-T-LOK™, Pull & AED Decal.

3. Trim Style and Depth:
a. Recessed Cabinet: 3/8-inch (9.53 mm) flat trim.
b. Trim Dimensions: 1-3/4-inch (44.45 mm) face trim on door and frame.

C. Fire-Rating: Fire-Rated for 1-hour and 2-hour combustible and noncombustible wall systems.

D. Alarms: Standard: 85 dB (audible) cabinet-mounted alarm standard (battery operated) to protect against theft or tampering. Alarm deactivated when door is closed.
1. Standard Alarm: 85 dB (audible) Alarm (battery operated). Alarm stays on for 2 minutes after door is closed.

E. Wall Signs and Cabinet Lettering:
1. AED wall signs.

2.2 DEFIBRILLATORS

A. Testing: IEC60529/EN60529 IPX4 “Splash Proof”, MIL STD-810E Shock testing.

B. Device Capacity: 20 full discharges or 140 minutes of “on time” with a fully charged device.
1. Output Energy Sequence: Multiple levels, configurable from 150 joules to 360 joules. Factory default settings of 200J, 300J, 360J.
2. Output Energy Accuracy: ±10% into 50 ohms, ±15% into 25 to 100 ohms.
3. Shock Charge Time: Charge times with a fully charged device: 200 joules in less than 9 seconds, 360 joules in less than 15 seconds.
4. Electrical Protection: Input protected against high voltage defibrillator pulses per IEC60601-1/EN60601-1.
5. Safety Classification: Internally powered equipment; IEC60601-1/EN60601-1.
6. The specifications apply from 25 to 200 ohms. Voltage compensation is limited to the voltage that would result in delivery of 360 joules into 50 ohms.

C. Prompting: Audible and visual with graphic.
1. Shock Advisory System: An ECG analysis system that advises whether a shock is appropriate; meets rhythm recognition criteria specified in DF39. The device charges for shock only when the Shock Advisory System advises defibrillation.

D. Controls: Lid Release/ON-OFF - Controls device power.

E. Data Storage: Device stores ECG data for wireless transmission to a personal computer. ECG and event data can be downloaded.
1. Memory Type: Internal digital memory.
2. ECG Storage: Dual patient data storage. Minimum 20 minutes of ECG stored for the current patient and summarized data stored for the previous patient.
3. Capacity: Minimum 200 time-stamped event log markers.

2.3 DEFIBRILLATOR ACCESSORIES

A. Battery Charger: Type: Li/SO2Cl2 Lithium Sulfuryl Chloride, 11.7V, 1.4 amp-hours.

B. Electrode Pads:
   1. Pads: ECG is received from disposable defibrillation electrodes, standard placement (anterior-lateral).
   2. Pads Packaging: User intuitive, rapid release QUIK-PAK electrodes allow the electrode pads to be preconnected to the device and protected under a top cover.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 43 13

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SECTION 10 44 00 – FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fire extinguishers and cabinets.
   2. Brackets for fire extinguishers.
   3. Knox boxes.

B. Related Sections:
   1. Section 09 29 00 - Gypsum Board: Roughed-in wall openings.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Provide extinguishers which are UL listed with UL listing mark for type, rating, and classification of extinguisher.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
   1. Sheet: ASTM B209.
   2. Extruded Shapes: ASTM B221.

C. Stainless-Steel Sheet: ASTM A666, Type 304.

D. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.2 EXTINGUISHERS

A. Dry Chemical Type: UL 299, cast steel tank, with pressure gage; UL Rating 2A-10B:C.

B. At Kitchens: Wet Chemical Type: UL 299, stainless steel tank, with pressure gage; UL Rating 2A-K, and containing potassium acetate based, low PH agent, 6 liter.

2.3 EXTINGUISHER CABINETS

A. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   1. Trim Type:
      a. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.

B. Door Material: Formed, enameled 18 gage, hollow metal design, reinforced for flatness and rigidity. Provide fire rated tubs where cabinets are to be installed in 1-hour rated areas.

C. Door Style: Vertical duo panel with frame.
   1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER".
         1) Location: Applied to cabinet door.
         2) Application Process: Silk-screened.
         3) Lettering Color: Red.
         4) Orientation: Vertical.

D. Door Glazing: Acrylic sheet.
   1. Acrylic Sheet Color: Clear transparent acrylic sheet.

E. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Handle: Manufacturer's standard.
   2. Hinge Type: Continuous, of same material and finish as trim, permitting door to open 180 degrees.
   3. Lock: Steel cam type designed to permit opening of the cabinet door in and emergency by pulling sharply on the handle.
      a. Factory Applied Lettering: "IN CASE OF FIRE ONLY - PULL FIRMLY ON HANDLE".

F. Cabinet Mounting Hardware: Manufacturer's standard for cabinet.

2.4 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   1. Color: Red.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical.

2.5 FIRE DEPARTMENT KEY ACCESS BOXES

A. Provide fire department "Knox-Box" access key lock boxes meeting City Fire Department Standards. Apply for and order boxes through the local Fire Department having jurisdiction.
   1. City's Representatives to coordinate locations to be determined by the City Fire Department. For Knox Box procedures, refer to City Fire Department Standards. Recommended location is 4 to 5 feet above ground and no more than 2 feet from the door. Verify with City Fire.
   2. Boxes: Knox-box for recessed mount, 1/4-inch steel case, fully welded.
   3. Coordinate and provide keying and type per fire/police department, and other jurisdictional agency requirements.
   4. Series: Knox Company; 3200 Series, as required by Fire Department.
   5. Size: Minimum 3-3/4" deep, 4" wide x 5" high with lift off face plate.
   6. Finish: Aluminum.
   7. Provide surface mounting kit and all other required mounting accessories.
   8. Mounting: Mounted to HSS tube at a height of 6'-0" as indicated on Drawings.

B. Where boxes are to be located within concrete or masonry walls, Contractor shall furnish Knox recess mounting kits for casting in place.

2.6 FINISHES

A. Extinguisher: Steel, red enamel color.

B. Cabinet Exterior Trim and Door: White baked enamel finish; painted to match adjacent wall surface.

C. Cabinet Interior: White, baked enamel finish; paint to match adjacent wall color.

PART 3 - EXECUTION – NOT USED

END OF SECTION 10 44 00

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SECTION 11 31 00 – RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Refrigeration appliances.
   2. Cooking appliances.
   3. Cleaning appliances.

B. Related Sections:
   1. Division 22: Water plumbing connections.
   2. Division 23: Hood and vent connections.
   3. Division 26: Electrical connections.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain appliances from a single manufacturer.

B. Energy Ratings: Provide appliances that carry labels indicating energy cost analysis (estimated annual operating costs) and efficiency information as required by Federal Trade Commission.
   1. Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program.

C. UL and NEMA Compliance: Provide electrical components that are listed and labeled by UL and comply with applicable NEMA standards.

D. AGA and ANSI Standards: Provide gas-burning appliances that carry the design certification seal of the American Gas Association (AGA) and comply with ANSI Z21-Series standards.

E. Regulatory Requirements, Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)" and California Title-24.

F. AHAM Standards: Provide appliances that conform to the following standards of the Association of Home Appliance Manufacturers:

PART 2 - PRODUCTS

2.1 REFRIGERATION APPLIANCES

A. Full Size Refrigerator/Freezer: TBD

B. Undercounter Refrigerator/Freezer: TBD

2.2 COOKING APPLIANCES

A. Freestanding Electric Range: TBD

B. Microwave Oven: TBD

C. Exhaust Hood: TBD

2.3 CLEANING APPLIANCES

A. Built-In Dishwasher: Under-counter automatic dishwasher with porcelain enamel interior, two wash levels, full-extension vinyl-coated upper and lower dish racks and removable silverware basket, sized to replace 24-inch base cabinet.

B. Clothes Washer: TBD

C. Clothes Dryer: TBD

2.4 FINISHES

A. Finish: Provide residential appliances in the manufacturer's standard finish.

B. Colors: Provide manufacturer's standard colors as shown or scheduled. If no color is indicated, provide stainless steel.

C. Wherever appliances by more than one manufacturer are installed in same space, provide units with color matching item designated by Owner’s Representative.

PART 3 - EXECUTION – NOT USED

END OF SECTION 11 31 00

SECTION 12 24 13 – ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roller shades of the following types:
      a. Privacy.
      b. Solar control.
   2. Operation types:
      a. Manual.

B. Related Sections:
   1. Section 06 10 53 – Miscellaneous Rough Carpentry: Wood blocking and grounds for mounting roller shades and accessories.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Resistance Ratings: CBC/CFC 806.4 Flame resistant in accordance with CCR, Title 19, Division 1, Chapter 8.

D. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of roller shade system that do not comply with requirements or that fail in materials, fabrication, or installation within specified warranty period.
   1. Failures include, but are not limited to, the following:

a. All operating parts except for the bead chain.
b. Shade cloth.

2. Warranty Period: 10 years from date of Substantial Completion.

B. In the event of a warranted product failure, the Shade Contractor shall, at no additional cost to the Owner, facilitate acquisition and delivery of all necessary replacement components to the Owner's Representative.

PART 2 - PRODUCTS

2.1 STANDARD ROLLER SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product listed below or a comparable product by one of the following:
1. Basis-of-Design: MechoShade Systems, Inc.; 'Thermoveil Group' shades.
2. Hunter Douglas Contract – Nysan Shading Systems.

B. Shade Band Material: PVC-free polyester shades, and as follows:
1. Thickness: Single, non-raveling 0.030-inch (0.762mm) vinyl fabric woven from 0.018-inch diameter extruded vinyl yarn comprised of 21 percent polyester and 79 percent reinforced vinyl.
2. Color: As selected by Owner’s Representative.
3. Openness: 1% - 2%.
4. Bottom Hem: Straight.
5. Provide shades meeting GREENGUARD certification requirements.

C. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Drawings.

D. Direction of Roll: Regular, from back of roller.

E. Mounting Brackets: Galvanized or zinc-plated steel

F. Pocket-Style Exposed Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.
1. Fascia: L-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; continuous panel concealing front and bottom of shade roller, brackets, and operating hardware and operators; length as indicated on Drawings; removable design for access.
2. Top/Back Cover: L-shaped; material and finish to match fascia; combining with fascia and end caps to form a six-sided headbox enclosure sized to fit shade roller and operating hardware inside.

G. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

2.2 MOUNTING AND OPERATION

A. Mounting: Recessed in ceiling pocket, mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

B. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.
   1. Pull: Manufacturer's standard pole engaged pull.
   2. Position of Clutch Operator: Left or Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
   3. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
   4. Lift-Assist Mechanism: Manufacturer's standard spring assist for balancing roller shade weight and lifting heavy roller shades.
   5. Loop Length: Full length of roller shade Length required to make operation convenient from floor level.
   6. Bead Chain: #10 qualified stainless-steel chain rated to 90 lb. (41 kg) minimum breaking strength.
   7. Operating Function: Stop and hold shade at any position in ascending or descending travel.

C. Lifting Device: Crank and gearbox meeting ANSI/WCMA A 100.1 safety standards.

PART 3 - EXECUTION – NOT USED

END OF SECTION 12 24 13

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SECTION 12 35 70 – HEALTHCARE CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes
   1. Manufactured cabinets for medical facilities.
   2. Installation of countertops on manufactured cabinets.

B. Related Sections:
   1. Section 06 41 00 – Architectural Woodwork: Plastic-laminate casework, countertops and backsplashes.
   2. Section 12 3 661.16 – Solid Surfacing Countertops: Solid-surfacing-material countertops and backsplashes.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Exposed Surfaces of Cabinets: Surfaces visible when doors and drawers are closed, including visible surfaces in open cabinets or behind glass doors.

B. Semiexposed Surfaces of Cabinets: Surfaces behind opaque doors or drawer fronts, including interior faces of doors and interiors and sides of drawers. Bottoms of wall cabinets are defined as "semiexposed."

C. Concealed Surfaces of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, bottoms of drawers, and ends of cabinets installed directly against and completely concealed by walls or other cabinets. Tops of wall cabinets and utility cabinets are defined as "concealed."

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Forest Certification: Provide components made with not less than 70 percent of wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

C. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND STYLE

A. Basis-of-Design Product: The design for the healthcare cabinets is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Basis-of-Design: Midmark.
      a. Style: As selected by Architect.
      b. Wood Species: As selected by Architect.

2.2 CABINET MATERIALS

A. General:
   1. Adhesives: Do not use adhesives that contain urea formaldehyde.
   2. Hardwood Lumber: Kiln dried to 7 percent moisture content.
   3. Softwood Lumber: Kiln dried to 10 percent moisture content.
   4. Hardwood Plywood: HPVA HP-1, made with adhesive containing no urea formaldehyde.
   5. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
   6. Hardboard: AHA A135.4, Class 1 Tempered.

B. Exposed Materials:
   1. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
   2. Staining and Finish: To be selected.
   3. Solid Wood: Clear hardwood lumber of species indicated, free of defects.
   4. Plywood: Hardwood plywood with face veneer of species indicated, with Grade A faces and Grade C backs of same species as faces.
      a. Edge band exposed edges with minimum 1/8-inch- (3-mm-) thick, solid-wood edging of same species as face veneer.
   5. Thermoset Decorative Panels: Medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
      a. Provide material finished on both sides for doors and drawer fronts.
      b. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semiexposed edges.
      c. Colors: White, unless noted otherwise.

C. Semiexposed Materials: Unless otherwise indicated, provide the following:
   1. Solid Wood: Sound hardwood lumber, selected to eliminate appearance defects. Same species as exposed surfaces or stained to be compatible with exposed surfaces.
   2. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces or stained to be compatible with exposed surfaces.

D. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; medium-density fiberboard; or hardboard.

2.3 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Back-mounted decorative pulls.

C. Hinges: Concealed European-style self-closing hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or B05091.

E. Adhesive: FS MMM-A-130 contact adhesive; type recommended by laminate manufacturer to suit application.
   1. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
      a. Wood Glues: 30 g/L.
      b. Contact Adhesive: 250 g/L.

PART 3 - EXECUTION – NOT USED

END OF SECTION 12 35 70

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SECTION 12 36 61.16 – SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-surfacing-material countertops and sink.

B. Related Sections:
   1. Section 06 68 13 – Solid Surface Paneling: Solid-surfacing-material restroom wall finish.
   2. Section 06 41 00 – Architectural Woodwork: For interior carpentry exposed to view that is not specified in this Section.
   3. Division 22: Faucet and plumbing connections.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Solid surfacing includes wood furring, blocking, and shims for installing solid surfacing items, unless concealed within other construction before solid surfacing installation.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing architectural solid surfacing similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. NAAWS Quality Standard: Comply with the specified grade(s) of interior architectural woodwork indicated for construction, finishes, and installation, specified section(s), and applicable requirements of the current edition of the "North American Architectural Woodwork Standards – 3.0, United States Version".
   1. Provide WI-certified compliance certificate indicating that countertops comply with requirements of grades specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the solid surfacing countertops is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Basis-of-Design: Corian; DuPont Commercial Surfaces.
   2. Formica, Inc.
   3. Lotte Chemical, USA.
   4. Accepted equivalent.

2.2 MATERIALS

A. General: Provide materials that comply with requirements of WI's quality standard for each type of countertop and quality grade specified, unless otherwise indicated.

B. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Type: Standard type.
   2. Colors and Patterns: As indicated on Drawings.

2.3 SOLID-SURFACING-MATERIAL COUNTERTOP CONSTRUCTION

A. Construction:
   1. Quality Standard: Comply with NAAWS Section 11.
   2. NAAWS Grade: Premium.
   3. Solid-Surfacing-Material Thickness: 3/4-inch (19 mm).
   4. Single length sections.
   5. Intermediate support for spans over 48-inches to prevent deflection in excess of 1/4-inch under a 50 pound per sq ft load.
   6. Edge Treatment: As indicated on Drawings in accordance with NAAWS.
   7. Back Splash: As indicated on Drawings in accordance with NAAWS.
   8. Back Splash Construction: NAAWS Assembly 2, deck mount, manufacturer-assembled.
   9. Adhesive: As approved by manufacturer, able to maintain its bond with the opposing contractions of core and laminate.
      a. VOC Requirement: Provide adhesive having a VOC content of <70g/L.
   10. Joints: Well fit, flush, and watertight.

B. Maximum Unsupported and Unloaded Overhang:
   1. Sheet Thickness of 3/4-inch: 12-inches.
   2. Sheet Thickness of 1/2-inch: 6-inches.

C. Colors, Patterns, and Finishes: As indicated on Drawings.

PART 3 - EXECUTION – NOT USED

END OF SECTION 12 36 61.16

SECTION 12 48 16 – ENTRANCE FLOOR GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Recessed stainless steel floor grilles and accessories.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain foot grilles and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed foot grilles that comply with Sections 302 and 303 in ICC A117.1.

PART 2 - PRODUCTS

2.1 FOOT GRILLES

A. Basis-of-Design Product: Subject to compliance with requirements, provide recessed floor grilles by the following:
   1. Basis-of-Design: Kadee Industries; SSS Clean Tread Model KD98.
   2. Accepted equivalent.

B. Stainless-Steel Foot Grille: Drainable foot grille assembly complying with the following:
   1. Material: Stainless steel, Type 304.
   2. Surface Treads: 0.071-by-0.177-inch (1.8-by-4.49-mm) wire with 0.125-inch- (3.17-mm-) wide openings between wires.
   3. Support Rods: 1-inch rods spaced 1 inch (25 mm) oc, welded to each wire.
   4. Pit Grating: 1-1/8 inches (28.5 mm) deep.
   5. Stainless-Steel Finish: No. 4 finish.
   6. Grille Size: As indicated on Drawings.
   7. Drainage Application: Provide intermediate supports spaced no greater than 3' apart. Units shall support a uniform load of 300 lbs. per square foot

2.2 FRAMES

A. Provide manufacturer's standard stainless steel angle frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

B. Lockdown: Concealed.

2.3 SUPPORT SYSTEM

A. Drainage Pit Applications: Provide manufacturer's special deep-pit frame and support extrusion system with intermediate support beams, sized and spaced as recommended by manufacturer for indicated spans and equipped with vinyl support cushions.

2.4 DRAIN PANS

A. Provide manufacturer's standard aluminum or stainless-steel sheet drain pan with NPS 2 (DN 50) drain outlet for each floor grille unit. Coat bottom of pan with protective coating recommended by manufacturer.

2.5 STAINLESS-STEEL FINISHES

A. Directional Satin Finish: No. 4.
1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION – NOT USED

END OF SECTION 12 48 16

SECTION 12 93 13 – BICYCLE RACKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Bicycle racks and accessories.
   2. Electric chargers for electric bicycles.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the stolen bicycle storage racks is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Basis-of-Design: Dero Bikeep Smart Bike Station with charging.
   2. Bike-Up Bicycle Parking Systems Inc.
   3. Cora Bike Rack.
   4. Cycle Safe Secure Bicycle Parking.

B. Body: 11g plate.
   1. Freestanding Base: 1/4” plate.
   2. Locking Arm: 1” x 11g tube.

C. Bikeep Dock:
   1. Required space for 1 dock (aisle not included):
      a. Footprint: 31”x79”
      b. Overall dimensions: L 86.5”, W 31”, H 37”

2.2 FINISHES

A. Finish: TGIC powder-coated colors are available from Dero Bike Rack Co.
   1. Final Coating Thickness: No less than 6 mils.

PART 3 - EXECUTION – NOT USED

END OF SECTION 12 93 13

SECTION 13 26 40 - PREFABRICATED MODULAR BUILDING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies prefabricated, custom steel modules provided as finished, self-contained units which include the following:
   1. Steel module framing.
   2. Metal stud wall and ceiling framing with gypsum panels at interior side.
   3. Plumbing fixtures including water closets, lavatories, and toilets.
   4. Plumbing work including water supply, sanitary lines, and floor drains.
   5. Electrical work including power and lighting circuits, GFCI outlets, and light fixtures.
   6. HVAC work including exhaust fans and air grilles.
   7. Prep work for fire sprinkler systems, which includes precutting required holes in finished walls and ceilings.
   8. Prep work for fire alarm enunciators, which includes pre-cutting required holes in finished walls and ceilings for strobes, lights, flashers, or alarms sirens.
   9. Structural connections to foundation and between units / site elements.
   10. AV, IT, and security connections.

B. Work includes delivery and final positioning of prefabricated units to their final locations.

C. Related Sections, Work Included: Refer to the following sections for specifications for products to be furnished and installed as part of the prefabricated modular units:
   1. Section 03 30 00 – Cast-in-Place Concrete: Foundations.
   2. Section 06 41 00 – Architectural Woodwork: For casework.
   3. Section 07 92 00 - Joint Sealants: For sealants.
   4. Section 08 14 00 - Wood Doors: For doors.
   5. Section 08 11 16 – Interior Aluminum Windows and Door Frames.
   6. Section 08 41 13 – Aluminum-Framed Entrances and Storefronts: For exterior windows and exterior glazing system.
   7. Section 08 71 00 - Door Hardware: For door hardware.
   8. Section 08 81 00 - Glazing: For exterior glazing.
   9. Section 09 65 00 – Resilient Flooring.
   10. Section 09 91 00 – Painting: For paints.
   11. Section 10 28 13 – Commercial Toilet Accessories: For toilet accessories and grab bars.
   12. Division 22 - Plumbing: For plumbing work and plumbing fixtures.
   13. Division 23 – Heating, Ventilating and Air Conditioning: For HVAC work and equipment.
   14. Division 26 - Electrical: For Electrical work light fixtures, outlets and switches.
   15. Division 27 – Communications: For audio/video connections.
   16. Division 28 – Security: For surveillance and alarm systems.

D. Related Sections, Work Not Included: Refer to the following sections for specifications for products to be furnished and installed as part of Work of other trades:
   1. Section 09 29 00 - Gypsum Board: For gypsum board panels to be applied in the field to exterior faces of metal stud partitions after unit are set in place and all electrical, plumbing and HVAC connections are completed, tested and inspected.
   2. Division 21 – Fire Protection: Fire Protection Contractor to install sprinkler heads and strobes, lights, flashers, and alarm sirens.

3. Division 22 - Plumbing: Plumbing Contractor to provide final installation of water closets and connections to all plumbing fixtures drains and vents, as well as single points of connections for hot and cold supply lines for entire structure.
4. Division 23 - Heating, Ventilating and Air Conditioning: HVAC Contractor to provide final connections in the field of all air grilles and exhaust fans.
5. Division 26 - Electrical: Electrical Contractor to provide final connections in the field for all power supply lines.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 SYSTEM DESCRIPTION

A. The design build team will establish what is factory-built and what is built on-site. Provide a matrix of responsibilities on the construction documents designating respective responsibilities and indicate for each sheet the corresponding Agencies Having Jurisdiction who should review relevant sheets.

B. In general, it is assumed the following would be assembled in the factory:
   1. Primary and secondary structural steel.
   2. Joist and wall framing, floor sheathing, roof sheathing, shear walls and framing to support other systems.
   3. Structural support fabrications.
   4. Fabrication of primary supports for vertical screen wall.
   5. Fabrication of stairs and steel framing for stairs.
   6. Elevator shaft enclosure.
   7. Installation of electrical and low voltage conduits and boxes.
   8. Rough plumbing, mechanical, electrical, telecommunication and security systems, including cabling and connections from cable trays.
   9. Gypsum board ceilings
   10. Bracing, blocking, backing and block outs for access panels and other wall mounted elements that are required in the framing.

C. In general, it is assumed the following would be installed on site:
   1. Attachment of module structure to podium slab embeds.
   2. Attachment of modules to each other- adjacent modules and first floor to second floor modules.
   3. Installation of overhang structural supports.
   4. Installation of terrace structural supports and framing.
   5. Installation of stairs.
   6. Installation of elevator shaft framing.
   7. Complete floor and roof sheathing.
   8. Rough plumbing, mechanical, electrical site utility connections.
   9. Finish plumbing, electrical and mechanical fixtures.

10. Fire alarm conduit, devices, controls.
11. Automatic sprinkler system.
12. Ceiling systems and finish ceiling panels.
13. All specialty wall finishes.
14. Interior glazing, doors and hardware.
15. Sloped roof insulation, roofing and roof access.
16. Photovoltaic panels and other roof-mounted equipment.
17. Elevator cab and finish of shaft.
18. Exterior storefront system, glazing and doors.
19. Handrails and guard rails.
20. Fire seals at rated penetrations and fire stopping.
21. Exterior finishes.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer shall demonstrate compliance with the following qualifications:
   1. Minimum 3 years' experience fabricating modular units for the specific building type and structural framing type required for the project.
   2. The module installation shall allow for adequate adjustment to align modules horizontally and vertically.
   3. Capable of furnishing transportation and as well as all customized units moving equipment for facilitating jobsite delivery installation.

B. Source quality control:
   1. Materials and fabrication procedures are subject to inspection and tests in the manufacturing plant. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
   2. Materials and fabrication procedures shall comply with Code and the Building Department regulations.
   3. Promptly remove and replace materials or fabricated components which do not comply with specified requirements.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

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

E. Testing: Factory test major components, including plumbing lines, exhaust fans and electrical wiring prior to shipment.

F. Fire Performance: Fire performance of interior wall and ceiling finishes shall meet ASTM E84 Smoke Development Index class rating in accordance with the CFC 2022.

G. Preinstallation Conference: Conduct pre-installation conference with Owner's Representative and associated trades.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Prefabricated modular units shall be volumetric, self-supporting, light gage steel framed structures containing all interior fixtures, accessories, and finishes excluding FF&E items.
   1. Pre-Manufactured units shall be complete with water supply lines and electrical and data circuits.
   2. The units shall be delivered to the construction site complete and ready to be placed into the building and connected to the building's Plumbing, HVAC, Electrical, AV, IT, Security, Fire, and Life Safety Systems.

B. Engineering:
   1. Contractor shall be responsible for the engineering of the building modules and their attachment to the building structural frame, and for obtaining Building Department approvals of it and paying costs and fees therefore.
   2. Engineer units to comply, as a minimum, with the performance criteria specified.
   3. Design the structure to withstand the dead and live loads prescribed by Code.

2.2 MATERIALS

A. Materials, General: Comply with material specifications in referenced specification sections and the following.

B. Light Gage Metal Framing: 16, 18 and 20 gage as determined by manufacturer.

C. Gypsum Board: 5/8-inch, Type X, mold and mildew resistant, ASTM D3273.

D. High-Impact Gypsum Board: 5/8-inch, Type X.

E. Fasteners: Corrosion resistant Type S-12 bugle-head fasteners.

2.3 FABRICATION

A. Approved Fabricator:
   1. Silver Creek Modular, 2830 Barrett Avenue, Perris, CA 92571, (951) 943-5393
   2. Accepted equivalent.

B. Modular units shall be fabricated to provide the design as indicated on the Drawings and Specifications, including room layout, fixture and finish selection, design of plumbing, HVAC, and electrical systems.
   1. Prefabricated unit designs and shop drawing packages shall be reviewed with the Owner's Representative prior to production and submission to all applicable State and Local Codes.

C. Door thresholds shall be included, either factory-installed or field-installed as applicable.

D. Painted ceilings shall be properly prepared, smooth and free of imperfections, primed and painted with specified color and gloss level paint. Painted ceiling surfaces shall comply with specified NFPA 286 flame spread requirements.

E. Countertops specified shall be furnished and installed. Adequate blocking shall be installed as required and countertop surfaces sealed in the factory as specified.

F. Factory-installed plumbing components shall be code compliant. All supply lines shall be routed to two common supply hookups, one hot and one cold water connection labeled in the factory. Include plumbing connections for vents and sewer lines.

G. Except for sink p-traps, all plumbing fixture drainage shall be field installed per the design as shown on the Shop Drawings.

H. Water supply lines shall be consistent with state and local plumbing codes of 1/2 to 2-inch copper "L" tubing with NSF-61 and UPC listed Viega crimp fittings. Copper supply lines are supported at a minimum of 6 feet per UPC 1-2003 Table 3-2. All plumbing systems shall pass manufacturer's standard air test.
   1. Factory pressure test results shall be documented on a tag affixed to the unit. The standard factory pressure test is 100psi held for 20 minutes or as defined by project. The drainage components of the pre-built unit.
   2. These components shall be connected to the building's waste/vent risers by the plumbing contractor in the field and site tested as normal.
   3. The prefabricated modular unit manufacturer shall be responsible for any inspection failures or leaks found within the unit supply lines during inspection and on-site testing.
   4. The plumbing contractor shall be responsible for all plumbing connections and for drainage and vent connections.

I. Plumbing fixtures shall be installed according to plumbing fixture manufacturer's instructions.

J. The prefabricated modular unit manufacturer shall provide for proper installation of ventilation components including, HVAC horn with grill, and ducting within the units as required by the Shop Drawings, and the HVAC specifications.

K. Light fixtures and exhaust fans shall be installed in the unit as specified. Electrical and HVAC trim shall be installed where possible with glass trim packaged inside the unit for on-site installation by fabricator. Fixture boxes shall be installed in the wall and factory wired to switches. Electrical supply whips shall be routed to unit ceilings for connection into a local junction box. MC cable or conduit shall be used according to local code.

L. Electric circuits servicing the units shall be code compliant as specified in the electrical specifications. Internal circuits shall consist of a GFCI power circuit, and a lighting circuit, or as specified on the Drawings. Both circuits shall have a ceiling mounted point of connection which shall be connected to the building's electrical service lines by the electrical contractor.

M. Alarms, strobe lights, and sprinkler heads or other fire suppression systems shall be installed by the appropriate contractor. Electrical rough in boxes, conduit, and pre-cut holes in the gypsum can be supplied by the manufacturer as documented on the Shop Drawings.

PART 3 - EXECUTION – NOT USED

END OF SECTION 13 26 40

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SECTION 14 21 00 – ELECTRIC TRACTION ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section includes electric traction passenger elevators.
      a. Elevator System: Include a car frame, car safety, overspeed governor and pit buffers for both car and counterweight; all integrated into the system.

B. Related Sections:
   1. Section 03 30 00 - Cast-in-Place Concrete: For setting sleeves, inserts, and anchoring devices in concrete.
   2. Section 05 12 00 - Structural Steel Framing: For the following:
      a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
      b. Divider beams.
      c. Hoist beams.
      d. Structural-steel shapes for subsills that are part of steel frame.
   3. Section 05 50 00 - Metal Fabrications: For the following:
      a. Attachment plates and angle brackets for supporting guide-rail brackets.
      b. Machine beam installation.
      c. Weld plates for anchoring elevator machine to machine room floor slab.
      d. Structural-steel shapes for subsills.
      e. Pit ladders.
   4. Section 09 65 00 – Resilient Flooring: For finish flooring in elevator cars.
   5. Section 14 28 01 – Elevator Systems Noise and Vibration Control
   6. Division 26 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.
   7. Division 27 Sections for telephone service for elevators.
   8. Division 28 Sections for smoke detectors in elevator lobbies to initiate emergency recall operation and for connection to elevator controllers.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain elevators through one source from a single manufacturer.
1. Provide major elevator components, including driving machines, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.
1. Effective peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic Category CD).
2. Provide earthquake equipment required by ASME A17.1.
3. Design earthquake spectral response acceleration, short period (Sds) for Project is indicated on Structural Drawings.
4. Project's seismic design category is indicated on Structural Drawings.
5. Elevator importance factor is 1.0.

D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)".

E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.

F. Acoustical Requirements: Comply with following requirements:
1. Limit overall elevator noise emissions to the following maximum A-weighted sound pressure levels in any mode of operation:
   a. 75 decibels measured 3 feet from any piece of equipment in the room where machinery is located.
   b. 50 decibels measured 5 feet above the cab floor near the center during all sequences of operation, including door operation, exhaust blower and annunciators.
   c. 45 decibels measured in the elevator lobby 10 feet from the elevator doors.
2. Provide filters on SCR power converter and regulation units to suppress acoustic noise. A-weighted sound pressure level shall not exceed 60 dB when measured 3 feet from the unit under all load conditions.
3. Provide gearless direct drive machinery to avoid gear box noise. Otherwise provide worm gear traction type machinery.
4. Vibration-isolate the following items with Mason Industries, or equivalent, isolators with a 0.2-inch static deflection or as noted:
   a. Power converter and regulation unit. Mason Industries model BR.
   b. Motor and gearbox assembly. Mason Industries model BR. Provide appropriate safety restraints.
   c. Sheave beams. Provide Mason Industries Model RBA or SWM waffle pad with neoprene grommet and washer isolated bolt attachment to eliminate structure-

borne sound being transmitted to the building. Select isolators to compress a minimum of 0.1 inches under load.

5. Provide flexible power connection to motor equivalent to Seal-tite.
6. Provide adjustable volume controls for elevator cab annunciators.
7. Provide optical cab position detectors.

1.5 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.
   1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the elevator system is based on the manufacturer identified below. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. Basis of Design: Schindler Elevator; 3100 MRL.
   2. KONE Inc.
   3. Otis Elevator Co.
   4. ThyssenKrupp Elevator

2.2 CAR ENCLOSURES

A. General: Provide steel-framed car enclosures with removable interior wall panels and ceiling, with car roof, access doors, power door operators, and ventilation.
   1. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.
   2. Provide finished car including materials and finishes specified below.

B. Car Operating Features:
   1. Two-speed fan.
   2. On/off light switch.
   3. Car-stall protection.
   4. Ascending car uncontrolled movement protection.
   5. Top of car inspection.
   6. Battery Operated Lowering Device: The operation shall return each car automatically to first floor. Once each car has returned to the designated landing, the doors shall remain open for a predetermined amount of time.

C. Car Enclosure Dimensions:
   1. Inside Width: 6’-9-5/16-inches from side wall to side wall.
   2. Inside Depth: 4’-10-7/8-inches from back wall to front wall (return panels).
   3. Car Height: TBD.
   4. Car Clear Height to Dropped Ceiling: 7’-5-3/16”.

D. Hoistway Entrance:
   1. Width: 3’-6”.
   2. Height: 7’-0”.

E. Materials and Finishes: Provide manufacturer's standards, but not less than the following:

1. Car Enclosure Finishes:
   a. Front Walls (Return Panels): Satin stainless steel, No. 4 finish.
      1) Fabricate car door frame integrally with front wall of car.
   b. Side and Rear Wall Panels: Plastic laminate, color as selected by Owner's Representative.
   c. Metal Ceiling: Suspended flush panels, with cutouts for downlights in the center of each panel.
      1) Finish: No. 4 stainless steel
      2) Align ceiling panel joints with joints between wall panels, or as shown on drawings.
   d. Reveals: Satin stainless steel, No. 4 finish.
   e. Handrails: 3/8 by 2 inches (10 by 50 mm) rectangular satin stainless steel, No. 4 finish, at sides and rear of car.
   f. Finish Floor: Floor prepared to receive LVT to be installed by others (specified in Section 09 65 00).
2. Subfloor: Underlayment grade, exterior plywood, 5/8-inch (16-mm) nominal thickness.
3. Stainless-Steel Doors: Flush, hollow-metal construction; fabricated from stainless-steel sheet at interior and exterior door faces. Finish: No. 4 satin stainless steel.
4. Door Sills: Aluminum, mill finish; ADA compliant.
5. Protective Pads & Hangers: Provide manufacturers standard quilted fire-retardant protective pads with button hooks hangers.
6. Ceiling Lights: LED down lights with stainless steel trim, recessed into ceiling panels.
   a. Quantity: 6.
7. Fabricate car with recesses and cutouts for signal equipment.

F. Star of Life: Provide Star of Life identification on hoistway door frame, place between 78 inches and 84 inches above the floor, visible from the lobby.

G. Braille Symbol Plates: Mechanically fastened to both sides of hoistway entrance frames at 60 above finished floor, identifying floor level of entrance to elevator.

H. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

2.3 ELEVATORS

A. Elevator Description: Description below applies to both Elevator #1 and Elevator #2 unless noted otherwise.
1. Type: Machine-roomless traction.
2. Number of Openings: 2 at front only.
3. Number of Stops: 2.
4. Rise: Approximately 13'-0".
5. Entrance Width & Type: Single-Slide Door 3' 6" x 7' 0".
6. Earthquake Emergency Operation: Comply with requirements in ASME A17.1.
   a. Seismic Category: TBD.
7. Machine Location: Machine room inside hoistway.
8. Controller Room: Located at roof level.
9. Power Supply: 208-volt; 3 phase.
10. Rated Load: 3000 lb.

11. Rated Speed: 100 fpm.
12. Operation System: Selective collective automatic operation.
13. Auxiliary Operations:
    a. Earthquake Emergency Operation: Comply with requirements in ASME A17.1.
    b. Automatic dispatching of loaded car.
    c. Nuisance call cancel.
    d. Loaded-car bypass.
14. Security Features: Keyswitch operation.
15. Signal Fixtures: Manufacturer's standard.
    a. Finish: Satin stainless steel, No. 4 finish.
16. Additional Requirements:
    a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
    b. Provide top-of-car railings as required.

PART 3 - EXECUTION – NOT USED

END OF SECTION 14 21 00

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SECTION 14 28 01 - ELEVATOR SYSTEMS NOISE AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Noise and vibration control materials and methods for elevator systems

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance
   1. Sound level within elevator cab shall not exceed 55 dBA from operation of elevator.
   2. Sound level within elevator equipment rooms shall not exceed 70 dBA from operation of elevator.
   3. When the building is operational, the elevator contractor shall measure the ambient noise level in dBA for a period of 30 minutes of time in each elevator lobby.
   4. The chime, bells and enunciators should be adjusted to 10 dBA above the ambient level and measured to show that it is 10 dBA above the ambient.
   5. The level of chimes, bells, and enunciators shall not exceed 80 dBA.

2.2 MATERIAL

A. Products:
   1. Traction and Machine-Room-Less Elevators:
      a. Hoist Machines - Mount in proper alignment on isolated bedplate utilizing resilient isolation material equal to Mason Industries type W. Bolts utilized for seismic restraint of the hoist machines shall not short-circuit the resilient isolation material. Washer bushings equal to Mason Industries type HG may be used at through-bolts.
      b. Solid State Power Conversion or Cabinets Containing Relays and Contractors - Mount on neoprene pads, equal to Mason Industries type W, with hold down bolts and grommets to provide seismic restraint and to avoid short-circuiting the isolators.
      c. Deflector Sheaves - Provide resilient isolation materials including isolating grommets and washers equal to Mason Industries type HG at hold down bolts between deflector sheaves and the building structure.
      d. Guide Shoes - Provide roller guide shoes using large diameters to minimize noise. Utilize resilient materials that do not create noise when in contact with guide rails. Utilize materials that do not flatten when idle. Provide materials equivalent to neoprene or other approved resilient materials. Do not utilize phenolic or other hard materials.

e. Roller Guide Assembly - Utilize a design incorporating a spring assembly to minimize noise from the motion of the elevator. To be equal to Elsco Model C roller guide assembly

2. Hydraulic Elevators:
   a. Pump Unit – Provide steel spring isolator with 1 inch deflection. The isolator shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or □ inch neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Bolt holes shall be provided in the base plate to permit attachment to the building structure where required. Isolator to be equal to Mason Industries type SLR.
   b. Cylinder: Provide neoprene pad minimum □ inch thick with load-distributing plate below all riser clamps. Isolator to be equal to Mason Industries Type W. Ensure a 1 inch gap is maintained all around and beneath cylinder below grade so that cylinder does not contact anything other than neoprene pads specified above.
   c. Provide muffler in discharge oil line near the pump unit. The muffler shall be designed to reduce pressure fluctuation (pulsation) in the hydraulic fluid.
   d. Provide vibration-isolated couplings between the pump unit and oil lines.
   e. Provide an oversized opening through the slab or wall for the oil line penetration. Utilize a sleeve having a diameter equal to two inches greater than the oil line. Center the oil line in the sleeve. Pack the opening with an approved resilient material which maintains the required fire separation.
   f. Hydraulic Piping

      1) Suspended: Utilize neoprene vibration isolation hangers. The vibration isolators shall be Mason Industries Type HD with a minimum static deflection of 0.2 inches.
      2) Supported: Utilize Unistrut saddle supports with neoprene isolators equal to Mason Industries type ND, having a minimum static deflection of 0.2 inches.

   g. Provide slack flexible conduit for all electrical connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Seismic restraint methods and materials shall not compromise the effectiveness of the vibration isolation.

B. Install flexible electrical conduit to hoist machines, motor generator sets, etc. In the event that there is occupied space directly below this equipment, route conduit so that it does not penetrate the floor separating the elevator machinery room from the occupied space.

C. Carefully align all guide rails so that there is minimum impulse generated at guide rail joints with car or counterweight movement during passage.

D. Carefully smooth all joints between guide rails so that there is minimum impulse generated with car or counterweight movement during passage.

END OF SECTION 14 28 01

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SECTION 21 05 00 - COMMON WOR RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.
B. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.
C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
D. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
E. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
F. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.
G. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having urisdiction, Including All Applicable Amendments and Supplements.
H. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.2 QUALITY ASSURANCE

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Sprinkler-based System:
   1. Comply with NFPA 13.
   2. See Section 21 13 00.
B. Welding Materials and Procedures: Comply with ASME BPVC-IX.
C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.2 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.

2.3 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 40, black.

2.4 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.

2.5 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Malleable iron, adjustable swivel, split ring.
B. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.

2.6 PIPING SPECIALTIES

A. Commercial Riser Manifold: Preassembled and tested riser manifold in accordance with NFPA 13.
B. Test Connections:
   1. Combination Inspector's Test Connection and Drain Valve:
      a. Provide test connections approximately 6 feet (2 m) above floor for each or portion of each sprinkler system equipped with an alarm device, located at most remote part of each system.
      b. Route combination test connection and drain valve to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
      c. Supply discharge orifice with same size as corresponding sprinkler orifice.
      d. Limit vertical height of exterior wall penetration to 2 feet (0.61 m) above finished grade.
   2. Backflow Preventer Test Connection:
      a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5-inch (65 mm) National Standard male hose threads with cap and chain.
      b. Provide one valve for each 250 gpm (16 L/sec) of system demand or fraction thereof.
      c. Provide permanent sign reading Test Valve. See Section 21 05 53.
C. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome-plated gong and motor housing, nylon bearings, and inlet strainer.
D. Electric Alarm: Electrically operated chrome-plated gong with pressure alarm switch.
E. Water Flow Switch: Vane-type switch for mounting horizontally or vertically, with two contacts; rated 10 A at 125 VAC and 2.5 A at 24 VDC.
F. Fire Department Connections:
   1. Type: Free standing made of corrosion-resistant metal complying with UL 405.
      a. Sleeve: Brass, 18-inch (460 mm) height.

END OF SECTION 21 05 00

SECTION 21 13 00 - FIRE-SUPPRESSION SPRIN LER SYSTEMS

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having urisdiction, Including All Applicable Amendments and Supplements.
B. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.2 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

PART 2 PRODUCTS

2.1 SPRIN LER SYSTEM

A. Sprinkler System: Provide coverage for entire building.
B. Occupancy: Light hazard; comply with NFPA 13.
C. Water Supply: Determine volume and pressure from water flow test data.
D. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 SPRIN LERS

A. Suspended Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
B. Exposed Area Type: Pendant type with guard.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

2.3 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
B. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS Y gate valve on each end.
C. Test Connections:
   1. Backflow Preventer Test Connection:
D. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
E. Electric Alarm: Electrically operated chrome plated gong with pressure alarm switch.
F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
G. Fire Department Connections:

1. Type: Free standing made of corrosion resistant metal complying with UL 405.
   a. Sleeve: Brass, 18 inches (460 mm) height.

END OF SECTION 21 13 00

SECTION 22 05 00 - COMMON WOR RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
B. This Section provides the basic plumbing requirements that apply to the Work of Division 22.
C. Related Requirements:
   1. Division 01: General Requirements.
   2. Division 22: Plumbing
   3. Division 23: HVAC
   4. Division 26: Electrical.
      REGULATORY REQUIREMENTS

D. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.
   1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.
   2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.
      a. Test samples for lead content by the atomic absorption spectrophotometry method.
   3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.
   4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.
E. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:
   1. ANSI - American National Standards Institute.
   2. ASME - American Society of Mechanical Engineers.
      a. ASME Boiler and Pressure Vessel Code.
      b. ASME B31 - Standards for Pressure Piping.
   3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
   4. ASTM - American Society for Testing and Materials.
      a. ASTM A53 Specification for Welded and Seamless Pipe.
   5. AWWA - American Water Works Association.
   6. CSA - Canadian Standards Association.
   7. FM Global - Factory Mutual Global
   8. IAPMO - International Association of Plumbing and Mechanical Officials.
   9. NFPA - National Fire Protection Association.

10. OSHA - Occupational Safety and Health Administration.
11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
12. UL - Underwriters Laboratories Inc.
13. Intertek (ETL Certification).

F. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:
   1. CBC, California Building Code, and CMC, California Plumbing Code.
      a. Latest edition as adopted by the City of Los Angeles, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.
   3. 3OSHA - Occupational Safety and Health Administration.
   4. CDPH - California Department of Public Health.
   5. SCAQMD - South Coast Air Quality Management District.

G. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

H. Permits and Fees: Refer to the General and Supplementary Conditions.

1.2 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.4 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.5 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:
   1. A minimum of 4 hours of on-site overview of the overall Plumbing System.
   2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued

to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.6 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. The additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

D. For substitution of materials or products, refer to the General Conditions.

END OF SECTION 22 05 00

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SECTION 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Angle valves.
D. Ball valves.
E. Butterfly valves.
F. Check valves.
G. Gate valves.

1.2 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013.
B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.
C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.
D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2017.
E. ASME B16.18 - Cast Copper Alloy Solder oint Pressure Fittings; 2012.
F. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017.
G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2014).
H. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.
I. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008).
. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011, with Errata (2013).
. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
L. NSF 61 - Drinking Water System Components - Health Effects; 2017.
M. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.3 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.
   6. Adjust butterfly valves to closed or partially closed position.
B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Dead-End: Single-flange butterfly (lug) type.
   3. Throttling: Provide angle, ball, or butterfly.
   4. Swing Check (Pump Outlet):
      a. 2 NPS (50 DN) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
      b. 2-1/2 NPS (65 DN) and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.
      c. 2-1/2 NPS (65 DN) and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

2.2 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
B. Valve Sizes: Match upstream piping unless otherwise indicated.
C. Valve Actuator Types:
   1. Handwheel: Valves other than quarter-turn types.
   2. Hand Lever: Quarter-turn valves 6 NPS (150 DN) and smaller except plug valves.
   3. Wrench: Plug valves with square heads.
D. Valves in Insulated Piping: With 2 NPS (50 DN) stem extensions and the following features:
   1. Gate Valves: Rising stem.
   2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   3. Butterfly Valves: Extended neck.
E. Valve-End Connections:
   1. Threaded End Valves: ASME B1.20.1.
   2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
   3. Pipe Flanges and Flanged Fittings 1/2 NPS (15 DN) through 24 NPS (600 DN): ASME B16.5.
   4. Solder oint Connections: ASME B16.18.
F. General ASME Compliance:
   1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
   2. Solder-joint Connections: ASME B16.18.
G. Valve Materials for Potable Water: NSF 61 and NSF 372.
H. Bronze Valves:
   1. Fabricate from dezincification resistant material.
   2. Copper alloys containing more than 15 percent zinc are not permitted.
I. Valve Bypass and Drain Connections: MSS SP-45.
. Source Limitations: Obtain each valve type from a single manufacturer.

2.3 BRONZE SWING CHEC VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
   1. Comply with MSS SP-80, Type 3.

2. Design: Horizontal flow.
3. Body: Bronze, ASTM B62.
4. Ends: Threaded as indicated.
5. Disc: Bronze.

2.4 IRON SWING CHEC VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
1. Comply with MSS SP-71, Type I.
2. Description:
a. CWP Rating: 200 psig (1380 kPa).
b. Design: Clear or full waterway.
c. Body: ASTM A126, gray iron with bolted bonnet.
d. Ends: Flanged as indicated.
e. Trim: Bronze.
f. Gasket: Asbestos free.
g. Closer Control: Factory installed, exterior lever, and weight.

END OF SECTION 22 05 23

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.2 QUALITY ASSURANCE

A. Comply with applicable building code.
B. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.
C. Installer Qualifications for Field-Welding: As specified in Section 05 50 00.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
B. Metal Channel (Strut) Framing Systems:
   1. Comply with MFMA-4.
C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
D. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

END OF SECTION 22 05 29

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SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.
D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
E. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General:
1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.2 EQUIPMENT SUPPORT BASES

A. Structural Bases:
1. Construction: Engineered, structural steel frames with welded brackets for side mounting of the isolators.
2. Frames: Square, rectangular or T-shaped.
3. Design: Sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators and snubbers.

2.3 VIBRATION ISOLATORS

A. Non-Seismic Type:
1. All Elastomeric-Fiber Glass Pads:
a. Configuration: Flat or molded.
b. Thickness: 0.25 inch (6 mm) minimum.
c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
2. Elastomeric Mounts:
a. Material: Oil, ozone, and oxidant resistant compounds.
b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
3. Steel Springs:
a. Assembly: Freestanding, laterally stable without housing.
b. Leveling Device: Rigidly connected to equipment or frame.
4. Restrained Steel Springs:
a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.

5. Elastomeric Hangers:
   a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
   b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
6. Spring Hanger:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
7. Combination Elastomeric-Spring Hanger:
   a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
   b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
8. Thrust Restraints:
   a. Housing: Steel construction containing stable steel spring and integral elastomeric element installed in pairs to resist air pressure thrusts.
   b. Bottom Openings: Sized to allow plus/minus 15 degrees rod misalignment.

B. Seismic Type:
1. Coil Springs Consisting of Single Elements:
   a. Housing: Manufactured from cast iron material.
   b. Ductile Material: Designed and rated for seismic applications.
   c. Spring: Restrained by housing without significant degradation of vibration isolation capabilities during normal equipment operating conditions.
   d. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch (6 mm) in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
   e. Resilient Pad: Located in series with spring.
   f. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
   g. Finish: Suitable for the application.
2. All Directional Elastomeric:
   a. Material: Molded from oil, ozone, and oxidant resistant compounds.
   b. Operating Parameters: Designed to operate within the isolator strain limits providing maximum performance and service life.
   c. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
   d. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
   e. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

2.4 SEISMIC SNUBBER ASSEMBLIES

A. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. All Directional External:
1. Application: Minimum three (3) snubbers are required for each equipment installation, oriented properly to restrain isolated equipment in all directions.

2. Construction: Interlocking steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches (6 mm) in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch (6 mm) thick cushions any impact and prevents metal-to-metal contact.

C. Lateral External:
1. Application: Minimum three (3) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches (6 mm) in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch (6 mm) thick cushions any impact and prevents metal-to-metal contact.

D. Omni Directional External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches (6 mm) in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch (6 mm) thick cushions any impact and prevents metal-to-metal contact.

E. Horizontal Single Axis External:
1. Application: Minimum four (4) snubbers are required for each stable equipment installation, oriented properly to restrain isolated equipment in all lateral directions where uplift forces are zero or addressed by other restraints.
2. Construction: Steel construction attached to the building structure and equipment in a manner consistent with anticipated design loads.
3. Performance: Equipment movement at each snubber location limited to a maximum of 0.25 inches (6 mm) in any direction without significantly degrading the vibration isolation capability of the isolator during normal operating conditions.
4. Resilient Pad: Minimum 0.25 inch (6 mm) thick cushions any impact and prevents metal-to-metal contact.

2.5 SEISMIC RESTRAINTS FOR SUSPENDED COMPONENTS AND EQUIPMENT

A. Comply with:
1. ASHRAE (HVACA) Handbook - HVAC Applications.
2. FEMA 412.
3. FEMA 413.
4. FEMA 414.
5. FEMA E-74.
6. SMACNA (SRM).

B. Cable Restraints:
1. Wire Rope: Steel wire strand cables sized to resist seismic loads in all lateral directions.
2. Protective Thimbles: Eliminates potential for dynamic cable wear and strand breakage.

3. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
4. Connections:
   a. Use overlapping wire rope U clips, cable clamping bolts, swaged sleeves or seismically rated tool-less wedge insert lock connectors.
   b. Internally brace clevis hanger bracket cross bolt to prevent deformation.
5. Vertical Suspension Rods: Attach required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

C. Rigid Restraints:
1. Structural Element: Sized to resist seismic loads in all lateral directions and carry both compressive and tensile loading.
2. Size: Based on the lesser of cable capacity or anchor load taking into account bracket geometry.
3. Connections: Internally brace clevis hanger bracket cross bolt to prevent deformation.
4. Static Support System: Anchorage capable of carrying additional tension loads generated by the vertical component of the rigid brace compression which is additive to any static load requirements on the system.
5. Vertical Suspension Rods: Attached required bracing of sufficient strength to prevent rod buckling from vertical compression forces utilizing series of attachment clips.

2.6 ROOF CURBS

A. Vibration Isolation Curbs:
1. Non-Seismic Curb Rail:
   a. Location: Between existing roof curb and rooftop equipment.
   b. Construction: Aluminum.
   c. Integral vibration isolation to conform to requirements of this section.
   d. Weather exposed components consist of corrosion resistant materials.
2. Non-Seismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Aluminum.
   c. Integral vibration isolation to conform to requirements of this section.
   d. Weather exposed components consist of corrosion resistant materials.
3. Seismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Steel.
   c. Integral vibration isolation to conform to requirements of this section.
   d. Snubbers consist of minimum 0.25 inch (6 mm) thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
   e. Weather exposed components consist of corrosion resistant materials.

B. Seismic Type Non-Isolated Curb and Fabricated Equipment Piers:
1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Stencils.
D. Pipe markers.
E. Ceiling tacks.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Identification painting.

1.3 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Instrumentation: Tags.
B. Piping: Tags.
C. Pumps: Nameplates.
D. Small-sized Equipment: Tags.
E. Tanks: Nameplates.
F. Thermostats: Nameplates.
G. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.
C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.
   2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.
   3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.
   4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.
   5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.

6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

B. Stencil Paint: As specified in Section 09 91 23, semi-gloss enamel, colors conforming to ASME A13.1.

2.5 PIPE MAR ERS

A. Comply with ASME A13.1.
B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.
E. Color code as follows:
1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

2.6 CEILING TAC S

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.
B. Color code as follows:
1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Plumbing Valves: Green.
4. Heating/Cooling Valves: Blue.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.
B. ackets and accessories.

1.2 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
E. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.
F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.5 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.
B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 POLYETHYLENE

A. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. ' ' (' si') Value: ASTM C177; 0.25 at 75 degrees F (0.036 at 24 degrees C).
   2. Maximum Service Temperature: 200 degrees F (93 degrees C).
   3. Density: 2 lb/cu ft (32 kg/cu m).
   4. Maximum Moisture Absorption: 1.0 percent by volume.
   5. Moisture Vapor Permeability: 0.05 perm inch (0.073 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

6. Connection: Contact adhesive.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 220 degrees F (104 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.4 AC ETS

A. Aluminum acket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. oining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

END OF SECTION 22 07 19

SECTION 22 10 05 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Flanges, unions, and couplings.
   5. Pipe hangers and supports.
   6. Valves.

1.2 RELATED REQUIREMENTS

A. Section 22 05 16 - Expansion Fittings and Loops for Plumbing Piping.
B. Section 22 07 19 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 2015.
B. ASME B16.18 - Cast Copper Alloy Solder oint Pressure Fittings; 2012.
C. ASME B16.22 - Wrought Copper and Copper Alloy Solder- oint Pressure Fittings; 2013.
D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2017.
E. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.
F. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.
G. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
H. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
I. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
L. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2017b, with Editorial Revision (2018).
M. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2015.
N. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2017.
O. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.
P. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2015.
Q. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013, with Editorial Revision.
R. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.
S. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2017.
T. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011a.

U. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing; 2015.
V. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2017.
W. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).
X. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).
Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
Z. MSS SP-67 - Butterfly Valves; 2017.
AA. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder oint, Grooved and Flared Ends; 2010.
BB. NSF 61 - Drinking Water System Components - Health Effects; 2017.
CC. NSF 372 - Drinking Water System Components - Lead Content; 2016.
DD. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2017.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
B. Provide temporary protective coating on cast iron and steel valves.
C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.3 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.

2. oints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
1. Fittings: Cast iron.
2. oints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

2.4 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
1. Fittings: Cast iron.
2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. oints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.5 DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.6 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2.7 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type (A), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. oints: ASTM B32, alloy Sn95 solder.

B. CPVC Pipe: ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
2. oints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

C. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
1. PPI TR-4 Pressure Design Basis:
a. 160 psig (1102 kPa) at maximum 73 degrees F (23 degrees C).
b. 100 psig (689 kPa) at maximum 180 degrees F (82 degrees C).
c. 80 psig (551 kPa) at maximum 200 degrees F (93 degrees C).
2. Fittings: Brass and copper.
3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
4. oints: Mechanical compression fittings.
5. oints: ASTM F1960 cold-expansion fittings.

2.8 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. oints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.9 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. oint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. oints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.10 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches (80 mm) and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
B. Flanges for Pipe Size Over 1 Inch (25 mm):
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.11 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch (15 mm) to 1-1/2 Inches (40 mm): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 Inches (50 mm) to 4 Inches (100 mm): Carbon steel, adjustable, clevis.
D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

2.12 BALL VALVES

A. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.13 BUTTERFLY VALVES

A. Construction 1-1/2 Inches (40 mm) and Larger: MSS SP-67, 200 psi (1380 kPa) CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
B. Provide gear operators for valves 8 inches (150 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.

2.14 PIPING SPECIALTIES

A. Flow Controls:
   1. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.

2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi (24 kPa).

2.15 WATER PRESSURE REDUCING VALVES

A. Up to 2 Inches (50 mm):
1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

B. Over 2 Inches (50 mm):
1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.16 RELIEF VALVES

A. Pressure:
1. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

B. Temperature and Pressure:
1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME BPVC-IV certified and labelled.

2.17 STRAINERS

A. Size 2 inch (50 mm) and Under:
1. Threaded brass body for 175 psi (1200 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi (2070 kPa) CWP, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.

B. Size 1-1/2 inch (40 mm) to 4 inch (100 mm):
1. Class 125, flanged iron body, Y pattern with 1/16 inch (1.6 mm) stainless steel perforated screen.

C. Size 5 inch (125 mm) and Larger:
1. Class 125, flanged iron body, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

END OF SECTION 22 10 05

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SECTION 22 10 06 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2016.
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2004, with Errata.
D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
E. NSF 61 - Drinking Water System Components - Health Effects; 2017.
F. NSF 372 - Drinking Water System Components - Lead Content; 2016.
G. PDI-WH 201 - Water Hammer Arresters; 2010.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 DRAINS

A. Roof Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable polyethylene dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type, refer to Architectural drawings.
B. Parapet Drains:
   1. Lacquered cast iron body with aluminum flashing clamp collar and epoxy coated sloping grate.
C. Canopy and Cornice Drains:
   1. Lacquered cast iron body with aluminum flashing clamp collar and epoxy coated flat strainer.
D. Roof Overflow Drains:
   1. Lacquered cast iron body and clamp collar and bottom clamp ring; pipe extended above flood elevation.
E. Downspout Nozzles:
   1. Bronze round with straight bottom section.
F. Area Drains:
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Round nickel-bronze.
   4. Accessories: Membrane flange and membrane clamp with integral gravel stop, with adjustable under deck clamp.
G. Floor Drain (FD-1):
   1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.
H. Floor Sink (FS-1):
   1. Lacquered cast iron body with dome strainer and seepage flange.

I. Floor Sink (FS-2):
1. Round lacquered cast iron body with integral seepage pan, epoxy coated interior, aluminum dome strainer, nickel bronze frame, full grate.

. Planter Drains:

2.3 CLEANOUTS

A. Cleanouts at Exterior Surfaced Areas (CO-1):
1. Round cast nickel bronze access frame and non-skid cover.

B. Cleanouts at Exterior Unsurfaced Areas (CO-2):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

C. Cleanouts at Interior Finished Floor Areas (CO-3):
1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas (CO-4):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.4 HOSE BIBBS

A. Interior Hose Bibbs:
1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in conformance with ASSE 1011.

2.5 WASHING MACHINE BOXES AND VALVES

A. Description: Plastic preformed rough-in box with brass long shank valves with wheel handles, socket for 2 inch (50 mm) waste, slip in finishing cover.

2.6 REFRIGERATOR VALVE AND RECESSED BOX

A. Description: Plastic preformed rough-in box with brass valves with wheel handle, slip in finishing cover.

2.7 BAC FLOW PREVENTERS

A. Reduced Pressure Backflow Preventers:
1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.8 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F (minus 73 to 149 degrees C) and maximum 250 psi (1700 kPa) working pressure.

2.9 MIXING VALVES

A. Thermostatic Mixing Valves:
1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.

B. Pressure Balanced Mixing Valves:
   1. Valve: Chrome plated cast brass body, stainless steel cylinder, integral temperature adjustment.

2.10 DOMESTIC WATER DISTRIBUTION MANIFOLDS

A. Description: Domestic water distribution system with integrated quarter-turn shutoff valves for each plumbing fixture.

END OF SECTION 22 10 06

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SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged water heating systems.
B. In-line circulator pumps.
C. Pressure booster systems.

1.2 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
B. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
B. Certifications:
   1. Electric Water Heaters: UL listed and labeled to UL 174.
   2. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 WATER HEATERS

A. Commercial Electric Heat Pump Water Heater:
   1. Type: Factory-assembled and wired, electric, vertical storage.

2.2 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig (860 kPa) working pressure, with stainless steel rotor assembly.
B. Impeller: Bronze.
C. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.
D. Seal: Carbon rotating against a stationary ceramic seat.
E. Drive: Flexible coupling.

END OF SECTION 22 30 00

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SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets.
B. Lavatories.
C. Sinks.
D. Service sinks.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Owner-furnished fixtures.

1.3 REFERENCE STANDARDS

A. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
B. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
C. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.
D. NSF 61 - Drinking Water System Components - Health Effects; 2017.
E. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 REGULATORY REQUIREMENTS

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.
B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 GENERAL

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   1. Bowl: ASME A112.19.2; 16.5 inches (420 mm) high with elongated rim.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated.
   4. Handle Height: 44 inches (1117 mm) or less.
   5. Supply Size: 1-1/2 inches (38 mm).
B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Sensor-Operated Type: Solenoid or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.

2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

2.3 TANK TYPE WATER CLOSETS

A. Tank Type Water Closet Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Supply Faucet Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

C. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow) (1.9 liters per minute (low-flow)), indexed handles.

2.5 SINKS

A. Sink Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 SERVICE SINKS

A. Service Sink Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

END OF SECTION 22 40 00

SECTION 23 05 00 - COMMON WOR RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
B. This Section provides the basic mechanical requirements that apply to the Work of Division 23.
C. Related Requirements:
   1. Division 01: General Requirements.
   2. Division 26: Electrical.

1.2 REGULATORY REQUIREMENTS

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:
   1. AMCA - Air Movement and Control Association.
   2. ANSI - American National Standards Institute.
   3. ASME - American Society of Mechanical Engineers.
      a. ASME Boiler and Pressure Vessel Code.
      b. ASME B31 - Code for Pressure Piping.
   4. AHRI - Air-Conditioning, Heating, and Refrigeration Institute.
   5. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.
   6. ASTM - American Society for Testing and Materials.
      a. ASTM A53 - Specification for Welded and Seamless Pipe.
   7. CSA - Canadian Standards Association.
   8. FM Global - Factory Mutual Global
   9. IAPMO - International Association of Plumbing and Mechanical Officials.
   10. NFPA - National Fire Protection Association.
   11. OSHA - Occupational Safety and Health Administration.
   12. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.
   13. UL - Underwriters Laboratories Inc.
   14. Intertek (ETL Certification).
B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:
   1. CBC, California Building Code, and CMC, California Mechanical Code.
      a. Latest edition as adopted by the City of Los Angeles, the County of Los Angeles, and the State of California including amendments effective on the Effective Date of the Contract.
   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.
   3. OSHA - Occupational Safety and Health Administration.
   4. CDPH - California Department of Public Health.
   5. SCAQMD - South Coast Air Quality Management District.
C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.
D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.3 PRO ECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 7700: Contract Closeout.
B. Project Record Drawings:
   1. Provide a complete set of mechanical and control system drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM.
   2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.
C. Operation and Maintenance Manuals:
   1. Submit operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return manuals. Manuals shall be bound in accordance to Section 01 7700. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.
   2. Contents of Manual:
      a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.
      b. Manufacturer's operating instructions including, but not limited to, the following:
         1) Identification of components and controls.
         2) Pre-start checklist and start-up procedures.
         3) Normal operation settings and checklists.
         4) Pre-shut down checklist and shut down procedures.
         5) Trouble shooting checklist and guidelines.
         6) Recommendations for optimum performance.
         7) Warnings and safety precautions on improper or hazardous operational procedures or conditions
      c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 23 that includes the following as a minimum:
         1) Manufacturer’s model, identification and serial numbers.
         2) Exploded view of assembly drawings identifying each component or part with the relevant part number.
         3) Directory of manufacturer’s representatives, service contractors and part distributors.
         4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.
      d. Project Record Drawings: Complete set of mechanical and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.
      e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 01 4525.
      f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.
      g. Los Angeles County industrial waste permits.
      h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.
      i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.4 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 23. Contractor shall coordinate work in accordance with Section 01 3113 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.
B. Do not store plastic pipe or materials in direct sunlight.

1.6 PRELIMINARY OPERATION

A. OAR may require any portion of mechanical Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.
B. Notify the Project Inspector at least 24 hours in advance of lighting or re-lighting pilots.

1.7 TRAINING OF OWNER PERSONNEL

A. Training of Owner’s personnel shall include:
   1. A minimum of 8 hours of on-site overview of the overall Mechanical System.
   2. Refer to Division 23 sections for specific training on each of the components of the Mechanical System.
   3. A minimum of 8 hours of on-site overview identifying location and function of all Control Valves and Actuator assemblies.
   4. A minimum of 40 hours of (in classroom) software training for a minimum of 20 LAUSD personnel on EMS/BMS if such systems are utilized in the project. Training shall be conducted at control contractor training facility with computer setup for each person attending.
B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.
C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.
D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.
E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.8 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model

number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. HVAC equipment products from different manufacturers are never identical. Equipment approved as being equal is interpreted as being equivalent in capacity, performance and quality. The dimensions, weight, configuration and utility requirements could be quite different from the equipment used as the basis of design. Due to these differences, additional coordination and adjustments by the Contractor are required. For the equipment to be deemed truly equal, the additional coordination and adjustments by the Contractor should not incur any additional cost to the Owner and any additional labor to the design team.

D. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. All the additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

E. For substitution of materials or products, refer to the General Conditions.

END OF SECTION 23 05 00

SECTION 23 05 05 -

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Work Included in this section includes acoustical performance requirements of the following:
   1. Acoustical Flexible Air Ducts.
   2. Acoustical Duct Lining
   3. Terminal Units
   4. Grilles and Diffusers

B. Related Work Not Included in this Section:
   1. Vibration Isolation.
   2. Duct Silencers.
   3. Maximum Sound Power Levels for Mechanical Equipment.

C. Requirements documented in this section are for acoustical performance only. Performance requirements documented in the Mechanical General Provisions section must also be met.

1.3 APPLICABLE STANDARDS AND TEST CONDITIONS

A. Air Diffusion Council Flexible Air Duct Test FD72R1: Paragraph 3.2.1, Sound Attenuation.

B. ASTM C1071-05e1 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material)

C. ANSI/ASTM C423-90a Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

D. ASTM E795-92 Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

E. ASHRAE Standard 70-2006 Method of Testing the Performance of Air Outlets and Air Inlets.

F. ARI 885-98 Standard for Estimating Occupied Space Sound Levels in the Applications of Air Terminals and Air Outlets.

G. ARI 880-98 Air Terminals.

1.4 SUBMITTALS

A. Provide submittal information in accordance with the requirements specified in this section and in Submittal Procedures.

B. Provide submittal documenting the following:

1. Itemized list referencing items being submitted and page numbers where the information indicated below can be found for each submitted item.
2. Manufacturer's model and catalog data.
3. Complete connection diagrams for each Trade.
4. Dimensions, capacities, ratings materials and finishes.
5. Tabulated data sheet clearly marked with items being proposed.
6. Acoustical test data measured in an accredited laboratory under the standards required in this submittal for each item being submitted.
    a. Acoustical test data must be provided based on the design operating conditions. For equipment with multiple design configurations, such as terminal units and grilles an itemized list of each piece of equipment, the location, the operating conditions, and the acoustical performance must be provided.

PART 2 - PRODUCTS

2.1 PRODUCT DESCRIPTION

A. Acoustical Flexible Ductwork
1. The acoustical flexible air duct shall be a factory fabricated assembly consisting of an inner sleeve, insulation and an outer moisture barrier. A minimum of 1 inch thick fiberglass insulating blanket shall encase the inner sleeve and be sheathed with an outer moisture barrier.
2. The sound attenuation of the acoustical flexible air duct shall meet or exceed the values tabulated tested in accordance with Air Diffusion Council Flexible Air Duct Test FD72R1: Paragraph 3.2.1 in a laboratory accredited for the testing procedure.
3. Minimum Straight Duct Insertion Loss in Decibels per Length of 10 Feet with No Airflow.

Acoustical Flexible Duct Inner Diameter	Straight Duct Insertion Loss (dB) per Octave Band Center Frequency (Hz)					
	125	250	500	1000	2000	4000
6 inches	5	10	18	22	22	20
8 inches	4	9	17	22	22	18
12 inches	3	7	15	22	22	16

4. The material shall be Casco Silentflex II, Thermaflex M- E Acoustical Flex Duct, or approved equal.

B. Internal Acoustical Lining for Mechanical Ductwork
1. Acoustical Lining shall be Semi-rigid inorganic fiberglass. The lining must have an erosion resistive coating suitable for air velocities up to 4000 ft/min and have a minimum density of 3 lbs/ft3. The flamespread rating cannot exceed 35 and fuel contributed and smoke developed rating cannot exceed 50. The bond strength shall exceed 20 lbs/ft3 and thermal conductivity should not exceed 0.26 BTU inches per hour ft2 degree F.
2. The sound absorption coefficient shall meet or exceed the values documented below when tested under ASTM C423-90a in configuration A documented in ASTM E795:

Thickness	Absorption Coefficient per Octave Band Center Frequency (Hz)					
	125	250	500	1000	2000	4000
1 inch	0.05	0.20	0.65	0.90	0.95	0.90
2 inches	0.15	0.75	0.95	0.95	0.95	0.95

C. Grilles, Registers, and Diffusers
1. The manufacturer's NC rating for grilles, diffusers, and registers shall not exceed the values documented on the project drawings.
2. The manufacturer's NC rating shall be determined using the sound power levels measured in accordance with ASHRAE Standard 70-2006 and calculated in accordance with ARI 885-98.

D. Terminal Units
1. Terminal units shall be tested in accordance with ARI Standard 880-98
2. The sound power levels of all terminal units both on the supply and return side of the system shall not exceed the values indicated in the schedules below.
3. Discharge Sound Power Level Limits:

Located Above Areas of:	Maximum Allowable Sound Power Level (dB re 10^{-12} W)					
	125	250	500	1000	2000	4000
NC20	51	48	47	47	45	40
NC30	61	58	57	57	55	50
NC35	65	62	62	62	60	55
NC40	70	67	67	67	65	60
NC45	73	71	71	72	70	65

4. Radiated Sound Power Level Limits:

Located Above Areas of:	Maximum Allowable Sound Power Level (dB re 10^{-12} W)					
	125	250	500	1000	2000	4000
NC20	44	40	37	36	34	33
NC30	54	50	47	46	44	43
NC35	59	55	52	51	49	48
NC40	64	60	57	56	54	53
NC45	67	64	61	61	59	58

5. If there are any rooms that are not clearly identified in the schedules above, or the project's NC requirement for a specific room is not clear, it is the responsibility of the contractor to request the category of terminal unit that is permissible to serve the area in question.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Installation of all products shall be in accordance with the manufacturer's instructions and recommended procedures.

B. Acoustical Flexible Ductwork
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Clean ductwork; close openings and open ends with temporary covers to keep construction dust out of ducts.
3. Install ductwork with clearance around equipment to allow normal operating and maintenance activities of equipment.
4. Acoustical flexible ductwork cannot be used to penetrate partitions extending full height. Sheet metal ductwork must be used to penetrate any full height partition.

5. Replace any flexible ductwork torn before or during installation.
6. Install as shown on drawings and so there is at least five feet of acoustical flexible ductwork between all grille or diffusers and dampers or terminal boxes.
7. Acoustical flexible ductwork must be installed so there are no kinks allowing laminar air flow.

C. Internal Acoustical Lining for Mechanical Ductwork
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Locate as shown on drawings.
3. Dimensions of lined ductwork or plenums are clear inside dimensions with lining installed.
4. All portions of the area designated to receive acoustical lining shall be covered. All joints shall be butted and there shall be no interruptions or gaps.
5. The coated surface of the acoustical liner shall face the air stream.
6. The acoustical liner shall be adhered to the sheet metal with 100% coverage of adhesive and all joints shall be coated with adhesive.
7. Provide continuous sheet metal edge protectors at entering and leaving edges of lined duct sections.
8. Duct liner shall be secured with mechanical fasteners which shall compress the duct liner as required below:
    a. Fasteners shall start within 3 inches of the upstream transverse edges of the liner and 3 inches from longitudinal joints and shall be spaced a maximum 12 inches around the perimeter of the duct or plenum.
    b. They may be a maximum of 12 inches from a comer break.
    c. They shall be placed no more than 6 inches from a longitudinal joint of the liner.
    d. They shall be placed no more than 12 inches from a corner break.

D. Grilles, Registers, and Diffusers
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.

E. Terminal Units
1. Install in accordance with manufacturer's requirements and as specified in other relevant sections of this Specification.
2. Connections to terminal units cannot be made with flexible duct unless specifically noted on project drawings.

END OF SECTION 23 05 05

SECTION 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe sleeves.
B. Manufactured sleeve-seal systems.

1.2 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.
B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.1 PIPE SLEEVES

A. Manufacturers:
   1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.
C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.
   2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
D. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

2.2 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Flexicraft Industries; PipeSeal: www.flexicraft.com/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.

3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

END OF SECTION 23 05 17

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

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 30 00.

1.4 QUALITY ASSURANCE

A. Comply with applicable building code.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Comply with MFMA-4.
C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
D. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Hollow Masonry: Use toggle bolts.
   5. Hollow Stud Walls: Use toggle bolts.
   6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   7. Sheet Metal: Use sheet metal screws.
   8. Wood: Use wood screws.
   9. Plastic and lead anchors are not permitted.
   10. Powder-actuated fasteners are permitted only as follows:
      a. Where approved by Architect.
      b. Use only threaded studs; do not use pins.
   11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4.
      b. Channel Material: Use galvanized steel.
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

END OF SECTION 23 05 29

SECTION 23 05 48 - MECHANICAL SYSTEM VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. All vibration isolators including but not limited to pads, mounts, springs and curbs
   2. Resilient pipe guides and anchors
   3. All seismic restraint including but not limited to snubbers, cable systems, struts for equipment, piping and ductwork.
   4. Flexible pipe connectors and couplings
   5. Flexible ductwork connectors
   6. Vibration isolation bases

1.3 DEFINITIONS

A. ASCE: American Society of Civil Engineers

B. ASTM: American Society of Testing Materials

C. IBC: International Building Code

D. ICC-ES: ICC-Evaluation Service

E. MSS: Manufacturers Standardization Society

1.4 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading: According to project wind loading reports.

B. Seismic-Restraint Loading: According to project structural drawings, reports, specifications, and Drawing S-001.

1.5 SUBMITTALS

A. Product Data
   1. Include actual load, deflection under actual load, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
      a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service or agency acceptable to authorities having jurisdiction.
      b. Annotate to indicate application of each product submitted and compliance with requirements.
   3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and where required wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
      a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
   2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
   3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
   4. Seismic and Wind-Restraint Details
      a. Design Analysis: To support selection and arrangement of seismic and wind restraints include calculations of combined tensile and shear loads.
      b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
      c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
      d. Preapproval and Evaluation Documentation: By an evaluation service or agency acceptable to the authorities having jurisdiction showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination and plan locations of seismic bracing for HVAC piping, ductwork, and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Qualification Data: Devices shall be selected to meet seismic and support requirements by a registered professional Civil or Structural Engineer licensed in the State of Arizona.

E. Field quality-control Special Inspections
   1. Required for anchorage of equipment in structures assigned to Seismic Design Category C,D,E, or F including
      a. Electrical equipment for emergency or standby power systems
      b. Piping systems intended to carry flammable, combustible or highly toxic contents in structures.
      c. Ductwork intended to contain hazardous materials.
      d. Special inspections of mechanical and electrical components
         1) Manufacturers of components defined with a component importance factor of 1.5 shall test or analyze the component and its mounting system or anchorage for the design forces experienced in the facility. The manufacturer shall submit a certificate of compliance. Components required to meet this requirement are:
            a) Equipment using combustible energy sources (boilers).
            b) Motors, transformers, switchgear unit substations, and MCC.
            c) Reciprocating and rotating-type machinery.

d) Piping distribution systems 3 inch and larger.
e) Tanks, heat exchangers, and pressure vessels.

e. Isolation system: Shall be part of the special inspection if used as part of the seismic isolation system of components meeting importance factor as defined in the code.

F. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE:

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1, Structural Welding Code - Steel.

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Building Structural Limits
1. The design of the seismic restraints shall not exceed the following building structure allowable point loads. the restraint design, whether permanent gravity induced loads or short term earthquake loads, shall not exceed the weakest component or configuration of components within the restraint assembly and/or the building structure limits identified below:
a. Metal Decking Concrete Filled: 1000 pounds
b. Metal Decking Without Fill: 150 pounds
c. Steel Beam, horizontal load applied to the upper 1/3 of Web, in a direction perpendicular to the span direction of the beam: 1,350 pounds
d. Steel Beam Lower 2/3 of web, design loads shall not exceed 10% of the load identified for Upper 1/3 of the Web.

1.7 SPECIAL REQUIREMENTS FOR HOT WATER RISERS

A. All vertical risers subjected to thermal expansion and/or contraction shall be supported by spring isolators and central anchors designed to ensure loading within the design limits at structural support points. The riser design must be prepared and submitted for approval by the same vibration isolation vendor supplying the Mechanical equipment and piping isolation and shall include the following:
1. Initial load
2. Initial deflection
3. Change in deflection
4. Final load

5. Change in load at all spring locations

B. In order to minimize load changes, the initial spring deflection shall be a minimum of 4 times the thermal movement.

C. The submittal shall also include anchor loads when installed, cold filled, and at operating temperature. It shall also include calculated pipe stress at end conditions and branch off locations as well as installation instruction. The submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration isolation vendor for a minimum of 5 years.

PART 2 - PRODUCTS

2.1 GENERAL PROPERTIES

A. All vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

B. All isolators shall operate in the linear portion of their load-versus-deflection curve. Load-versus-deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.

C. The ratio of lateral-to-vertical stiffness shall not be less than 0.5 or greater than 1.0.

D. The vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than or - 10%.

E. Wave motion through the isolator shall be reduced to the following extent: isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system, with a minimum isolation of 50 decibels above 150 cycles per second.

F. All neoprene mountings shall have a shore hardness of 50 to 60 after minimum aging of 20 days or corresponding oven aging.

G. Design deflections for vibration isolators shall be as listed in the Vibration Isolation Schedule, except in the event of unacceptable levels of vibration when the equipment is in operation, due to any of the resonances of the isolated systems coupling, by coincidence, with any of the resonances of the building structure. In this event, the contractor shall bear the cost of changing the isolators to alter the natural frequencies of the isolated systems so that the amplitude of structural vibrations is reduced to acceptable levels.

H. Factory Finishes
1. Standard paint applied to factory-assembled and -tested equipment before shipping.
2. All hardware is to be zinc plated and epoxy powder coated.
3. All bolts and springs are to be epoxy powder coated or electro-galvanized.
4. Bases shall be cleaned, primed and painted on-site with approved corrosion-resistant paint.

2.2 VIBRATION ISOLATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
   1. Mason Industries
   2. M.W. Sausse/Vibrex
   3. inetics Noise Control

B. Type CHF is a felt-lined clevis hanger with a minimum felt thickness of 3/16 . Felt shall cover hanger steel sufficient to prevent direct contact between pipe and hanger. The hanger shall be Cooper Industries B-Line Clevis Hanger with Felt Lining.

C. Type E is a sound control matting having a composite of extruded nylon filaments forming a three dimensional geomatrix that has a non-woven fabric heat bonded to its upper surface. The isolator shall be 0.40 Enkasonic as manufactured by Maxxon Corp., Hamel, MN, or approved equal. To prevent uneven distribution of load, WonderBoard, manufactured by Modulars, Inc., shall be used above and between the equipment and E isolator.

D. Type HN is a suspension hanger with a steel box frame and a molded neoprene in shear element. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so that no metal to metal contact occurs. The isolator shall be Mason Industries Type HD or approved equal.

E. Type HMN is a neoprene isolator incorporating a steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also includes floor mounting holes. The isolator shall have a rated deflection of 0.20 inches compression, 0.175 inches in tension and 0.125 inches in shear. The isolators shall be Mason Industries Type BR or approved equal.

F. Type HS is a suspension hanger with a steel box frame and a steel spring resting on a neoprene cup. The cup shall contain a steel washer designed to distribute the load evenly to the neoprene and prevent its overload or extrusion. The spring diameter and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so that no metal to metal contact occurs. Hangers shall be provided with an eye bolt, eye socket or hanger rod on the spring end as required. The isolators shall be Mason Industries Type 30 or approved equal.

G. Type MSL is a bare, stable, steel spring isolator, free standing and laterally stable with a 1/4 inch thick ribbed neoprene pad between the base plate and the support. Bolt holes shall be provided in the baseplate to permit attachment to the building structure. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Limit stops shall be provided to prohibit spring extension if the load is removed. These stops may also serve as rigid blocking during erection so that the installed and operating heights shall be the same. Clearance shall be maintained around restraining bolts and between the limit stops and the housing so as not to interfere with the spring action. The isolator shall be Mason Industries Type SLR or approved equal.

H. Type PGA is an all direction acoustical pipe anchor or guide consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum half inch thickness of heavy duty neoprene material. Vertical restraints shall be provided by similar material arranged to

prevent vertical travel in either direction. Allowable loads on the isolation material shall not exceed 500 psi and the design shall be balanced for equal resistance in any direction. All direction anchors shall be Mason Industries Type ADA. All direction guides shall be Mason Industries Type VSG Guides or approved equal.

I. Type PN is a molded 5/16 inch thick neoprene pad. The area of pad shall be chosen to match the load in order to achieve the required static deflection. The isolator shall be Mason Industries Type W or approved equal.

. Type SCMS is a prefabricated, seismically restrained, spring isolation curb for rooftop equipment. The lower member shall consist of a rectangular steel tube containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4 inch thick. Steel springs shall rest on 1/4 inch thick neoprene acoustical pads and be available with either 1 inch, 2 inch, or 3 inch static deflection. Hardware must be cadmium plated or galvanized and the springs plated or provided with an approved rust resistant finish. Weatherproofing shall be provided by a continuous flexible aluminum seal joined at the corners by a flexible frictionless neoprene bellows. The aluminum seal must be nailed over and provide counter-flashing to the curb's waterproofing. Provision shall be made for access ports for accessibility to adjust the springs with waterproof covers at the spring location and 2 inch thermal insulation on the sides of the lower curb. The roof curbs shall be built to seismically restrain the rooftop equipment. The rooftop unit shall be solidly anchored to the top floating rail, and the lower section anchored to the roof structure. The curb shall have anchorage pre-approval OPA from OSHPD attesting to the maximum certified horizontal and vertical load ratings. The curb shall be type SRSC manufactured by Mason Industries, Inc or approved equal.

2.3 VIBRATION ISOLATION STEEL EQUIPMENT BASES:

A. Mounting bases shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

B. Basis-of-Design Product: Subject to compliance with requirements provide a comparable product by one of the following:
1. Mason Industries.
2. M.W. Sausse/Vibrex.
3. inetics Noise Control

C. Steel Base (Types A or B): Factory-fabricated, welded, structural-steel bases and rails.
1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
2. Include supports for suction and discharge elbows for pumps.
3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
4. All perimeter structural steel members shall have a minimum section depth equal to 1/10 the longest dimension of the base.
5. Height-saving Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
6. Base Types:
   a. Type A: WF structural steel section
   b. Type B: Structural steel channel
7. Product Selection Basis: Mason WFSL or approved equal

D. Inertia Base (Type C): Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
   2. Include supports for suction and discharge elbows for pumps.
   3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
   4. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
   5. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.
   6. Product Selection Basis: Mason SL or approved equal

2.4 SEISMIC-BRACING/RESTRAINT DEVICES/SYSTEMS FOR EQUIPMENT, PIPING, AND DUCTWOR

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Mason Industries
   2. Amber/Booth Company, Inc.
   3. Cooper B-Line, Inc./TOLCO Incorporated
   4. Hilti, Inc.
   5. inetics Noise Control
   6. Loos Co.
   7. PHD Manufacturing, Inc.
   8. Unistrut

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
   1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
   2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
   3. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Seismic Bracing: All suspended piping, ductwork, conduit and cable trays shall be provided with seismic braces in accordance with the applicable codes.

F. Seismic braces shall consist of galvanized steel aircraft cables or steel angles/strut channels. Steel aircraft cables shall be pre-stretched to establish a certified minimum modulus of elasticity. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor of 2. Brace end connections shall be steel assemblies that swivel to the final installation angle.

Do not mix cable and steel braces to brace the same system. Steel angles or strut channels, when required, shall be clamped to the threaded hanger rods at the seismic brace locations utilizing a minimum of two ductile iron clamps.

G. Basis of Design
1. Cable brace assemblies shall be Type SCB;
2. Steel brace assemblies shall be Type SSBS;
3. Rod clamps shall be either Type SRC or UC;
4. Pipe clevis braces shall be Type CCB;
5. Multiple anchor load distribution brackets shall be Type SLDB;
6. All as manufactured by Mason Industries, Inc.

H. Hanger Rod Stiffener: Steel tube, steel slotted support system sleeve or reinforcing steel angle clamped to hanger rod are acceptable.

I. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

L. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

M. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FLEXIBLE PIPING CONNECTORS

A. Flexible Spherical oint (F-1)
1. Flexible spherical joints shall employ peroxide cured EPDM in the covers, liners and evlar tire cord frictioning. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2 and larger shall have two spheres reinforced with a ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 to 24 may be single sphere. Sizes 3/4 to 1 1/2 may have threaded bolted flange assemblies, one sphere and cable retention. 14 and smaller connectors shall be rated at 250 psi up to 190F with a uniform drop in allowable pressure to 190 psi at 250F. 16 and larger connectors are rated 180 psi at 190F and 135 psi at 250F. Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure

requirement without control rods, as control rods are not desirable in seismic work. If control rods are used, they must have 1/2 thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi maximum on the washer area. Expansion joints shall be installed on the equipment side of the shut off valves. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

2. Manufacturer: Mason Industries SFDE , SFE , SFDCR, SFU and CR.

B. Stainless Hoses (F-2)
   1. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3 and larger shall be flanged. Smaller sizes shall have male nipples. Hoses must have sufficient length to accept 1/2 intermittent motion without failure. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible.
   2. Manufacturer: Mason Industries BSS.

C. FLEXIBLE DUCTWOR CONNECTORS
   1. Flexible ductwork connection (F-3)
      a. Flexible fiberglass canvas with fire resistant rated neoprene and UV resistant coating. Stainless steel metal edge banding.
      b. Minimum 4 width: DuroDyne Durolon or Neoprene .

PART 3 - EXECUTION

3.1 LOCATION AND APPLICATION OF VIBRATION ISOLATIORS

A. Equipment vibration isolation: See Schedule in Part 3.

B. Piping vibration isolation: See Schedule in Part 3.

3.2 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service or agency acceptable to authorities having jurisdiction. Indicate on Drawings, by details, schedules, or a combination of both, the locations where hanger rods for individual pipes and hanger rods for trapeze hangers require hanger rod stiffeners.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section Roof Accessories for installation of roof curbs, equipment supports, and roof penetrations.

B. Comply with manufacturer's recommendations for selection and application of vibration isolation materials and units except as otherwise indicated. Comply with minimum static deflections recommended by ASHRAE, of vibration isolation materials and units where not otherwise indicated.

C. Comply with manufacturer's instructions for installation and load application to vibration control materials and units except as otherwise indicated. Adjust to ensure that units have equal deflection, do not bottom out under loading, and are not short circuited by other contacts or bearing points. Remove space blocks and similar devices intended for temporary support during installation.

D. Install units between substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.

E. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where substrate is not level.

F. Flexible Pipe Connectors: Install on equipment side of shutoff valves.

G. Upon completion of vibration control work, prepare report showing measured equipment deflections for each major item of equipment as indicated. Clean each vibration control unit, and verify that each is working freely, and that there is no dirt or debris in immediate vicinity of unit that could possibly short circuit unit isolation.

H. Equipment Restraints
1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
3. Install seismic-restraint devices using methods approved by an evaluation service or agency acceptable to the authorities having jurisdiction.
4. Provide required submittals for component.

I. Piping Restraints
1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40', and longitudinal supports a maximum of 80'.
3. Brace a change of direction longer than 12'.

. Install cables so they do not bend across edges of adjacent equipment or building structure.

. Install seismic-restraint devices using methods approved by an evaluation service or agency acceptable to the authorities having jurisdiction, providing required submittals for component.

L. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

M. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

N. Attachment to Structure
1. If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

O. Drilled-in Anchors
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

P. Special Requirements
1. Type CHA: Install AP Armaflex in tubular form or in sheet/roll form. Utilize insulation shield to avoid over-compressing the AP Armaflex.
2. Type HN, HS: Hanger box shall be installed tight to and against building structure. Install hanger rod so that it is plumb and does not contact the hanger box.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 23 Section HVAC Piping, Valves, and Specialties for piping flexible connections.

3.6 AD USTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

E. Operate, and maintain air-mounting systems.
1. Refer to Division 01 Section Demonstration and Training.
2. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

3.7 HVAC PIPING SEISMIC RESTRAINT AND VIBRATION ISOLATION SCHEDULE

A. Notes:
1. Seismic restraint is built into the isolator.
2. Detail is provided to indicate that clearance is required between the pipe and the roof construction in order to avoid a short circuit of the vibration. See architectural, structural and HVAC details regarding attachment and waterproofing requirements.
3. Cable restraints – see specifications.

Description		Design Deflect.	Isolator		Mtg. Detail	Seismic Restraint	
			Type	Detail		Type	Detail (Note 3)
Condenser, Chilled, and Heating Hot Water Supply and Return							
Suspended Piping	2” diameter or greater	1.0”	HS	6	8 (a)	(Note 3)	SE-3,4,5
	Less than 2” diameter	0.2”	HN	3	8 (a)	(Note 3)	SE-3,4,5
Supported Piping	2” diameter or greater	1.0”	MSL	5	8 (b)	(Note 1)	—
	Less than 2” diameter	0.2”	HMN	29	8 (b)	(Note 1)	—
Riser Support	2” diameter or greater	0.2”	HMN	29	19	(Note 1)	—
	Less than 2” diameter	0.06”	PN	1	18	—	—
Riser Guides, Riser Anchors		—	PGA	55	—	—	—
Roof Penetrations		—	—	—	26	(Note 2)	—
Penetrations of partitions, ceilings, floor slabs, etc.		—	—	—	17, 48	—	—
Condensate drain riser		0.06”	PN	1	18	—	—
Suspended condensate drain lines		—	CHF	24	8 (b)	(Note 3)	SE-3,4,5
Flexible connections		—	F-2	—	—	—	—

3.8 HVAC EQUIPMENT SEISMIC AND VIBRATION ISOLATION SCHEDULE

A. Notes:
1. Equipment frame may be eliminated if equipment manufacturer approves in writing.
2. Seismic restraint is built into the vibration isolator.
3. Cable restraints – see specifications.
4. Utilize same vibration isolators as connected piping.

Equipment Type	Design Deflect.	Isolator		Frame		Mnt. Detail	Seismic Restraint	
		Type	Detail	Type	Detail		Type	Detail
Cooling Towers	2.0”	MSL	5	A	14CT	23	(Note 2)	—

Closed-Circuit Fluid Coolers		2.0”	MSL	5	A	14CT	23	(Note 2)	—
Chillers	Maglev	2.0”	MSL	5	A	14	(Note 1)	(Note 2)	—
	All others	—	AS	7	A	14	—	—	SE-1
Hot Water Boilers		0.2”	HMN	29	B	14	(Note 1)	(Note 2)	—
Pumps, Filtration Units	Base-mounted	1.0”	MSL	5	A	11	—	(Note 2)	—
	In-line	(Note 4)	(Note 4)	—	—	—	—	(Note 4)	—
Fans, Air Handlers, Make-up Air Units, Pollution Control Units, Outside Air Units, Compressors	Suspended	1.0”	HS	6	B	14	(Note 1)	(Note 3)	SE-2,4,5
	Supported	1.0”	MSL	5	B	14	(Note 1)	(Note 2)	—
	Curb Mounted	1.0”	SCMS	23	—	—	—	(Note 2)	—
Wall-Mounted Fans		1.0”	HS	5	—	—	34		SE-2,4,5
Pressure Reduction Station		0.3”	HMN	29	B	14	—	(Note 2)	—
Expansion Tanks, Heat Recovery Units, etc.	Suspended	(Note 4)	—	—	—	—	—	(Note 3)	SE-2,4,5
	Supported	0.2”	HMN	29	—	—	—	(Note 2)	—
Water Source Heat Pumps, Fan Coil Units, VAV Units	Suspended	1.0”	HS	6	—	—	—	(Note 3)	SE 2,4,5
	Supported	1.0”	MSL	5	A	14	(Note 1)	(Note 2)	—

END OF SECTION 23 05 05

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SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment support bases.
B. Vibration isolators.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General:
   1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
   2. Steel springs to function without undue stress or overloading.

2.2 EQUIPMENT SUPPORT BASES

2.3 VIBRATION ISOLATORS

A. Non-Seismic Type:
   1. All Elastomeric-Fiber Glass Pads:
      a. Configuration: Flat or molded.
      b. Thickness: 0.25 inch (6 mm) minimum.
      c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
   2. Elastomeric Mounts:
      a. Material: Oil, ozone, and oxidant resistant compounds.
      b. Assembly: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
   3. Steel Springs:
      a. Assembly: Freestanding, laterally stable without housing.
      b. Leveling Device: Rigidly connected to equipment or frame.
   4. Restrained Steel Springs:
      a. Housing: Rigid blocking during rigging prevents equipment installed and operating height from changing during temporary weight reduction.
      b. Equipment Wind Loading: Adequate means for fastening isolator top to equipment and isolator base plate to supporting structure.
   5. Elastomeric Hangers:
      a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.
      b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
   6. Spring Hanger:
      a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
      b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
B. Seismic Type:
   1. Coil Springs Consisting of Single Elements:
      a. Housing: Manufactured from cast iron material.
      b. Ductile Material: Designed and rated for seismic applications.

c. Resilient Snubbing Grommet System: Incorporated and designed with clearances of no more than 0.25 inch (6 mm) in any direction preventing direct metal-to-metal contact between supported member and fixed restraint housing.
d. Resilient Pad: Located in series with spring.
e. Coil Springs: Color coded elements to have a lateral stiffness greater than 0.8 times the rated vertical stiffness with 50 percent overload capacity.
f. Finish: Suitable for the application.

2. All Directional Elastomeric:
   a. Material: Molded from oil, ozone, and oxidant resistant compounds.
   b. Attachment Method: Encapsulated load transfer plate bolted to equipment and base plate with anchor hole bolted to supporting structure.
   c. Rating: Cast iron and aluminum housings rated for seismic restraint applications.
   d. Minimum Operating Static Deflections: Deflections indicated in project documents are not to exceed published load capacities.

END OF SECTION 23 05 48

SECTION 23 05 50 - MAXIMUM SOUND POWER LEVEL FOR MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included in this section includes acoustical performance requirements of the following:
   1. Fans
   2. Air Handling Units
   3. Package Units
   4. Heat Pumps and Vertical Air Conditioners
   5. Fan Coil Units
   6. Condensing Units
   7. Terminal Units
   8. Cooling Towers and Evaporative Coolers

B. Related Work Not Included in this Section:
   1. Acoustical Mechanical General Provisions
   2. Vibration Isolation
   3. Prefabricated Silencers

1.2 APPLICABLE STANDARDS AND TEST CONDITIONS

A. AMCA Standard 300-08 Reverberant Room Method for Sound Testing of Fans

B. AMCA Standard 301-06 Methods for Calculating Fan Sound Ratings from Laboratory Test Data

C. ARI 260-2001 Sound Rating of Ducted Air Moving and Conditioning Equipment

D. ARI 270-95 Sound Rating of Outdoor Unitary Equipment

E. ARI 350-2000 Sound Rating of Non-Ducted Indoor Air-Conditioning Equipment

F. ARI 370-2001 Sound Rating of Large Outdoor Refrigeration and Air-Conditioning Equipment

G. ARI 880-2008 Performance Rating of Air Terminals

H. ARI 885-2008 Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets

I. CTI ATC-128 Code for Measurement of Sound from Water Cooling Towers

1.3 SUBMITTAL

A. Provide submittal information in accordance with the requirements specified in this section and in Submittal Procedures.

B. Include the following:
   1. Itemized list referencing:
      a. Items being submitted
      b. Documenting the acoustical test standard used.

c. Sound Power Levels in octave band format ranging from 63Hz to 8000Hz.
d. Page numbers specifically referencing pages for cutsheets, details, test data, and manufacturer's installation recommendations.

2. Acoustical test data measured in a laboratory accredited under the standards required in this submittal.
   a. Acoustical test data must be reported at the design operating conditions.

PART 2 - PRODUCTS

2.1 ACOUSTICAL REQUIREMENTS

A. Fans: Sound Power Levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with AMCA 300-2008 or calculated in accordance with AMCA 301-2006.

B. Air Handling Units: Sound Power Levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with AMCA 300-2008 or calculated in accordance with AMCA 301-2006.

C. Package Units:
   1. Discharge and Inlet sound power levels must not exceed the octave band limits scheduled on the project drawings when measured and calculated in accordance with ARI 260-2001, or AMCA 300-2008 and AMCA 301-2006.
   2. Radiated sound power levels must not exceed the octave band limits scheduled on the project drawings when measured in accordance with ARI 270-2001.

D. Heat Pumps and Vertical Air Conditioners: Sound Power levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with ARI 260-2001.

E. Fan Coil Units: Sound power levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with ARI 350-2000.

F. Condensing Units: Sound power levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with ARI 370-2001.

G. Cooling Towers: Sound pressure levels at 50 feet must not exceed the octave band limits scheduled on the project drawings measured accordance with CTI ATC-128.

H. Terminal Units: Sound power levels must not exceed the octave band limits scheduled on the project drawings measured in accordance with ARI 880-2008.

2.2 WITNESSED ACOUSTICAL TEST

A. It shall be the option of the architect to select one or more units to be tested at design duty in an accredited independent acoustical test facility. The test(s) would be witnessed by the architect's acoustical consultant. All testing procedures would be submitted to the architect for approval prior to the test(s). All costs associated with the testing shall be borne by the contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of all products shall be in accordance with the manufacturer's instructions and recommended procedures.

END OF SECTION 23 05 50

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SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Adhesive-backed duct markers.
D. Pipe markers.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

PART 2 PRODUCTS

2.1 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Piping: Tags.
C. Thermostats: Nameplates.

2.2 NAMEPLATES

A. Letter Color: White.
B. Letter Height: 1/4 inch (6 mm).
C. Background Color: Black.
D. Plastic: Conform to ASTM D709.

2.3 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.
B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.4 PIPE MAR ERS

A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

END OF SECTION 23 05 53

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SECTION 23 07 13 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation.
B. Duct liner.

1.2 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
D. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).
H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. ohns Manville: www.jm.com/ sle.
   2. Owens Corning Corporation: www.ocbuildingspec.com/ sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
C. Vapor Barrier acket:
   1. raft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.
D. Vapor Barrier Tape:
   1. raft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.3 GLASS FIBER, RIGID

A. Manufacturer:
   1. ohns Manville: www.jm.com/ sle.
   2. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/ sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.
B. Insulation: ASTM C612; rigid, noncombustible blanket.
C. Vapor Barrier acket:
   1. raft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.
D. Vapor Barrier Tape:
   1. raft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.4 DUCT LINER

A. Manufacturers:
   1. Armacell LLC; AP Coilflex: www.armacell.us/ sle.
   2. ohns Manville: www.jm.com/ sle.
   3. Owens Corning Corporation: www.ocbuildingspec.com/ sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.
C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.
D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

END OF SECTION 23 07 13

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.
B. Flexible removable and reusable blanket insulation.
C. Engineered wall outlet seals and refrigerant piping insulation protection.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.2 POLYETHYLENE

A. Manufacturers:
   1. Armacell LLC: www.armacell.us/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.
   1. ' ' (' si') Value: ASTM C177; 0.25 at 75 degrees F (0.036 at 24 degrees C).
   2. Maximum Service Temperature: 300 degrees F (150 degrees C).
   3. Density: 2 lb/cu ft (32 kg/cu m).
   4. Maximum Moisture Absorption: 1.0 percent by volume.
   5. Moisture Vapor Permeability: 0.05 perm inch (0.073 ng/Pa s m), when tested in accordance with ASTM E96/E96M.
   6. Connection: Contact adhesive.

2.3 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc: www.aeroflexusa.com/ sle.
   2. Armacell LLC; AP Armaflex: www.armacell.us/ sle.
   3. -Flex USA LLC; -Flex Titan: www.kflexusa.com/ sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

2.4 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Manufacturers:
   1. Substitutions: See Section 01 60 00 - Product Requirements.
B. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/ sle.
   1. Pipe Penetration Wall Seal: Airex Titan Outlet.
   2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
   3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System it.
C. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
D. Insulation Protection System: Refrigerant piping insulation PVC protective cover.
   1. PVC Insulation Cover Color: Black with full-length velcro fastener.
   2. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.

END OF SECTION 23 07 19

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping.
B. Refrigerant.
C. Moisture and liquid indicators.
D. Valves.
E. Strainers.
F. Check valves.
G. Filter-driers.
H. Flexible connections.

1.2 RELATED REQUIREMENTS

A. Section 08 31 00 - Access Doors and Panels.
B. Section 09 91 23 - Interior Painting.
C. Section 22 07 19 - Plumbing Piping Insulation.
D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder- oint Pressure Fittings; 2013.
C. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.
D. ASME B31.9 - Building Services Piping; 2014.
E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.
H. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.4 SYSTEM DESCRIPTION

A. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.
B. Liquid Indicators:
   1. Use line size liquid indicators in main liquid line leaving condenser.
   2. If receiver is provided, install in liquid line leaving receiver.
   3. Use line size on leaving side of liquid solenoid valves.
C. Valves:
   1. Use service valves on suction and discharge of compressors.
   2. Use gauge taps at compressor inlet and outlet.
   3. Use gauge taps at hot gas bypass regulators, inlet and outlet.
   4. Use check valves on compressor discharge.
   5. Use check valves on condenser liquid lines on multiple condenser systems.
D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.
E. Strainers:

1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. Use shut-off valve on each side of strainer.

F. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

G. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.
B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.
C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.
B. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.2 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
1. Fittings: ASME B16.22 wrought copper.
2. oints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch (22 mm) OD: ASTM B88 (ASTM B88M), Type (A), annealed.
1. Fittings: ASME B16.26 cast copper.
2. oints: Flared.

C. Pipe Supports and Anchors:
1. Provide hangers and supports that comply with MSS SP-58.
a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Hangers for Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
3. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
4. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
5. Vertical Support: Steel riser clamp.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
7. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

8. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.3 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2.4 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
1. Henry Technologies: www.henrytech.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F (93 degrees C) and maximum working pressure of 500 psi (3450 kPa).

2.5 VALVES

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

C. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 275 degrees F (135 degrees C).

D. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi (3450 kPa) and maximum temperature of 300 degrees F (149 degrees C).

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi (3450 kPa).

2.6 STRAINERS

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/ sle.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Straight Line or Angle Line Type:
1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi (2960 kPa).

2.7 CHEC VALVES

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/ sle.

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.8 FILTER-DRIERS

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Performance:
   1. Flow Capacity - Liquid Line: rated in accordance with AHRI 710.
   2. Pressure Drop: 2 psi (14 kPa), maximum, when operating at full connected evaporator capacity.
   3. Design Working Pressure: 350 psi (2410 kPa), minimum.
C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.
D. Construction: UL listed.
   1. Connections: As specified for applicable pipe type.

2.9 FLEXIBLE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure of 500 psi (3450 kPa).

END OF SECTION 23 23 00

SECTION 23 31 00 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.
B. Nonmetal ductwork.
C. itchen hood ductwork.
D. Duct cleaning.

1.2 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
E. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.
F. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; 2003.
G. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.
H. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.4 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.1 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
B. Ducts: Galvanized steel, unless otherwise indicated.
C. Low Pressure Supply (Heating Systems): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
D. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
E. General Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
F. itchen Cooking Hood Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
G. Outside Air Intake: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.
H. Combustion Air: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

2.2 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
B. oint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.3 DUCTWOR FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
C. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.4 MANUFACTURED DUCTWOR AND FITTINGS

A. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   3. Maximum Velocity: 4000 fpm (20.3 m/sec).
   4. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).
B. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.
   1. UL labeled.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: 4 inches WG (1000 Pa) positive and 0.5 inches WG (175 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).
C. itchen Cooking Hood and Grease Exhaust: Nominal 3 inches (76.2 mm) thick ceramic fiber insulation between 20 gage, 0.0375 inch (0.95 mm), Type 304 stainless steel liner and 24 gage, 0.0239 inch (0.61 mm) aluminized steel sheet outer jacket.
   1. Tested and UL listed for use with commercial cooking equipment in accordance with NFPA 96.
   2. Certified for zero clearance to combustible material in accordance with:
      a. UL 2221 with a 2 hour rating.
   3. Materials and construction of the modular sections and accessories to be in accordance with the terms of the following listings:
      a. UL 1978.
      b. UL 2221.

2.5 FIBROUS GLASS DUCTS

A. Fibrous Glass Ducts: 1 inch (25 mm) thick rigid glass fiber with aluminum foil, glass scrim and raft or plastic jacket vapor barrier; maximum 0.23 value at 75 degrees F (0.034 SI at 24 degrees C).
B. Fabricate in accordance with SMACNA (FGD), except as indicated.
C. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.
D. Do not use fibrous glass ducts within 12 inches (300 mm) of electric or fuel fired heaters.

2.6 ITCHEN HOOD EXHAUST DUCTWOR

END OF SECTION 23 31 00

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SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Combination fire and smoke dampers.
B. Duct access doors.
C. Duct test holes.
D. Fire dampers.
E. Smoke dampers.
F. Volume control dampers.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com/ sle.
   2. rueger-HVAC, Division of Air System Components: www.krueger-hvac.com/ sle.
   3. Ruskin Company, a brand of ohnson Controls: www.ruskin.com/ sle.
   4. Titus HVAC, a brand of ohnson Controls: www.titus-hvac.com/ sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.
C. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.2 BAC DRAFT DAMPERS - METAL

A. Manufacturers:
   1. Louvers Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/ sle.
   2. Nailor Industries, Inc: www.nailor.com/ sle.
   3. Ruskin Company, a brand of ohnson Controls: www.ruskin.com/ sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.
B. Gravity Backdraft Dampers, Size 18 by 18 inches (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed

edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
   1. Manufacturers:
      a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/ sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.4 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:
   1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
B. Fabricate in accordance with SMACNA (DCS) and as indicated.
C. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
      a. Net Fabric Width: Approximately 2 inches (50 mm) wide.
   2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.
D. Maximum Installed Length: 14 inch (356 mm).
E. Manufacturers:
   1. Ruskin Company, a brand of ohnson Controls: www.ruskin.com/ sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.
F. Fabricate in accordance with SMACNA (DCS) and as indicated.
G. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for sizes over 24 inches (600 mm).
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw .
H. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch (150 by 760 mm).
   2. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.
I. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch (200 by 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch (1.21 mm), minimum.
. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
   1. Manufacturers:
      a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com/ sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.
3. Manufacturers:
   a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/ sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

END OF SECTION 23 33 00

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SECTION 23 33 19 - DUCT SILENCERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

A. Furnish and install silencers of the types and sizes shown on the drawings and listed in the silencer schedule.

1.3 APPLICABLE STANDARDS AND TEST CONDITIONS

A. ASTM E477-06a Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

B. Comply with NFPA 90A Installation of Air Conditioning and Ventilation Systems.

C. Comply with NFPA 90B Installation of Warm Air Heating and Air Conditioning Systems.

D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

E. NFPA 255 Standard Method of Test Surface Burning Characteristics of Building Materials.

F. UL Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Provide catalog cuts and data sheets on the specific silencers utilized.

B. Provide documentation showing compliance with the performance requirements documented in this Specification Section including Flamespread Classification, Smoke Development Rating, and a detailed description of the acoustical fill material intended to be used.

C. Include a list showing the silencer used, its location, its size, pressure drop at scheduled CFM, certified test data on Dynamic Insertion Loss, Self-Noise Power Levels and Aerodynamic Performance for Reverse and Forward Flow test conditions.

D. Provide copies of the independent laboratory test reports for the silencers being submitted.

PART 2 - PRODUCTS

2.1 CONSTRUCTION

A. General
   1. Units shall be constructed in accordance with the ASHRAE Guide recommendations for high pressure duct work. Seams shall be lock formed and mastic filled. Rectangular casing seams shall be in the corners of the silencer shell to provide maximum unit

strength and rigidity. Interior partitions shall be fabricated from single-piece, margin-perforated sheets and shall have die-formed entrance and exit shapes so as to provide the maximum aerodynamic efficiency and minimum self-noise characteristics in the duct silencer. Blunt noses or squared off partitions will not be accepted.

2. Attachment of the interior partitions to the casing shall be by means of an interlocking track assembly. Tracks shall be solid galvanized steel and shall be welded to the outer casing. Attachment of the interior partitions to the tracks shall be such that a minimum of 4 thicknesses of metal exist at this location. The track assembly shall stiffen the exterior casing, provide a reinforced attachment detail for the interior partitions, and shall maintain a uniform airspace width along the length of the silencer for consistent aerodynamic and acoustic performance. Interior partitions shall be additionally secured to the outer casing with welded nose clips at both ends of the duct silencer.
3. Duct silencer units shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge from inside to outside the casing. Airtight construction shall be provided by use of a duct sealing compound on the jobsite material and labor furnished by the contractor.

B. Rectangular Silencers
1. Outer casings of rectangular silencers shall be made of 22 gauge galvanized steel in accordance with ASHRAE guide recommended construction for high pressure rectangular ductwork. Seams shall be lock-formed and mastic-filled.
2. Interior partitions for rectangular silencers shall be made of 26 gauge galvanized perforated steel, or thicker.

C. Tubular Silencers
1. Outer casings of tubular silencer shall be made of galvanized steel in accordance with ASHRAE guide recommended construction for high pressure rectangular ductwork. Seams shall be lock-formed and mastic-filled. Outer casing shall be 22 gauge for silencers with an outside diameter between 12-36 inches, and 18 gauge for outside diameters of 38-60 inches.
2. Interior metal of tubular silencers shall be the same construction as the outside casing.

D. Interior Fill
1. Type A – Standard Filler material shall be of inorganic mineral or glass fiber of a density sufficient to obtain the specified acoustical performance. The material shall be packed under at least 5% compression to eliminate voids due to vibration and settling. The material shall be inert, vermin-, and moisture-proof.
    a. Combustion ratings for silencer acoustical fill shall be no greater than the following tested in accordance with ASTM E84, NFPA 255, or UL No. 723.
        1) Flamespread Classification 20
        2) Smoke Development Rating 20
2. Type B – Green Filler material shall be constructed from recycled natural fibers. Each fiber shall be treated with an EPA registered fungal inhibitor to prevent mold, mildew, fungi, and promote protection against pests. The fill material must not contain any harmful chemicals, irritants, and/or volatile organic compounds (VOC). The material must not produce off-gassing.
    a. Combustion ratings for the silencer acoustic fill shall be no greater than the following when tested in accordance with ASTM E84, NFPA 255, or UL No. 723.
        1) Flamespread Classification 5
        2) Smoke Development Rating 35
3. Type C – Wrapped Filler material shall be inorganic glass fiber of a proper density to obtain the specified acoustical performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert, vermin- and moisture-proof. The filler material shall be totally encapsulated and sealed with polymeric film of an appropriate thickness. The encapsulated fill material shall be

separated from the interior perforated baffles by means of a non-combustible erosion resistant factory-installed acoustic standoff.

a. Combustion ratings for the silencer acoustic fill shall be no greater than the following when tested to ASTM E84, NFPA 255, or UL No. 723
   1) Flamespread Classification 20
   2) Smoke Development Rating 20

4. Type D – No Filler Silencers shall not have sound absorptive material of any kind within the silencer. The silencer shall attenuate air-/gas-transmitted noise solely by virtue of controlled impedance membranes and broadly tuned resonators.
5. Type E – Spiral Silencers shall consist of fiberglass-based acoustical insulation bonded to 26 gauge acoustical barrier material. Exposed fiberglass shall be bonded with a fiberglass scrim cloth to a minimum strength per square inch of 80 lbs. warp and 70 lbs. filler, packed under a minimum of 5% compression. Insulation shall be vermin- and moisture-proof, retained in casing by a 16 gauge galvanized welded wire screen. Casing shall consist of 18 gauge galvanized fully welded steel. Center spiral tree shall consist of stainless steel type 316.
   a. Combustion ratings for the silencer acoustic fill shall be no greater than the following when tested to ASTM E84, NFPA 255, or UL No. 723
      1) Flamespread Classification 25
      2) Smoke Development Rating 50

2.2 ACOUSTICAL PERFORMANCE

A. The sound insertion loss shall meet or exceed the values given in the schedule on the drawings when measured in accordance with ASTM E477-06a. All measurements shall be performed by an independent acoustical laboratory that is accredited for the test procedure under the National Voluntary Laboratory Accreditation Program (NVLAP).

B. The static pressure drop shall not exceed the value scheduled on the drawings as the airflow indicates. Airflow measurements shall be made in accordance with ASTM specification E477-99 and applicable portions of ASME, AMCA, and ADC airflow test codes. Tests shall be reported on the identical units for which acoustic data is presented.

C. The self-noise shall not exceed the values scheduled on the drawings.

2.3 ACCEPTABLE MANUFACTURERS

A. Vibro-Acoustics.

B. Pottorff/Dynasonics.

C. Industrial Acoustics Company.

D. Innovative Metal Industries, Inc.

PART 3 - EXECUTION

A. Install in accordance with the manufacturer's recommendations to obtain the submitted acoustical and air flow performance.

B. Locate as shown in the drawings.

C. Orient the internal baffles (splitters) of the silencers so they are parallel to the plane of any elbow within 3 duct diameters of the silencers.

D. Do not locate silencers within one duct diameter from elbows, fan inlet or return openings unless indicated on the drawings and approved by the design team.

END OF SECTION 23 33 19

SECTION 23 34 23 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cabinet exhaust fans.
B. Ceiling exhaust fans.
C. Inline centrifugal fans.

1.2 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.
B. AMCA 99 - Standards Handbook; 2016.
C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.
E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

1.3 QUALITY ASSURANCE

1.4 FIELD CONDITIONS

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Loren Cook Company: www.lorencook.com/ sle.
B. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
D. Fabrication: Conform to AMCA 99.
E. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.3 CABINET EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
B. Grille: Molded white plastic.
C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.4 INLINE CENTRIFUGAL FANS

A. Manufacturers:
   1. Loren Cook Company: www.lorencook.com/ sle.

2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

END OF SECTION 23 34 23

SECTION 23 37 00 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers.
B. Registers/grilles.
C. Door grilles.
D. Louvers.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. American Louver Company; ALC Grilles and Registers: www.americanlouver.com/ sle.
B. rueger-HVAC, Division of Air System Components: www.krueger-hvac.com/ sle.
C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/ sle.

2.2 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern, stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, and multi-louvered diffuser to discharge air in 360 degree, one way, two way, three way, and four way pattern with sectorizing baffles where indicated.
B. Connections: As indicated on drawings.
C. Frame: Provide surface mount, snap-in, inverted T-bar, and spline type. In plaster ceilings, provide plaster frame and ceiling frame.
D. Fabrication: Steel with baked enamel finish.
E. Color: As selected by Architect from manufacturer's standard range.
F. Accessories: Provide radial opposed blade, butterfly, and combination splitter volume control damper; removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, anti-smudging device, and gaskets for surface mounted diffusers with damper adjustable from diffuser face.

2.3 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.
B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.
C. Fabrication: Steel with steel frame and baked enamel finish.
D. Color: As selected by Architect from manufacturer's standard range.

2.4 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.
C. Construction: Made of aluminum extrusions with factory enamel finish.
D. Color: As selected by Architect from manufacturer's standard range.
E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.5 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.
B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.
C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.
D. Color: To be selected by Architect from manufacturer's standard range.
E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.6 DOOR GRILLES

A. Type: V-shaped louvers of 20 gage, 0.0359 inch (0.91 mm) thick steel, 1 inch (25 mm) deep on 1/2 inch (13 mm) centers.
B. Frame: 20 gage, 0.0359 inch (0.91 mm) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.7 LOUVERS

A. Type: 4 inch (100 mm) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.
B. Fabrication: 16 gage, 0.0598 inch (1.52 mm) thick galvanized steel welded assembly, with factory prime coat finish.
C. Color: To be selected by Architect from manufacturer's standard range.
D. Color: To be selected by Architect from manufacturer's standard range.
E. Mounting: Furnish with interior flat flange for installation.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
C. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
D. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 91 23.

END OF SECTION 23 37 00

SECTION 26 00 00

GENERAL PROVISIONS

1.0 GENERAL

A. The general contract provisions apply to this section and take precedent over this section in case of conflict.

1.1 GENERAL PROVISIONS

A. This division supplements the applicable requirements of other divisions.

1.2 DEFINITIONS

A. For the purposes of Division 26 00 00, the following definitions apply:

1. Provide: Furnish and install.
2. Indicated: As shown on the drawings or specified herein.
3. Circuit Designation: Panel designation and circuit number, i.e., LA-13.
4. Approved equal: Approved by the engineer of record as equal in his sole determination.

1.3 SCOPE OF WORK

A. The Specifications for Work of Division 26 00 00 include, but are not limited to the following sections:

26 00 00–General Provisions
260030–Tests and Identification
26 0050–Basic Electrical Materials and Methods
260080–Technical Services Division Start-Up Service
260111–Conduits
260120–Conductors
260130–Electrical Boxes
260140–Wiring Devices
260142–Nameplates and Warning Signs 260164–
Branch Circuit Panelboards 260170–Disconnects
260190–Support Devices
262420- Switchboards
262450–Grounding

262510–Lighting Fixtures
264901–General Control Devices

SECTION 23 81 29 - VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.2 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.
B. ITS (DIR) - Directory of Listed Products; current edition.
C. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Company that has been manufacturing variable refrigerant volume heat pump equipment for at least 5 years.
   2. Company that provides system design software to installers.
B. Installer Qualifications: Trained and approved by manufacturer of equipment.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle equipment and refrigerant piping according to manufacturer's recommendations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The system design indicated in the Contract Documents is based on equipment and system designed by LG Electronics.
   1. Substitution requests will be considered only if required submittal data is complete; see article SUBMITTALS above.
   2. Contractor (not equipment supplier) shall certify that the use of the substitute system and equipment will not require changes to other work or re-design by Architect.
   3. Do not assume substitution has been accepted until formal written notice has been issued by Architect.

2.2 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.

4. Conditioned spaces are indicated on drawings.
5. Outdoor/Condenser unit locations are indicated on drawings.
6. Indoor/Evaporator unit locations are indicated on drawings.
7. Branch selector unit locations are not indicated on drawings.
8. Required equipment unit capacities are indicated on drawings.
9. Refrigerant piping sizes are not indicated on drawings.
10. Connect equipment to condensate piping provided by others; condensate piping is indicated on drawings.
11. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
12. Setpoint Range: 57 degrees F (14 degrees C) to 77 degrees F (25 degrees C).
13. Night Setback: 78 degrees F (25 degrees C).
14. Interior Relative Humidity: 20 percent, maximum.
15. Daytime Setpoint: 68 degrees F (20 degrees C), plus or minus 2 degrees F (1 degrees C).
16. Setpoint Range: 59 degrees F (15 degrees C) to 80 degrees F (27 degrees C).
17. Night Setback: 60 degrees F (15 degrees C).
18. Interior Relative Humidity: 10 percent, minimum.

B. Outside Air Design Conditions:

C. Energy Design Wind Speed: 25 mph (40 km/h).

D. Operating Temperature Ranges:
1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F (minus 20 degrees C) to 60 degrees F (16 degrees C) dry bulb.

E. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet (165 m), actual; 620 feet (189 m), equivalent.
2. Total Combined Liquid Line Length: 3280 feet (1000 m), minimum.
3. Minimum Piping Length Between Indoor Units: 49 feet (15 mm).

F. Control Wiring Lengths:
1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet (2031 m), minimum.
2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet (1015 m), minimum.
3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet (507 m).

G. Controls: Provide the following control interfaces:

2.3 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
1. Performance Certification: AHRI Certified; www.ahrinet.org.
2. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
3. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
4. Provide units capable of serving the zones indicated.
5. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
6. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:
1. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.

3. 208-230 Voltage Range: 187 to 253 volts.

C. Refrigerant Piping:
1. Insulate each refrigerant line individually between the condensing and indoor units.

2.4 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
2. Refrigerant: Factory charged.
3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
4. Capable of being installed with wiring and piping to the left, right, rear or bottom.
5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet (one meter) from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
1. Provide minimum of 2 fans for each condensing unit.
2. External Static Pressure: Factory set at 0.12 in WG (30 Pa), minimum.
3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG (80 Pa), minimum; provide for mounting of field-installed ducts.
4. Fan Airflow: As indicated for specific equipment.
5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.

1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
4. Provide oil separators and intelligent oil management system.
5. Provide spring mounted vibration isolators.

2.5 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.
   1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
   2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
   3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
   4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
   5. Refrigerant Connections: Braze type.
   6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.6 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
   6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
   7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Recessed Ceiling Units - 3 FT by 3 FT: Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.
   1. Face Size: 33 inches (939 mm) square, nominal.
   2. Cabinet Height: Maximum of 10 inches (250 mm) above face of ceiling.
   3. Exposed Housing: White, impact resistant, with washable decoration panel.

4. Supply Airflow Adjustment:
    a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
    b. Field-modifiable to 3-way and 2-way airflow.
    c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
5. Return Air Filter: Manufacturer's standard.
6. Minimum Capacity: As indicated on drawings.
7. Sound Pressure Range: Between 28 dB(A) to 33 dB(A) at low speed measured at 5 feet (1.5 m) below the unit.
8. Fan: Direct-drive turbo type, with motor output range of 0.06 to 0.12 HP (45 to 90 W).
9. Condensate Pump: Built-in, with lift of 21 inches (533 mm), minimum.
10. Provide side-mounted supply air branch duct connection.
11. Provide side-mounted fresh air intake duct connection.

C. Recessed Ceiling Units - 2 FT by 2 FT: Four-way airflow cassette with central return air grille, sized for installation in standard 24 by 24 inch (610 by 610 mm) lay-in ceiling grid.
1. Cabinet Height: Maximum of 12 inches (305 mm) above face of ceiling.
2. Exposed Housing: White, impact resistant, with washable decoration panel.
3. Maintenance Access: All electrical components accessible through decoration panel.
4. Supply Airflow Adjustment:
    a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.
    b. Field-modifiable to 3-way and 2-way airflow.
    c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.
5. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
6. Fan: Direct-drive turbo type.
7. Condensate Pump: Built-in, with lift of 21 inches (533 mm), minimum.
8. Provide side-mounted supply air branch duct connection.
9. Provide side-mounted fresh air intake duct connection.

D. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.
1. Return Air Filter: Manufacturer's standard.
2. Sound Pressure: Measured at low speed at 5 feet (1.5 m) below unit.
3. Provide external static pressure switch adjustable for high efficiency filter operation
4. Condensate Pump: Built-in, with lift of 9 inches (229 mm), minimum.
5. Switch box accessible from side or bottom.

E. Ceiling Surface-Mounted Units: White, finished casing, with removable front grille; foamed polystyrene and polyethylene sound insulation, and mounting brackets; mildew-proof polystyrene drain pan.
1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.
2. Sound Pressure Range: Measured at low speed at 3.3 feet (1 m) below and away from unit.
3. Fan: Two-speed, direct-drive cross-flow type.

F. Air Handling Units: Factory-painted heavy gage steel casing insulated with sound absorbing foil faced insulation.
1. Secondary condensate drain pan; field installed.
2. Fan: Direct-drive ECM type fan with automatic airflow adjustment.
3. Provide air filter.

4. External insulation; field installed.

END OF SECTION 23 81 29

B. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this division, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all divisions for related work required to be included as work under this division.
2. General provisions for electrical work.
3. Site observation including existing conditions.

C. Related Work Specified Elsewhere but included in the scope of work:

1. Motors and their installation.
2. Control wiring and conduit for heating, ventilating and air conditioning.

D. Work Not In Contract (N.I.C.):

1. Telephone instruments.

E. Coordination

1. The following supplements are additional General Requirements pertaining to work of this Division. Provisions of Division 1 - General Requirements shall remain in effect.

a. Coordinate work of various sections of Division 26 and 27.
b. Coordinate work of this Division 26 with work of Divisions 2 through 25.

1.4 REFERENCE STANDARDS

A. American National Standards Institute (ANSI).
B. Association of Edison Illuminating Companies (AEIC).
C. Electrical Testing Laboratories (ETL).
D. Illuminating Engineering Society (IES).
E. Institute of Electrical and Electronic Engineers (IEEE).
F. Insulated Cable National Electrical Manufacturers Association (NEMA).
G. National Fire Protection Association (NFPA).
H. Underwriters Laboratories, Inc. (UL).
I. California State Fire Marshal (CSFM).
J. California Energy Commission (CEC) Title 24.
K. Engineers Association (ICEA).

1.5 QUALITY ASSURANCE

A. Regulations: All the electrical equipment and materials, including their installations, shall conform to the following applicable latest codes and standards:

1. California Electric Code, Latest Adopted Edition (CEC), 2021 unless a more current version has been adopted.
2. Local and State Fire Marshal.

3. Occupational Safety and Health Act (OSHA).
4. Requirements of the Serving Utility Company.
5. Local Codes and Ordinances.
6. Requirements of the Office of the California State Architect (OSA).
7. California Administrative Code, Title 8, Chapter 4, Industrial Safety Orders.
8. California Administrative Code, Title 24.
9. City of Redondo Beach Codes and Regulations.
10. CA Green Code 2022

B. Variances: In instances where two or more codes are at variance, the most restrictive requirement shall apply. In instances where plans and specifications are at variance or conflict the most restrictive requirement shall apply. Contractor shall be responsible for all his associated work and materials and also the work and materials of related or affected trades.

C. Contractor's Expense: Obtain and pay for all required bonds, insurance, licenses, and pay for all taxes, fees and utility charges required for the electrical work.

D. Testing and Adjustment:

1. Perform all necessary tests required to ascertain that the electrical system has been properly installed, that the power supply to each item of equipment is correct, and that the system is free of grounds, ground faults, and open circuits, that all motors are rotating in the proper directions, and such other tests and adjustments as may be required for the proper completion and operation of the

   electrical system. Contractor shall provide a copy of all test reports to prove these tests have been performed.

2. If, during the course of testing, it is found that system imbalance is in excess of 20%, rearrange single-pole branch circuit in lighting and receptacle panels to bring system balance to within 20% on all phases. Record all such changes on the typewritten panelboard schedule and submit a summary of changes to the Engineer on the record drawings.

1.6 SUBMITTALS

A. Procedure: In accord with the Submittal Section.

B. Shop drawings: Detailed shop drawings for the following equipment:

1. EM lighting inverter
2. Branch circuit panelboards.
3. Switchboards.
4. EV Chargers

C. Product data: Detailed manufacturer’s data for:

1. Cabinets.
2. Concrete pull boxes.
3. Disconnects.
4. Lighting fixtures and associated equipment including control.
5. Gel-filled wire connectors.

D. Test results for the following:

1. Circuit breakers.
2. Grounding systems.
3. Cables.

E. Include sufficient information to indicate complete compliance with Contract Documents. Include illustrations, catalog cuts, installation instructions, drawings, and certifications. On each sheet show manufacturer's name or trademark.

F. Operating, maintenance, and instruction data for:

1. Switchboards.
2. EM inverter
3. Lighting time clock/controller
4. Lighting system controls

G. Instruction materials:

1. Provide at the time of personnel instruction period three bound copies of instruction manuals for the systems as listed in Subparagraph 1.04.A.4.f.
2. Include the following (minimum) information in each copy of instruction manual:
   a. Manufacturers' names and addresses including phone numbers.
   b. Serial numbers of items furnished.
   c. Catalog information, exploded views and brochures, complete with technical and performance data for all equipment, marked to indicate actual items furnished and intended use.
   d. Recommended spare parts.

1.7 OWNER'S PERSONNEL INSTRUCTIONS

A. Prior to completion of the contract, and at the Owner's convenience, instruct verbally and demonstrate to the Owner's personnel, the operation of the systems as listed under operating, maintenance, and instructional data and/or emergency generator, automatic transfer switch and fire alarm annunciator panel.

1.8 CLEANING

A. Clean exterior surfaces and interiors of equipment and remove all dirt, cement, plaster and other debris. Protect interior of equipment from dirt during construction and clean thoroughly before energizing.

B. Clean out cracks, corners and surfaces on equipment to be painted. Remove grease and oil spots so that paint may be applied without further preparation.

1.9 PROJECT RECORD DOCUMENTS - Prepare the following and submit to the engineer before final acceptance:

A. Mark Project Record Documents daily to indicate all changes made in the field.
1. In addition to general requirements of Project Record Drawings, indicate on drawings, changes of equipment locations and ratings, trip sizes, and settings on

circuit breakers, alterations in raceway runs and sizes, changes in wire sizes, circuit designations, installation details, one-line diagrams, control diagrams and schedules.

B. Use green to indicate deletions and red to indicate additions.

1. Use the same symbols and follow the same drafting procedures used on the Contract Drawings.

C. Locate dimensionally off of contract drawings all underground conduit stubbed-out for future use, underground feeder conduits, and feeder pull box locations using building lines by indicating on the Project Record Drawings.

D. At the completion of underground conduit installation provide underground conduit record documents to owner's representative.

E. Two copies, in binder form, of all test results as required by these specifications -

F. Two copies of local and/or state code enforcing authoritiy final inspection certificates.

G. Two copies, in binder form, of electrical equipment cut sheets, manufacturer's installation instructions, warranty certificates, and product literature for all products utilized on project.

1.10 SERVICE INTERRUPTIONS AND UTILITY

A. Coordinate with the Owner the interruption of services necessary to accomplish the work.

B. Coordinate with the utility company all work associated with power and communications distribution systems and service entrance equipment.

C. Electrical contractor shall supply temporary power for all trades.

1.11 MINIMUM SPECIFICATION REQUIREMENTS (ALL WORK OF DIVISION 26 00 00)

A. As a minimum Specification requirement, all materials and methods shall comply with applicable governing codes.

1.12 PENETRATION SEALING

A. Seal penetration through exterior walls and fire rated walls, floors, ceilings, and roofs with 3M Firestopping materials of fire rating capacity rated per architectural plans and UBC or prevailing building code requirements.

1.13 PLACING EQUIPMENT IN SERVICE

A. Do not energize or place electrical equipment in service until all interested parties have been duly notified and are present or have waived their rights to be present. Where equipment to be placed in service involves service or connection from another contractor of the owner, notify the owner in writing when the equipment will be ready for final testing/connection and schedule to the owner's satisfaction of this service connection. Notify the owner two weeks in advance of the date the various items of equipment will be complete.

1.14 OWNER-FURNISHED ITEMS

A. Pick up Owner-furnished items and handle, deliver, install, and make all final connections.

1. Assume responsibility for the items when consigned at the storage facility or in the field in accord with requirements of the Contract Documents.

1.15 ELECTRIC ITEM LOCATION

A. Electrical drawings are generally diagrammatic. Verify equipment sizes with shop drawings and manufacturers' data and coordinate location layout with other trades. Notify owner and engineer of any changes of location requirements prior to installation and obtain engineer's written acceptance for all changes/revisions.

1.16 DEMOLITION

A. Scope: Provide and perform demolition, preparatory and miscellaneous work as indicated and specified, complete.

B. Principal Items of Work:

1. Demolition and removal of existing electrical conduit, wiring and equipment required to complete the project.
2. Preparation of the existing building to receive or connect the new work.
3. Miscellaneous demolition, cutting, alteration, and repair work in and around the existing building necessary for the completion of the entire project.
4. Disconnecting and reconnection of electrical equipment as required by the construction modifications.

C. Existing Conditions: Make a detailed survey of the existing conditions pertaining to the work. Check the locations of all existing structures, equipment and wiring (branch circuiting and controls). Provide at bid time any exclusions for existing conditions work.

D. Salvage and Disposal: All removed material other than items to be reused shall be returned to the owner or disposed of in accordance with instructions from the owner's representative. Disposal shall be done in accordance with EPA and governing body requirements and regulations. Contractor shall pay all fees and charges for disposal.

1.17 ELECTRICAL WORKMANSHIP REQUIREMENTS

A. It is required that all electrical construction of this Contract be performed by journeyman electricians. All journeyman electricians shall have a minimum of 4 years of apprenticeship training and hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards. This is intended to mean that a person who does

not hold a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards will not be permitted to do electrical work of any kind that involves new construction, nor make repairs, alterations, additions, or changes of any kind to any existing system of electrical wiring, apparatus, equipment, light, heat, or power.

B. Contractor may employ electrical helpers or apprentices on any job of electrical construction, new or existing, when the work of such helpers or apprentices is performed under direct and constant personal supervision of a journeyman electrician holding a valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

1. Each journeyman electrician will be permitted to be responsible for quality of

workmanship for a maximum of eight helpers or apprentices during any same time period, provided the nature of work is such that good supervision can be maintained and quality of workmanship achieved is the best, as expected by Owner and as implied by the latest edition of the California Electrical Code (National Electrical Code with State of California amendments).

2. Before each journeyman electrician commences work, deliver to Owner at project site a photocopy of journeyman's valid Certificate of Completion from an apprenticeship training course approved by the State of California Department of Industrial Relations, Division of Apprenticeship Standards.

C. All electrical systems shall be installed in a neat and workmanlike manner per National Electrical Code requirements and ANSI approved NEIS National Electrical Installation Standards.

1.18 DESIGN CHANGES AFTER AWARD OF BID

A. When a change in the quantity or size of conductors is made, the conduit size will remain in accordance with that indicated in the original contract drawings rather than the drawing symbol conduit table. When code permits, provide conductor insulation 'THWN' where required to maintain conduit fill conformance with the National Electrical Code.

1.19 MATERIAL AND EQUIPMENT SUBSTITUTION

A. Where two or more trade names or manufacturers are mentioned, selection shall be made from the group listed for use in the base bid. The order in which names are listed is not intended to be any indication of preference.

B. Where a single manufacturer, product or trade name is stated, that manufacturer, product or trade name shall be used in the base bid. The use of other manufacturers, products or trade names will be considered by the engineer of record (unless that product is indicated for no substitution) only if submitted as alternate items at the time of bidding, with evidence of equality and a statement of net price difference as compared to the specified item. After approval by the engineer of record, the architect and owner reserve the right to review such submittals and to determine the acceptability for use.

C. Equipment other than that specified will be accepted only when written approval is given by the engineer of record and architect, in accordance with Division 1.

D. The contractor shall be held responsible for all physical changes in piping, equipment, etc. resulting from equipment substitution and likewise bear any increased cost of other trades in making said substitution. Approval by the architect of equipment other than that specified does not relieve this contractor of this responsibility.

1.20 REQUESTS FOR INFORMATION

A. The contractor shall submit all requests for information (RFI's) typewritten on the attached form.

2.0 PRODUCTS

Not Used.

3.0 EXECUTION

Not Used.

END OF SECTION

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SECTION 260030

TESTS AND IDENTIFICATION

1.0 GENERAL

1.1 SECTION INCLUDES

A. Tests and identification.

1.2 SUBMITTALS

A. In accord with Section 260000.
B. All test values.

1.3 DEFINITION

A. Circuit designation: This term is construed to mean panel designation and circuit number; i.e., LA-13.

1.4 TESTS AND ADJUSTMENTS

A. Prior to energizing, test all systems. Test to ensure systems are:

1. Free from short circuits and grounds.
2. Free from mechanical and electrical defects.

B. Circuit breakers (main and feeder circuits that are adjustable only): Testing and adjustments of circuit breakers shall be made by Owner-approved independent testing firm. Testing firm shall meet the criteria for full membership of the International Electrical Testing Association (NETA).

1. Visual and mechanical inspection:

a. Compare nameplate data with Drawings and Specifications.
b. Inspect circuit breaker for correct mounting.
c. Operate circuit breakers to ensure smooth operation.
d. Inspect case for cracks or other defects.
e. Verify tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method in accord with manufacturer's published data.
f. Inspect mechanism contacts and arc chutes in unsealed units.

2. Electrical tests:

a. Perform a contact-resistance test.
b. Perform an insulation-resistance test at 1000 volts dc from pole-to-pole and from each pole-to-ground with breaker closed and across open contacts of each phase.
c. Perform adjustments for final settings in accord with coordination study supplied by Owner.

d. Determine short-time pickup and delay by primary current injection.
e. Determine ground-fault pickup and time delay by primary current injection. This test shall be done after short time and instantaneous testing are complete.
f. Determine instantaneous pickup current by primary injection using run-up or pulse method.
h. Verify correct operation of any auxiliary features such as trip and pickup indicators, zone interlocking, electrical close and trip operation, trip-free, and anti-pump function.

3. Test values:

a. Record all test values conditions and provide certified copies to Owner.
b. Compare microohm or millivolt drop values to adjacent poles and similar breakers. Investigate deviations of more than 25%. Investigate any value exceeding manufacturer's recommendations.
c. Insulation resistance shall not be less than 100 megohms.
d. Trip characteristic of breakers shall fall within manufacturer's published time-current characteristic tolerance band, including adjustment factors. Circuit breakers not within tolerance band shall be tagged defective.

C. Adjust all installation and equipment for their intended use and rating as defined in manufacturer's specifications and test procedures.

1. Contractor recognizes and understands that the show and character lighting, electronic control equipment, special effects, etc., must have a minimum 4-week adjustment period, occurring after installation and verification of said equipment, for each area or facility. Contractor shall provide appropriate personnel (i.e., electricians, carpenters, laborers) as necessary to support Owner during this adjustment period. Adjustment is defined as orientation of adjustable lighting fixtures, installation of color filters to any lighting fixtures requiring same, location adjustment 6 ft., control system setting including programming of control functions, system debugging (i.e., cross-wiring). Contractor shall assume day and night activities during the adjustment period.

D. Ground systems:

1. Visual and mechanical inspection: Verify ground system is in compliance with Drawings and Specifications.

2. Electrical tests:

a. Perform fall-of-potential test or alternative in accord with IEEE 81 on the main ground electrode or system.
b. Perform point-to-point tests to determine resistance between main ground system and all major electrical equipment frames, system neutral, and/or derived neutral points.

3. Test values:

a. Resistance between main ground electrode and ground shall be no greater than 10 ohms. Additional rods shall be installed and bonded to

grounding system and driven to a depth of 50 ft. or refusal, whichever comes first.

b. Investigate point-to-point resistance values which exceed 0.5 ohm.

c. Record all test values and provide certified copies to Owner.

E. Cables:

1. Make insulation resistance tests on all power cables, using a self-contained instrument such as the direct-indicating ohmmeter of the generator type, or "megger" such as manufactured by J.G. Biddle Company, or Owner-approved equivalent. Insulation resistance values shall be at least 75% of shop test records.

a. Apply the following test voltages for 1 minute, except where specified otherwise herein, in accord with procedure recommended by manufacturer of test equipment and as specified herein.

Rated Circuit Voltage	Megger Voltage (DC)	Minimum Megger Reading
600 volts	500 volts	600 kilohms
1000 volts	500 volts	1 megohm

2. Record all test values and provide certified copies to Owner.

3. Replace cables not meeting specified resistance values.

I. Miscellaneous tests:

1. Wiring: check all control circuits for continuity and conformance with wiring diagrams furnished by Owner and manufacturers.

2. Polarity tests: Make continuity and polarity tests on all current and potential transformers to determine whether polarity is as indicated on drawings, and the circuit is continuous.

3. Phasing tests: Identify phases of all switchgear and power cables by stenciling switchgear and tagging cables with approved tags, so that phases can be identified for connecting to proper phase sequence.

1.5 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all electrical distribution equipment shown on single-line diagram, and on control panels, dimmer panels, terminal cabinets, and separately mounted circuit breakers, disconnects, and starters.

B. Provide equipment and circuit designation on nameplates with minimum letter and plate sizes as indicated.

C. Provide engraved plastic nameplates with 1/4 in. minimum height letters indicating:

1. Circuit designation at branch overcurrent devices in distribution panelboards, switchboards, and motor control centers.

2. Circuit designation of panel, equipment-controlled or device-controlled on disconnect switches and on circuit breakers, starters, and controls which are individually enclosed.

3. Voltage rating and circuit designation of all outlets larger than 120V, 20A rating and more than 2 poles.

4. Designation of control and terminal cabinets including CUTC, as indicated.
5. Designation of each contactor and relay in control cabinets.
6. Designate area controlled for each dimmer in dimmer cabinet or rack.
7. Circuit designation at all ground fault detectors and ground fault test receptacles.
8. Equipment designation on front of switchboards, distribution panelboards, branch circuit panelboards, and load centers.

D. Secure nameplates with at least two rivets. Cementing and adhesive installation is not acceptable.

E. Provide two copies of a typewritten directory for each branch circuit panelboard, showing each circuit and its use. Attach one copy to panelboard door and deliver the other copy to Owner.

F. Provide caution label on branch circuit panelboards with integral control compartments. Caution label shall be red with white letters reading "CAUTION, EXTERNAL CONTROL VOLTAGE CIRCUIT WITHIN THIS PANEL."

G. Conductor identification:

1. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices, and in pull boxes.
2. Branch circuits: Identify with corresponding circuit designation at overcurrent device and at all splices.
3. Control wires: Identify with indicated number and or letter designation at all terminal points and connections, including manufacturer pre-wired control sections and cabinets.
4. Alarm and detection wires: Identify with indicated wire and mnemonics numbers at all connections, terminal points, and coiled conductors within cabinets for future termination by Owner.
5. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Perma sleeve with typewritten identification.

END OF SECTION

SECTION 260050

BASIC ELECTRICAL MATERIALS & METHODS

1.0 GENERAL

1.1 DESCRIPTION: Division 1 applies to this Section. This Section contains general requirements for the Sections in Division 26.

A. Related Work Not in Division 26: Refer to individual Division 26 Sections.

1.2 QUALITY ASSURANCE:

A. Codes: Entire installation shall comply with requirements of authorities having jurisdiction.
B. Permits: Contractor shall pay for all permits required by work under this Division.
C. Inspections: Contractor shall arrange for all inspections and correct non-complying installations.

1.3 SUBMITTALS: Refer to Division 1 for procedures.

A. Material and Equipment: Prior to start of work, 6 copies of a list of all materials and equipment covered by Division 26 shall be submitted for approval. Contractor shall allow ample time for checking and processing and shall assume responsibility for delays incurred due to rejected items. No installation of material concerned shall be made until such written approval has been obtained. Approval of materials and equipment shall in no way obviate compliance with the Contract Documents. Each item proposed shall be referenced to the applicable Section, Page, and Paragraph of Division 26. For each item proposed, give name of manufacturer, trade name, catalog data, and performance data.

B. Equipment Layout Drawings: Submit "Equipment Layout Drawings" for each equipment room or area containing equipment items furnished under this Division. Layout Drawings shall consist of plan view of room, to scale, showing projected outlines of all equipment, complete with dotted line indication of all required clearances including all those needed for removal or service. Location of all conduit and pull boxes shall be indicated.

C. Service Manuals: Refer to Submittal Section. Indexed Service Manuals shall be submitted which shall include test reports, service instructions, and renewal parts lists of all equipment.
   1. Submission and Information: Service Manuals shall be submitted for approval at least 30 days before final inspection. The following information together with any pertinent data, shall be included in Service Manual:
      a. Renewal part numbers of all replaceable items.
      b. Manufacturer's cuts and rating data.
      c. Serial numbers of all principal pieces of equipment.
      d. Supplier's name, address, and phone number.
      e. Final settings for all breakers, relays, and control devices
   2. Copies: Four (4) copies of approved Service Manual shall be delivered on or before date required.

D. Record Drawings: Prepare and submit in accordance with requirements. Contractor shall make notations, neat and legible, daily as the work proceeds. Drawings shall be available for inspection at all times and kept at the job site. All buried conduit and/or indicated future connections outside any building shall be located both by depth and by accurate

measurement from a permanently established landmark such as a building or structure.

E. Seismic Calculation: Refer to Article 3.01 herein.

F. Spare Parts: Conform to the Submittal Section. Deliver following spare parts to Owner and obtain receipts. Submit at same time as Operating Instructions:
   1. Spare fuses; 1 set for each combination fuse breaker.
   2. Spare pilot light lamps of each type used on project, in quantity of 10%, but not less than 2%.
   3. Overload heater elements; 2 sets for each size used on project.

G. Special Tools: If any part of the equipment furnished under Division 26 requires a special tool for assembly, adjustment, resetting, or maintenance thereof and such tool is not readily available on the commercial tool market, it shall be furnished with the equipment as a standard accessory and delivered to the Owner.

H. Maintenance Paint: One (1) can of touch-up paint shall be delivered to Owner for each different color factory finish which is to be the final finished surfaces of the product.

1.4 DRAWINGS:

A. Diagrammatic Drawings: For purposes of clarity and legibility, drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible, Contractor shall make use of data in all the Contract Documents and verify information at building site.

B. Routing of Conduit and Piping: The drawings indicate required size and termination of conduits and raceways. It is not intent to indicate all necessary offsets and it shall be the responsibility under this Division to install conduit in such a manner as to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without extra cost to the Owner.

C. Coordination with Other Trades: Check with other Divisions of the Specifications so that no interference shall occur and in order that elevations may be established for the work. Installed work which interferes with the work of other trades shall be removed and rerouted at the discretion of the Architect.

1.5 DAMAGE AND REPAIRS:

A. Emergency Repairs: Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding Contractor's warranty or relieving Contractor of his responsibility during warranty period.

B. Responsibility for Damage: Contractor shall be responsible for damage to grounds, buildings, or equipment due to work furnished or installed under this Division 26.

1.6 PROTECTION, CARE, AND CLEANING:

A. Protection: Provide adequate protection for finished parts of materials and equipment against physical damage from any cause during progress of work and until final completion. Sensitive electrical equipment shall not be installed until major construction is completed.

B. Care: During entire construction, properly cap all lines and equipment to prevent entrance of sand and dirt. Protect equipment against moisture, plaster, cement, paint or work of other trades by covering with polyethylene sheets.

C. Cleaning: After installation is completed, clean all systems as follows in addition to requirements specified:

   1. Field Painted Items: Clean exterior of conduits, raceways, piping and equipment

exposed in completed structure; removing all rust, plaster, cement and dirt by wire brushing. Remove grease oil and similar materials by wiping with clean rags and suitable solvents.

2. Factory Finished Items: Remove grease and oil on all factory finished items such as cabinets and controllers, and leave surfaces clean and polished.

D. Connection: Prior to energizing, check all electrical connection hardware and torque where necessary.

2.0 PRODUCTS

2.1 PRODUCTS: Products and materials shall be as specified in the pertinent Sections of Division 26.

2.2 MATERIALS AND EQUIPMENT: Wherever possible, all materials and equipment used in installation of this work shall be of same manufacturer throughout for each class of material or equipment. Materials shall be new and bear UL label, wherever subject to such approval. Comply with ANSI, IEEE and NEMA standards, where applicable.

3.0 EXECUTION

3.1 SEISMIC REQUIREMENTS: Electrical equipment for emergency systems shall be braced to withstand the lateral forces that result from earthquakes. Under Work of Division 26, submit seismic calculations stamped and signed by a registered California structural engineer confirming size, number, and location of required anchoring hardware. Electrical equipment vendors shall furnish weights together with dimensions and the center of gravity location for all emergency electrical equipment for this purpose.

3.2 GENERAL LATERAL BRACING REQUIREMENTS: As shown on Drawings. Additional bracing requirements shall conform to specific requirements shown on Drawings or in other Sections of Division 26. Anchorages for equipment subject to thermal expansion and movement shall conform to manufacturer's recommendation and intent of general bracing requirements. When general and specific bracing requirements enumerated above are in conflict with referenced standards, the most stringent requirements shall govern.

3.3 EXCAVATION AND BACKFILL: Perform all excavation and back fill required to install Work of Division 26, both inside and outside. Perform all excavation and backfilling in accordance with Division 2.

A. Excavation: Bury conduits outside building to a depth of not less than 24" (or as required by Code) below finish grade, unless noted otherwise.

B. Backfilling: Do not backfill until after final inspection and approval of conduit installation by all legally constituted authorities and recording of the buried items on the Record Drawings. Provide 1 sack concrete sand slurry for all backfill.

3.4 CUTTING AND PATCHING:

A. Cutting of Existing Structural Work: Holes in existing slabs and concrete walls shall be cored to the minimum size required. The Contractor shall submit Drawings showing dimensioned sizes and locations for all such holes to Architect for approval before cutting. Where required for conduit installation, slabs on grade shall be saw-cut to minimum required width; submit cutting Drawings to the Architect for approval before cutting.

B. Patching: Holes or chases shall be patched to match adjacent surfaces.

3.5 CONCRETE WORK: Concrete construction required for the Work of Division 26 shall be provided under the Work of Division 26.

3.6 PAINTING: Finish painting of electrical equipment will be as specified in Division 9, unless equipment is herein specified to be furnished with factory applied finish coats. Equipment to be field painted shall be furnished with a factory applied prime coat. All exposed conduits shall be painted to match the existing surface or painted per the AOR.

A. Touch-Up: If factory finish on any equipment furnished under Division 26 is damaged in shipment or during construction of building, the equipment shall be refinished by Contractor to satisfaction of Architect.

B. Concealed Equipment: Uncoated cast-iron or steel that will be concealed, or will not be accessible when installations are completed, shall be given one heavy coat of black asphalt before installation.

3.7 OPERATING INSTRUCTIONS: Contractor to provide services of an experienced Engineer to instruct Owner in operation of entire installation. Instructional period shall be during normal work day hours. This instruction period may be simultaneous with compliance tests.

3.8 COMPLIANCE TESTS: Conduct such tests of all portions of installation as may be necessary to ensure full compliance with the Drawings and Specifications. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete all the tests. Tests may be required on any item between installation of Work and the end of 1 year warranty period. Should these tests develop any defective materials, poor workmanship or variance with requirements of Specifications, Contractor shall make any changes necessary and remedy any defects at his expense.

A. All Feeders: Measure and record as follows:

1. 600 volt conductors shall be tested with 500 volt megger to ground on each phase. megger to be on test for one minute before any readings are taken. The minimum values on all feeders shall be 100,000 OHMS.
2. Copies of the certified test readings shall be transmitted to Owner.

3.9 SYSTEM ACCEPTANCE:

A. Final Review: The Contractor shall request a final review prior to system acceptance after:

1. Completion of installation of all systems required under the Contract Documents.
2. Submission and acceptance of operating and maintenance data.
3. Completion of identification program.

B. Acceptance: Is contingent on:

1. Completion of final review and correction of all deficiencies.
2. Satisfactory completion of acceptance tests demonstrating compliance with all performance and technical requirements of Contract Documents.
3. Satisfactory completion of training program and submission of manuals and Drawings required by Contract Documents.

3.10 PRELIMINARY OPERATION: The Owner reserves the right to operate portions of the electrical system on a preliminary basis without voiding the warranty or relieving the Contractor of his responsibilities.

3.11 **CLEAN-UP:** Conform to the Submittal Section. Upon completion and at other times during progress or Work, when required, remove all surplus materials, rubbish, and debris resulting from Work of Division 26.

END OF SECTION

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SECTION 260080

TECHNICAL SERVICES DIVISION START-UP SERVICE

1.0 GENERAL

1.1 OVERVIEW

A. As part of this project, start-up services will be performed on the electrical distribution and control equipment as specified. This specification is intended as a part of the electrical portion of this project.

B. The start-up service company must follow job site electrical safety requirements, installation standards and electrical testing standards per NEMA®, ASTM®, IEEE®, ANSI® C2, OSHA®, ANSI/NFPA® 70, ANSI/NFPA 70B, NFPA 70E, ANSI/NFPA 78, and ANSI/NFPA 101 guidelines.

C. Documentation of all procedures performed shall be provided. Four bond copies shall be provided and forwarded to the engineer. Written documentation must contain recorded test values of all electrical tests performed per the individual product specification.

D. Individual product start-up procedures must be submitted and on file with start-up service company office 10 days prior to the specified bid date.

E. Start up of panelboards, lighting transformers, safety switches, enclosed circuit breakers, and lighting contactors will not be part of this specification.

F. Start-up service scheduling must be available through a 24-hour, toll-free national dispatch system.

G. The start-up service company shall be present during energization of the primary distribution equipment. Job site and equipment access must be provided by the electrical contractor. De-energization of equipment, when required for testing, must be available within 15 minutes of the start-up service company arrival at the job site.

H. The contractor shall supply a power source, specified by the start-up service company, for on-site test equipment.

I. Start-up service shall be performed by authorized employee(s) of the equipment manufacturer.

2.0 PRODUCT

2.1 INSPECTION AND TEST PROCEDURES

A. Switchgear and Switchboard Assemblies

1. Visual and Mechanical Inspection

a. Equipment nameplate data shall be documented.
b. Verify the presence of all the manufacturers intended Documentation.

c. Inspect physical, electrical, and mechanical condition of switchboard/switchgear and all components.
d. Confirm correct application of lubricants at manufacturer's recommended locations.
e. Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study.
f. Verify drawings for correct revision and date in accordance with customer and supplier records.
g. Verify that current and potential transformer ratios correspond to drawings.
h. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench.
i. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
j. Verify correct barrier and shutter installation and operation.
k. Inspect all mechanical indicating devices for correct operation.
l. Verify that filters are in place and/or vents are clear.
m. Electrical Test
n. Perform insulation-resistance tests on each bus section, phase-to-phase and phase-to-ground.
o. Perform secondary current injection tests on the entire current circuit in each section.
p. Perform phasing check on double-ended switchgear to insure correct bus phasing from each source.

2. Test Values

a. Bolt torque levels are checked in accordance with U.S. Standards or manufacturer's specifications.
b. Insulation resistance testing is to be performed in accordance with the following guidelines:

MINIMUM VOLTAGE RATING TEST VOLTAGE
250 V 500 Vdc

3. Electrical Tests

a. Perform a contact-resistance test in accordance with manufacturer’s recommended procedure.
b. Perform an insulation-resistance test at 1000 Vdc from pole-to-pole and from each pole-to-ground with circuit breaker closed and across open contacts of each phase.
c. Make adjustments for the final settings in accordance with the coordination study supplied by contractor
d. Determine the following using secondary current injection:
   - Minimum pickup current
   - Long-time delay

- Short-time pickup and delay
- Instantaneous pickup value

e. Activate auxiliary protective devices such as undervoltage relays, to insure operation of shunt trip devices.
f. Check the operation of electrically operated circuit breakers in their cubicles.
g. Verify correct operation of any auxiliary features such as trip and pickup indicator, electrical close and trip operation, trip-free, and anti-pump function.
h. Check electric charging mechanism, if applicable.

B. Circuit Breakers-Low Voltage Molded Case/Insulated Case.

1. Visual and Mechanical Inspection

a. Document equipment nameplate data on test report.
b. Verify equipment nameplate ratings are in accordance with the customer's drawings and specifications.
c. Inspect circuit breaker for correct mounting.
d. Operate circuit breaker to insure smooth operation.
e. Inspect case for cracks or other defects.
f. Verify tightness of accessible bolted connections and/or cable connections by calibrated torque-wrench method.
g. Verify that trip units, shunt trip coils, auxiliary contacts and all other accessories are in accordance with the job specifications.

C. Cables: Low-Voltage, 600 V Maximum

1. Visual and Mechanical Inspection

a. Verify cable sizing and insulation temperature rating in accordance with customer's drawings.
b. Inspect exposed sections of cables for physical damage and correct connection in accordance with single-line diagrams.
c. Verify tightness of accessible bolted connections by calibrated torque wrench.
d. Inspect compression-applied connectors for correct cable match and indentation.
e. Verify cable color-coding with applicable engineer's specifications.

2. Electrical Tests

a. Test cables and leads for continuity to ensure correct cable connection and phasing rotation.
b. Perform an insulation resistance test on each conductor between one conductor and ground with the other conductors grounded.

D. Drives: AC

1. Visual and Mechanical Inspection

a. Document equipment nameplate data on test report.
b. Verify equipment nameplate ratings are in accordance with the customer's drawings and specifications.

c. Inspect controller for physical and mechanical condition.
d. Inspect for proper grounding.
e. Check customer cables, power wiring, and control wiring to insure correct installation.
f. Check for proper heaters used in ISO/bypass unit.
g. Check transformer taps for proper connection.
h. Check all terminal wiring.
i. Verify motor and drive sizing.

2. Electrical Test

a. Verify the proper selection and operation of the electrical test equipment and record the date of the last calibration date and the date due re-calibration.

E. Grounding Systems

1. Visual and Mechanical Inspection

a. Verify ground system is in compliance with drawings and specifications.

2. Electrical Tests

a. Verify the proper selection and operation of the electrical test equipment and record the date of the last calibration date and the date due re-calibration.
b. Perform fall-of-potential test or alternative in accordance with IEEE Standard 81-1991 on the main grounding electrode or system.
c. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.

2. Electrical Tests

a. Perform the following pickup tests using primary injection.
   - Verify that the relay does not operate at 90% of the pickup setting.
   - Verify pickup is less than 125% of setting or 1200 A, whichever is smaller.
d. Verify the presence of all the manufacturers intended Documentation.
e. Inspect physical, electrical, and mechanical condition of switchboard/switchgear and all components.
f. Confirm correct application of lubricants at manufacturer's recommended locations.
g. Verify that fuse and/or circuit breaker sizes and types correspond to drawings and coordination study.
h. Verify drawings for correct revision and date in accordance with customer and supplier records.
i. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench.
j. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
k. Verify correct barrier and shutter installation and operation.

l. Inspect all mechanical indicating devices for correct operation.
m. Verify that filters are in place and/or vents are clear.
n. Test operation, alignment, and penetration of instrument transformer withdrawal disconnects.

END OF SECTION

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SECTION 260111 – CONDUITS

PART 1 - GENERAL

A. The general provisions apply to this section.

1. WORK INCLUDED

A. Conduits; including:

1. Rigid steel conduit.
2. Intermediate metal conduit (IMC).
3. Electrical metallic tubing (EMT).
4. NOT USED
5. Polyvinyl chloride conduit (PVC).
6. Flexible metal conduit.
7. Liquid-tight flexible metal conduit.

1.2 DEFINITION

A. Conduit: This term shall be construed to mean conduit and conduit fittings; and tubing and tubing fittings.

1. RELATED WORK SPECIFIED ELSEWHERE

A. Support material: Section 260190.

PART 2 - PRODUCTS

2.1 MATERIAL AND FABRICATION - ALL MATERIALS SHALL BE MANUFACTURED IN THE USA.

A. Rigid Steel Conduit: Hot-dipped galvanized or sherardized including the threads, manufactured in accordance with ANSI C80.1 and UL6.

1. Threaded, hot-dipped galvanized or sherardized fittings manufactured in accordance with ANSI C80.4.

B. Intermediate Metal Conduit: Hot-dipped galvanized including the threads, manufactured in accordance with UL 1242.

C. Electrical Metallic Tubing: Manufactured in accordance with ANSI C80.3 and UL 797.

1. Provide compression fittings in walls, ceiling spaces or exposed construction areas.

2. Provide compression (water tight) fittings in damp areas or areas exposed to weather.

D. NOT USED

E. Polyvinyl Chloride Conduit: Schedule 40 and Schedule 80, manufactured in accordance with ANSI C33.91, UL 651, and NEMA TC-2.

1. Cemented type fittings of the same manufacturer as the conduit.

F. Polyvinyl Chloride Conduit: Type EB, heavy wall, manufactured in accordance with ANSI C33.91, UL651, and NEMA TC-8.

1. Cemented fittings of the same manufacturer as the conduit.

G. Flexible Metal Conduit: Hot-dipped galvanized steel, manufacturer in accordance with UL 1.

1. Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes and twist-in connectors for 3/4-inch flexible metal conduit.

H. Liquid-Tight Flexible Conduit: Hot-dipped galvanized with liquid-tight vinyl jacket.

1. Liquid-tight fittings.

PART 3 - EXECUTION

3.1 USE

A. EMT is allowed on this project.
B. Rigid steel, IMC, or rigid aluminum conduit in areas where exposed conduit could be subject to physical damage or where conduit is exposed and conductor phase to ground voltage exceeds 300 volts.
C. Rigid aluminum conduit is not allowed on this project.
D. PVC Conduit:
1. Schedule 40 or 80, for runs below grade in direct contact with earth.
2. Schedule 40 or 80, in concrete floors, walls or roofs.
3. Schedule 80 for all sweeps.
E. All exterior risers shall be PVC SCHEDULE 80 with bushings.
F. In concrete or below grade use conduit not smaller than 1 inch. Maximum size in concrete slab: 1 inch. Run larger sizes under slab.
G. Use long sweep elbows with minimum radius 10 times nominal conduit diameter.

3.2 INSTALLATION

A. Provide conduit support and bracing in accordance with the latest published SMACNA guidelines.
B. Perform excavating, trenching, backfilling, and compacting as specified in Division 2.
C. Minimum cover for runs below finished grade outside buildings: 24 inches except where noted or required by the serving utility. Minimum cover for conduit in concrete floors, walls or roof: 1/3 thickness of slab. Minimum cover under building slabs is 12-inches.

D. Minimum separation from uninsulated hot water pipes, steam pipes, heater flues or vents: 6 inches
E. Avoid running conduit directly under water lines.

F. Protect inside of conduit from dirt and rubbish during construction by capping all openings with plastic caps intended for the purpose.
G. Provide conduit bodies for exposed conduit runs at junctions, bends or offsets where required. Do not use elbows or bends around outside corners of beams, walls or equipment. Make conduit body covers accessible.
H. Make conduit field cuts square with saw and ream out to full size. Shoulder conduits in couplings.
J. Make conduit projections from covered areas to areas exposed to the weather watertight by proper flashing. Extend flashing a minimum of 6 inches in all directions from conduit.
K. Where conduit is to remain empty, install polypropylene or nylon pull-line 3/16" minimum diameter from end to end with tag at each end designating opposite terminations.
L. Run conduit parallel and at right angle to building lines, when visible in finished construction.
M. Cap conduits indicated to be stubbed-out underground using glued-on PVC caps intended for this purpose.
N. Install a coupling flush with the floor on all conduits stubbed up through floors on grade.
O. Make no bends with a radius less than 12 times the diameter of the cable it contains nor more than 90 degrees. Make field bends with tools designed for conduit bending. Heating of metallic conduit to facilitate bending is not permitted.
P. Where conduit installed in concrete or masonry extends across building construction joints, provide expansion fittings as manufactured by O.Z.; Crouse-Hinds; Appleton; or equal, with approved ground straps and clamps.
Q. Concrete Wall or Slab Penetrations: All core drilling, sleeves, blockouts or other penetrations must be approved by the Structural Engineer prior to installation.

    1. Space sleeves and core drills to insure a minimum dimension of 3 times the nominal trade diameter of the largest adjacent conduit between sleeves or core drills.
    2. Use block outs for concentrations of conduits in a confined area.

R. Do not penetrate walls with flexible conduit where subject to physical damage. Use recessed box with extension ring for transition from interior to exterior of wall.
S. All homeruns shown shall be run to the panel indicated independently of all other homeruns. Provide pull points so as not to exceed total bends of 360 degrees between them unless otherwise indicated.
T. At switchboards, manholes and floor standing distribution panelboards, provide insulated throat bushings or bell ends on all non-metallic conduit entries and bushings on all metallic conduit entries.
U. Provide bushings on all conduit terminations sized 1" and larger.
V. Provide weatherproof boxes and connectors for all exposed parking structure raceways and boxes.
W. Provide bell ends on all conduits into pullboxes and manholes, seal all conduits after conductors are pulled.
X. Cap all unused conduits with end cap. Do not tape.
Y. Provide conduit racking for all trench conduit systems.
Z. Provide 2 sack concrete slurry mix for all trench backfill with warning/locator tape 12” above.
AA. Provide minimum of 9” of asphalt in cut asphalt areas and “tack” all “cut” areas.
BB. Provide all low voltage cables (fire alarm, AV, Control, ETC.) in conduit, unless plenum rated cabling is used for communications or non-plenum (where applicable) com cable on j-hooks.

END OF SECTION 260111

SECTION 260120

CONDUCTORS

1.0 GENERAL

1.1 WORK INCLUDED

A. Conductors; for power, lighting, sound, communication and control, including conductors for general wiring, flexible cords and cables, and ground conductors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Conductors for General Wiring: Thermoplastic insulated rated for 600V manufactured in accordance with UL 83.

1. Provide 3/4 hard drawn copper conductors. Provide no conductor smaller than #12 AWG. Provide stranded conductors for #12 AWG and larger.

B. Conductor Connectors for General Wiring:

1. Sizes No. 12 to No. 10: Splice with insulated spring wire connectors.
   a. Ideal No. 451, 455 and 453.
   b. Minnesota Mining: Types Y, R, G, and B.
   c. Buchanan No. B1, B2 and B4.
2. Size No. 8 or Larger, Copper: Splice and terminate with compression or pressure type connectors and terminal lugs.

C. Provide connector sealing packs for all area lighting and exterior box splices which require complete protection from dampness and water.

1. Scotchlok No.'s 3576, 3577 and 3578, by 3M Company.

3.0 EXECUTION

3.1 USE

A. Conductors for General Wiring:

1. Minimum 90 degrees C temperature rated insulation on conductors in conduits, exposed on roof, or where required due to ambient temperature.
2. Stranded conductors at motors, audio video and other applications where subject to vibration.
3. Minimum size conductors for power and lighting #12 AWG, except where noted.
4. Minimum size conductors for control circuits #12 AWG stranded with THHN/THWN insulation.

B. Use flexible cords and cables for connection of special equipment as indicated. Length not to exceed 72 inches.
C. Ground Conductors:
   1. Provide an insulated green ground conductor for all branch circuit wiring where indicated.
   2. Bare copper conductor may be used.
      a. Install ground conductors in all non-metallic conduits as required by code. Install ground conductors in all motor branch circuits and all feeders. Where ground conductor size is not indicated, provide size as required for an equipment ground conductor by the National Electrical Code.
      b. Install ground conductors in all flexible metal conduits.
D. Install XHHW – 2, 90°C copper conductors for all underground installation

3.2 INSPECTION

A. Check conduit system for damage and loose connections, replace damaged sections.
B. Check for caps at conduit openings. Make sure that inside of conduit is free of dirt and moisture.
C. Pull mandrel, one size smaller than the conduit, through entire length of all underground conduits prior to conductor installation.

3.3 INSTALLATION

A. Conductors for General Wiring:
   1. Color code conductors insulation as follows:

CONDUCTOR	SYSTEM 208Y/120	VOLTAGE 480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow

   2. For conductors #6 AWG or larger, permanent plastic colored tape may be used to mark conductor in lieu of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.
      a. Provide color tape on each end and at all terminal points and splices on wire enclosed in conduit.
      b. Provide color tape every 3 feet on wire not enclosed in a listed wireway.
   3. When pulling conductors, do not exceed manufacturer's recommended values.
   4. Use polypropylene or nylon ropes for pulling conductors.
B. Insulate splices with plastic electrical tape: Scotch No. 33+, Tomic No. 1T, or equal.
C. Terminate all control wires with terminal lugs on terminal boards not designed with pressure plates. If splices are needed, use same procedure, installing a terminal board in a junction box for protection.
D. All splices or connections shall be compression type Thomas & Betts or Burndy, no split bolt connections are allowed.

3.4 IDENTIFICATION

A. Feeders: Identify with the corresponding circuit designation at over-current device and load ends, at all splices and in pull boxes.
B. Branch Circuits: Identify with the corresponding circuit designation at the over-current device and at all splices and devices.
C. Control Wires: Identify with the indicated number and/or letter designation at all terminal points and connections.

D. Alarm and Detection Wires: Identify with the indicated wire and zone numbers at all connections, terminal points, and coiled conductors within cabinets.
E. Conductors Terminated By Others: Indicate location of opposite end of conductor, i.e., Pull Box-Room 101.
F. For identification of conductors, use heat shrinkable white marking sleeves such as Brady Perma sleeve with type written identification.
G. Circuit designation is construed to mean panel designation and circuit number, i.e., LA-13.

END OF SECTION

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SECTION 260130

ELECTRICAL BOXES

1.0 GENERAL

1.1 WORK INCLUDED

A. Boxes; including:
   1. Outlet boxes.
   2. Pull and junction boxes.
   3. Cabinets.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Outlet Boxes:

   1. Pressed Steel Boxes: Knockout type, hot-dipped or electro-plate galvanized.
   2. Cast Iron Boxes: Hot-dipped or electro-plate galvanized with threaded hubs.
   3. Cast Iron Conduit Bodies: Hot-dipped or electro-plate galvanized with threaded hubs.
   4. Cast copper free aluminum conduit bodies with threaded hubs.
   5. Covers for Pressed Steel Boxes: Hot dipped or electro-plate galvanized.
   6. Outlet boxes manufactured in accordance with UL 514.

B. Pull and Junction Boxes:

   1. Sheet steel, hot-dipped or electro-plate galvanized, or prime coated and a final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.
      a. Where exposed to weather, provide raintight hubs for conduits entering the boxes, top and sides only.
   2. Floor Boxes:
      a. Single gang, similar to Hubbell #B-2536.
      b. Covers:
         1) Combination, similar to Hubbell #S-2525.
         2) Duplex receptacle, similar to Hubbell #S-3925.
      c. Carpet flange, similar to Hubbell #S-3075 thru #S-3079.
      d. Hubs: Provide hubs as required to suit the conduit arrangement.
   3. Pre-Cast Concrete Pull Boxes: As manufactured by Jensen Pre-Cast or Utility Vault and shown on drawings.
   4. High impact resistant PVC boxes: As manufactured by Carlon, Sedco, or R & G Sloan.

C. Cabinets: Sheet metal, prime coat and final coat of manufacturer's standard enamel or lacquer finish. Manufactured in accordance with UL 50.

   1. Control Cabinet: NEMA 1 enclosure, door with butt hinges and flush handle latches.

a. Provide with removable steel back panel.

2. Terminal Cabinets: NEMA 1 enclosure, door with concealed hinges and spring catch type flush cylinder locks. Key locks alike, provide two keys with each lock.
3. Provide engraved plastic nameplates with 1/2" minimum height letters indicating designation of control and terminal cabinets as shown on the drawings.
   a. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

3.0 EXECUTION

3.1 USE

A. Outlet Boxes:
   1. Ceiling Outlet Boxes: Not less than 4" octagonal by 2" deep.
   2. FDD cast iron or cast aluminum device boxes and conduit bodies with metal covers for exposed conduit installation. Provide gasket for covers in wet areas.
   3. Intercom, Microphone and TV Outlet Boxes: Not less than 4-11/16" square x 2-1/8" deep.
   4. Provide floor boxes with quantity of gangs as required for power, communication or control as indicated. Use boxes with barriers where required. Provide carpet flanges in carpeted areas.

B. Pull and Junction Boxes:
   1. Use sheet steel boxes NEMA Type 1 for indoor and NEMA Type 3R for outdoor installation, except as follows.
   2. Use pre-cast concrete boxes for boxes flush in finish grade where requiring a nominal capacity greater than 144 cubic inches, where located in vehicular traffic areas, or where indicated.
   3. Use polyvinyl chloride (PVC) boxes flush in finish grade when the nominal internal volume is less than or equal to 144 cubic inches or where indicated.
   4. Use cast iron boxes for boxes flush in slab on grade with traffic rated bolt on covers.

3.2 INSTALLATION

A. Provide 3/8" fixture studs in wall bracket and ceiling boxes.
B. Provide covers suitable for the fixtures or devices used.
C. Make outlet box covers flush with finished surfaces.
D. Close unused open knockouts with knockout seals.
E. Provide 1" deep plaster rings on recessed outlet boxes installed in areas where concrete will be exposed after construction is complete.
F. Where boxes are concealed in exposed concrete unit masonry, use square cornered types or boxes fitted with rings of sufficient depth for the box to be recessed completely within cavity of block or tile. Install box to insure that ring fits an opening sawed out of the masonry, so that no mortar is required to fill between ring and construction.
G. Provide a 6" base of compacted crushed rock under pre-cast concrete pull boxes.
H. Adjust floor boxes so they are level with top of finished floors.
I. Provide pull boxes and junction boxes in all branch circuit and feeder runs as indicated. Do not provide pull boxes unless they are indicated or required by the Electrical Code.

3.3 IDENTIFICATION

A. Junction Boxes: Use permanent black marker, 2” high lettering, and on each cover plate indicate the power source and circuits contained within that junction box.

END OF SECTION

SECTION 260140

WIRING DEVICES

1.0 GENERAL

1.1 SECTION INCLUDES

A. Wiring devices.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. General Conditions: Section 260000.

B. Boxes: Section 260130.

1.3 SUBMITTALS

A. In accord with Section 260010.

1.4 DEFINITION

A. Wiring devices: This term includes all wall switches, pushbuttons, receptacles, and plates used for general purpose installation.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Wall switches:

1. Quiet toggle type, 20A – 120/277 VAC rated, with terminal screws to take up to No. 10 AWG conductors:

	SPST	DPST	3-WAY	SPST KEY SWITCH LOCK	4-WAY
Arrow-Hart	1991-I	1992-I	1993-I	1991-L	1994-I
Bryant	4901-I	4902-I	4903-I	4901-L	4904-I
General Electric	GE5951-2	GE5952-2	GE5953-2	GE5951-OL	GE5954-2
Hubbell	1221-I	1222-I	1223-I	1221-L	1224-I
Pass & Seymour/ Legrand	20AC1-I	20AC2-I	20AC3-I	20AC1-L	20AC4-I

2. Momentary contact type, 20A-120/277V, two-circuit, three-position, center off:

Arrow-Hart	1995-I
Bryant	4921-I
General Electric	GE5935-2

Hubbell	1557-I
Pass & Seymour/Legrand	1250-I

3. Passive infrared wall switch sensors: Ivory, 180° field of view, adjustable time out and ambient light, 1200 sq. ft. Coverage, 120 VAC, 60 Hz, 1500W. Maximum load, incandescent and fluorescent. As manufactured by Hubbell No. AT1201 or Owner-approved equivalent by Leviton or Pass & Seymour.
4. Fan speed controllers: AC unit rated 15A - 120V used to control up to twelve 56 in./52 in./48 in. ceiling fans or up to twenty 42 in. fans on a single circuit. Rinaudo's Reproductions No. 22394.

B. Passive infrared motion switching system:

1. Ceiling mount sensor, white, 500 sq. ft. coverage, requires control unit. Hubbell No. ATD500CRP.
2. Ceiling mount sensor, white, 2000 sq. ft. coverage, ceiling height dependent, requires control unit. Hubbell No. ATD2000CRP.
3. Ceiling or wall mount sensor, white, 1000 sq. ft. coverage, requires control unit. Hubbell No. ATD1000CRP.
4. Ceiling or wall mount hallway sensor, white, covers area 75 ft. long by 20 ft. wide, requires control unit. Hubbell No. PIR90HW1.
5. Low-voltage control unit, 120VAC, controls one to four sensors. Mount in 4 in. x 4in. enclosure. Hubbell No. CU120A.
6. Relay, 120VAC coil, used when load to be controlled exceeds capacity of a single circuit. Hubbell No. AAR

C. Receptacles, caps, and connectors:

1. 15A-125V, NEMA 5-15, parallel slot type with grounding pin:

	DUPLEX	**SINGLE**	**GFI**
Arrow-Hart	5252-I	5261-I	GF5242-I
Bryant	5252-I	5261-I	GFR52FT
General Electric	5252-2	5261-2	TGTR115F
Hubbell	5252-I	5251-I	GF5252-I
Pass & Seymour/Legrand	5252-I	5261-I	1591-SHG

2. 15A-250V, NEMA 6-15, straight blade grounding type:

	RECEPTACLE	**CAP**
Arrow-Hart	5661-I	6666
Bryant	5661-I	5666-N
General Electric	GE4069-2	GED0611
Hubbell	5661-I	5666-C
Pass & Seymour/Legrand	5662-I	5666-X

3. 15A-125V, NEMA L5-15, locking type with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	4700	4721	4731
Bryant	4700	4721-NSY	4732-NSY
General Electric	GL4700	GLD0511	GLD0513
Hubbell	4700	4720-C	4729-C
Pass & Seymour/Legrand	4700	L515-P	L515-C

4. 20A-125V, NEMA 5-20, straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5361-I	5362-I
Bryant	5361-I	5362-I
General Electric	GE4102-2	GE4108-2
Hubbell	5361-I	5362-I
Pass & Seymour/Legrand	5361-I	5362-I

5. 20A-125V, NEMA L5-20, two-pole, three-wire locking type, with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6200	6202	6204
Bryant	70520-FR	70520-NP	70520-NC
General Electric	GL0520	GLD0521	GLD0523
Hubbell	2310-A	2311	2313
Pass & Seymour/Legrand	L520-R	L520-P	L520-C

6. 20A-125V, NEMA 5-20, two-pole, three-wire, straight blade isolated grounding type receptacle:

	DUPLEX	SINGLE
Arrow-Hart	IG5362	IG5361
Bryant	5362-IG	5361-IG
General Electric	GE8300-IG	GE8310-IG
Hubbell	IG-5362	IG-5361
ass & Seymour/Legrand	IG-6300	IG-5361

7. 20A-125 VAC, two-pole, three-wire, NEMA 5-20, straight blade, specification grade, ivory color, ground fault circuit interrupter receptacle (GFCI), rated for feed-through wiring, with LED indicator light:

	GFCI RECEPTACLE
Hubbell	GF-5362I
Pass & Seymour	2091-S-L-I
Leviton	6898-I

8. 20A-125/250V, NEMA 14-20, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5759	5757
Bryant	-	-
General Electric	GE1420	GED1421
Hubbell	8410	8411-C
Pass & Seymour/Legrand	L1420-R	L1420-P

9. 20A-250V, NEMA 6-20, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	8510	6866	6869
Bryant	5461	5466N	5469N
General Electric	GE4182	GED0621	GED0623
Hubbell	5461	HBL5466-C	HBL5469-C
Pass & Seymour/Legrand	5871	5466-X	5469-X

10. 20A-120/208V, NEMA L21-20, four-pole, five-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6470	6472	6474
Bryant	72120-FR	72120-NP	72120-NC
General Electric	GL2120	GLD2121	GLD2123
Hubbell	2510A	2511	2513
Pass & Seymour/Legrand	L2120R	L2120P	L2120C

11. 20A-250V, NEMA L6-20, two-pole, three-wire locking and grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6210	6212	6214
Bryant	70620FR	70620NP	70620NC
General Electric	GL0620	GLD0621	GLD0623
Hubbell	2320A	2321	2323
Pass & Seymour/Legrand	L620-R	L620-P	L620-C

12. 20A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6430	6432	6434
Bryant	71620-FR	71620-NP	71620-NC
General Electric	GL1620	GLD1621	GLD1623
Hubbell	2430A	2431	2433
Pass & Seymour/Legrand	L1620-R	L1620-P	L1620-C

13. 30A-125V, NEMA 5-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5716N	5717N	6716N
Bryant	9530-FR	9630-RP	-
General Electric	GE4138-3	GED0531	GED0533
Hubbell	9308	9309	-
Pass & Seymour/Legrand	3802	5921	-

14. 30A-125V, NEMA L5-30, two-pole, three-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6330	6332	6334
Bryant	70530-FR	70530-NP	70530-NC
General Electric	GL0530	GLD0531	GLD0533
Hubbell	2610	2611	2613
Pass & Seymour/Legrand	L530-R	L530-P	L530-C

15. 30A-125/250V, NEMA 14-30, three-pole, four-wire straight blade grounding type:

	RECEPTACLE	CAP
Arrow-Hart	5744N	5746N
Bryant	9430-FR	5746
General Electric	GE4191-3	GED1431
Hubbell	9430	9431
Pass & Seymour/Legrand	5740	5741-AN

16. 30A-125/250V, NEMA L14-30, three-pole, four-wire grounding and locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6510	6512	6514
Bryant	71430-FR	71430-NP	71430-NC
General Electric	GL1430	GLD1431	GLD1433
Hubbell	2710-A	2711	2713
Pass & Seymour/Legrand	L1430-R	L1430-P	L1430-C

17. 30A-250V, NEMA L6-30, two-pole, three-wire locking blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	6340	6342	6344
Bryant	70630-FR	70630-NP	70630-NC
General Electric	GL0630	GLD0631	GLD0633
Hubbell	2620-A	2621	2623
Pass & Seymour/Legrand	L630-R	L630-P	L630-C

18. 30A-250V, NEMA 6-30, two-pole, three-wire straight blade grounding type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5700N	5701N	6700N
Bryant	9630-FR	9630-ANP	-
General Electric	GE4139-3	GE4328-9	GE4373-9
Hubbell	9330	9331	-
Pass & Seymour/Legrand	3801	5931	-

19. 50A-208V (50A-600V), three-pole, four-wire locking type with ground:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	3769	3765	3764
Bryant	3769	3765	3764
General Electric	LD3769	LD3765	LD3764
Hubbell	3769	3765-C	3764-C
Pass & Seymour/Legrand	3769	3765	3764

20. 50A-125/250V, NEMA 15-50, three-pole, four-wire grounding straight blade type:

	RECEPTACLE	CAP
Arrow-Hart	5754N	5745N
Bryant	9450-FR	5745
General Electric	GE4181-3	GE4180-3
Hubbell	9450	9451
Pass & Seymour/Legrand	5750	5751-AN

21. 50A-125/250V, three-pole, four-wire grounding locking blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	CS6369	CS6365	CS6364
Bryant	CS6369	CS6365	CS6364
General Electric	-	-	-
Hubbell	CS6369	CS6365	CS6364
Pass & Seymour/Legrand	-	-	-

22. 50A-250V, NEMA 6-50, two-pole, three-wire grounding straight blade type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	5709N	5710N	6709N
Bryant	9650-FR	9650-RP	-
General Electric	GE4141-3	GED0651	GED0653
Hubbell	9367	9368	-
Pass & Seymour/Legrand	3804	3869	-

23. 60A-120/208V, three-phase, 60 Hz, five-pole, five-wire, watertight, with threaded cap:

	BOX	ANGLE ADAPTER	RECEPTACLE BODY	COMPLETE ASSEMBLY
Hubbell	26401	26404	26520	-
Crouse-Hinds	-	-	-	Area-6575
Russell Stoll	-	-	-	DS6516-FRAB-

24. 60A-480V, NEMA L16-20, three-pole, four-wire locking type:

	RECEPTACLE	CAP	CONNECTOR
Arrow-Hart	-	-	-
Bryant	-	-	-
General Electric	-	-	-
Hubbell	HBL 26410	HBL 26402	HBL 26418
Pass & Seymour/Legrand	-	-	-

D. Safety receptacle: 15A-125V, NEMA 5-15, straight blade grounding safety receptacle, Hubbell No. SG-62H-1.

E. Device cover plates:

1. Interior plates: Specification grade plastic, 0.1 in. thick, ivory in color, UL listed.
   a. Plates in kitchens and restrooms to be polished stainless steel, 0.040 in.
   b. MATV plate: RMS No. CA-4028.
2. Exterior plates: Choose type of exterior cover plate in accord with the device location and/or manner in which device will be used. Device cover plates shall be die-cast aluminum with hinged cover, rated for respective type of use specified below, or as indicated on Drawings.
   a. Outlet box weatherproof hoods: NEMA 3R rating, gasketed, for unattended use with cover closed, padlockable latching cover to meet OSHA lockout/tagout requirements, large cord opening and UL listed. As manufactured by Hubbell, Intermatic or Leviton.
   b. Low profile weatherproof cover: Gasketed, approved for use with cover open, self-closing hinged covers (two independent self-closing lids for duplex receptacles which are horizontally mounted), UL listed. As manufactured by Hubbell, Leviton or Pass & Seymour.

3.0 EXECUTION

3.1 INSTALLATION

A. Mount switches and receptacles in vertical position in building interiors.

B. Mount receptacles with weatherproof plates in horizontal position.

C. Install receptacles mounted vertically so that the ground contact falls on the top position, and horizontally-mounted receptacles with neutral pole in top position.

D. Use plastic blank plates on J-boxes in public areas.

E. Use mechanical type door switches for load control.

F. Install receptacles for plug in lighting fixtures within 36 in. of fixture location.

G. Use safety type receptacles with low profile weatherproof metal covers for all convenience outlets in guest accessible areas (i.e., queue lines, waiting areas, etc.).

H. All GFI type exterior receptacles shall be provided with weatherproof metal hoods.

I. GFI type receptacles shall not be fed-through wire.

END OF SECTION

SECTION 260142

NAMEPLATES AND WARNING SIGNS

1.0 GENERAL

Not Used.

2.0 PRODUCTS

2.1 NAMEPLATES

A. Nameplate shall be plastic laminate with 3/4" high letters in white on black background screwed onto equipment designations shall clearly state:

1. Equipment Enclosure Nameplates.

a. Manufacturer's nameplate including equipment design rating of current, voltage, KVA, HP, bus bracing rating, or as applicable.

b. Equipment nameplate designating system usage and purpose, system nominal voltage, equipment rating for KVA, amperes, HP and RPM as applicable. Designation data per drawings or to be supplied with shop drawings approval.

1. Device nameplates: Device usage, purpose, or circuit number; manufacturer and electrical characteristic ratings including the following:

a. Circuit Breakers: Voltage, continuous current, maximum interrupting current and trip current.

b. Switches: Voltage, continuous current, horsepower or maximum current switching. If fused, include nameplate stating "Fuses must be replaced with current limiting type of identical characteristics."

c. Contactors: Voltage, continuous current, horsepower or interrupting current, and whether "mechanically-held" or "electrically-held".

d. Motors: Rated voltage, full load amperes, frequency, phases, speed, horsepower, code letter rating, time rating, type of winding, class and temperature.

e. Controllers: Voltage, current, horsepower and trip setting of motor running over current protection.

2.2 WARNING SIGNS

A. Warning signs shall be minimum 18 gauge steel, white porcelain enamel finish with red lettering. Lettering to read "DANGER - HIGH VOLTAGE" in 1" letters. Warning signs to be included on door or immediately above door of all electrical equipment rooms, vaults or closets containing equipment rooms, vaults or closets containing equipment energized, except where such spaces are accessible from public areas.

2.3 WARNING SIGN DESIGNATION

A. Warning designation in 1" red letters shall be painted by stencil or pre-printed adhesive on each pull box, cabinet or 1-foot length of exposed conduit stating "DANGER" and giving voltage of enclosed conductors.

3.0 EXECUTION

3.1 INSTALLATION

A. Nameplates shall be mounted by self-tapping or threaded screws and bolts or by rivets.

B. Signs shall be permanently mounted with cadmium plated steel screws or nickel-plated brass bolts.

END OF SECTION

SECTION 260164

BRANCH CIRCUIT PANELBOARDS

1.0 GENERAL

1.1 WORK INCLUDED

A. Branch circuit panelboards.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Provide factory assembled, enclosed panelboards in dead front cabinets, with doors, surface mounted or recessed as indicated, not less than 20" wide and 5-3/4" deep. Height will depend on the number of breakers and spaces.

B. Where a control compartment is indicated, provide an integral compartment with a separate hinged lockable door held with captive screws. Identify all internal control wiring with manufacturers wire numbering or control wire numbering when indicated, at all terminal points and connections.

C. Provide feeder terminal lugs for both main lugs only and main breakers rated for use with copper conductors.

D. Provide full length copper bussing including areas indicated as space only.

E. Provide full size neutral bus where neutral bus is indicated. Provide equipment ground bus and bolt-on circuit breakers.

F. Key all door locks alike.

G. 120/208V, 3 Phase, 4 Wire Panelboards: Square-D Co. Type NQOD or Powerlink G3 NF with programmable module where designated, or approved equal

H. All equipment shall be listed to meet or exceed the available fault current by 10%.

I. Panel cover doors shall be continuous hinged to allow for access without removing the entire dead front.

J. All placards are welded steel type.

3.0 EXECUTION

3.1 INSTALLATION

A. Secure panelboards to building structure to withstand wire pulling strains.

B. Secure surface mounted panelboards to wood studs or channel material spanning metal studs.

C. Do not use toggle bolts.

D. Contractor shall program lighting control Powerlink panelboard per owner's requirements.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all branch circuit panelboards shown on the single line diagram.

B. Provide panelboard and source feed designation on nameplates with 3/8" minimum height lettering for the panel name and 1/4" height lettering for the source feed designation.

EXAMPLE: LA
FED FROM: DLA

C. Secure nameplates with at least two spaces or rivets. Cementing and adhesive installation not acceptable.

D. Provide a typewritten directory for each branch circuit panelboard, showing each circuits and its use. Provide metal directory frame with plastic window.

END OF SECTION

SECTION 260170

DISCONNECTS

1.0 GENERAL

1.1 WORK INCLUDED

A. Disconnects: Switches, fused or unfused.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square D Company

B. EATON or ABB

2.2 MATERIAL AND FABRICATION

A. Provide heavy duty type, quick-make, quick-break disconnects with cover interlocks.

B. Provide NEMA Type 1 enclosure for dry locations, provide the proper enclosure for other locations as indicated. NEMA type 3R for wet locations.

C. Provide motor rated toggle switches where indicated.

D. Provide fused disconnect for elevator drive motors.

E. Provide rejection clips on disconnects where rejection type fuses are to be installed.

3.0 EXECUTION

3.1 INSTALLATION

A. Securely fasten disconnects to structure to withstand wire pulling strains.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on individually mounted disconnects with minimum 1/4" height letters indicating the load served and the source feed designation.

EXAMPLE: LOAD: A/C-1
FED FROM: DHA-1

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION

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SECTION 260190

SUPPORT DEVICES

1.0 GENERAL

1.1 WORK INCLUDED

A. Support devices for conduit, boxes, lighting fixtures and equipment.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hangers, Straps and Beam Clamps:

1. Efcor.
2. Raco, Inc.
3. Steel City.
4. O.Z./Gedney Co.
5. Caddy Fastening System by ERICO Products Inc.

B. Channels and Fittings:

1. Kindorf.
2. Unistrut Corp.

C. Anchors:

1. Acherman-Johnson Corp.
2. Phillips Drill Co.
3. Rawl Products Co.

2.2 MATERIAL AND FABRICATION

A. Hangers: Steel cadmium plated.
B. Straps: One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.
C. Beam Clamps: Malleable iron, hot-dipped galvanized or cadmium plated.
D. Channels and Fittings:

1. Channels: Hot-dipped galvanized.
2. Fittings: Galvanized.

E. Anchors: Self drilling and expansion bolt types. No wood or fiber plugs or concrete nails are acceptable.

3.0 EXECUTION

3.1 USE

A. Use one-hole or two-hole straps for single conduit runs on walls or ceilings.

B. Use hangers with solid steel rods for hanging single conduits.
C. Use formed channel trapezes for groups of two or more conduits.
D. To fasten boxes and supports to:

1. Wood: Use wood screws or screw type nails of equal holding power.
2. Brick and Concrete: Use bolts and expansion shields.
3. Hollow Masonry Units: Use toggle bolts.

E. Support sheet metal boxes from building structure directly or by bar hangers.
F. Do not penetrate reinforced concrete beams with fastenings more than 1-1/2" or reinforced concrete joints with more than 3/4" fastenings to prevent contact with reinforcing steel.

END OF SECTION

SECTION 262420

SWITCHBOARDS

1.0 GENERAL

1.1 WORK INCLUDED

A. Floor standing switchboards; including main and feeder overcurrent protective devices, underground pull sections, disconnects and metering equipment as required.

1.2 QUALITY ASSURANCE

A. Reference Specification and Standards:

1. Standard for Safety for Dead-Front Switchboards, UL 891.
2. Requirements of the serving utility company.

1.3 RELATED WORK SPECIFIED ELSEWHERE

A. Submittals: Section 260000.
B. Disconnects: Section 260170.

2.0 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Square-D Co.
B. ABB, Eaton or approved equal

2.2 MATERIAL AND FABRICATION

A. Provide switchboards with the voltage and ampere ratings for the main breaker or disconnect, the main bus and the feeder breakers, or disconnects and fuses as indicated on the one-line diagram. All equipment shall be listed to meet or exceed the available fault current.

1. Provide busbars of silver plated copper.
2. Provide full length bussing including areas indicated as space only.
3. Provide circuit breakers or disconnects for the main and feeders, as indicated.
4. Provide full length copper ground bus.
5. Provisions for padlocking the circuit breakers or disconnect in the "on" and "off" positions.
6. Provide reverse feed rated circuit breakers
7. Provide full rated bussing (no cascading).
8. All equipment shall be listed to meet or exceed the available fault current by 10%.
9. Provide metering for KW, KVA, amperage, power factor and demand metering at main service entry.

B. Coordinate with the serving utility company and provide all required service components including, but not limited to, the incoming lugs, metering sockets, current transformers, test blocks, etc.

3.0 EXECUTION

3.1 INSTALLATION

A. Secure switchboards to structure to withstand wire pulling strains.
B. Install switchboard sections plumb and in straight horizontal alignment as indicated. Securely fasten to one another, and anchor to floor slab with adequate concrete inserts and 5/8-inch bolts. As a minimum, four anchors per section are required.

3.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates on all switch boards not shown as existing on the single line diagram, unless otherwise noted.
B. Provide switchboard designation on nameplates with 3/4" height minimum lettering.
C. Provide engraved plastic nameplates with 3/4" minimum height letters indicating circuit designation at branch overcurrent devices in switchboards.
D. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION

SECTION 26 05 48 - ELECTRICAL SYSTEMS VIBRATION ISOLATION AND SEISMIC RESTRAINT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. All general conditions and supplementary general conditions apply to the work of this section.

1.2 SUMMARY

A. Principal work included in this Section
   1. Vibration isolation and seismic restraint of electrical and power generating equipment.
   2. Noise control of electrical and power generating equipment.

1.3 GENERAL REQUIREMENTS

A. Submittal
   1. Catalog cuts and data sheets on specific vibration isolators, mufflers, electrical box pads and other equipment to be utilized, showing compliance with the specification.
   2. An itemized list showing the items of equipment to be isolated, the isolator type and model number selected, isolator loading and deflection.
   3. For cable restraints, the cable size, location and attachment to the structure shall be approved with calculations signed by a structural engineer licensed in the State in which the work is to take place.
   4. Submittal drawing shall indicate proposed method of vertical restraint.
   5. Generated sound power levels and muffler insertion losses for generators showing compliance with the requirements of this specification.

B. Conflicts and Discrepancies
   1. Bring to the architect's attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, raceways, etc., described herein. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

1.4 SEISMIC RESTRAINTS REQUIREMENTS

A. Seismic restraint shall be furnished and installed in accordance with all relevant State and local code requirements.

1.5 RESPONSIBILITY OF MANUFACTURER

A. Vibration isolation manufacturer shall have the following responsibilities:
   1. Determine vibration isolation sizes and locations.
   2. Provide equipment isolation system as scheduled or specified.
   3. Guarantee specified isolation system deflection.
   4. Provide installation instructions and drawings.
   5. Provide calculations signed by a structural engineer licensed in the State in which the work is to take place certifying that the seismic restraints will act in accordance with the relevant State and local codes and will maintain equipment in captive position.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATION AND NOISE CONTROL REQUIREMENTS

A. Vibration Isolation Schedule
1. See Part 3 for vibration isolation schedules.

B. Flexible Electrical Connections
1. At all transformers within buildings.
2. At connections to motors, generators, or other vibrating equipment.
3. Floor-mounted distribution panels connected to transformers.

C. Emergency Generator
1. Generator exhaust: super critical muffler.
2. Muffler insertion loss values must meet or exceed the table below:

Grade	Minimum Insertion Loss Values (dB re: 20 µPa) per Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Super Critical	29	40	42	39	38	37	33	32

3. Noise level at air intake or exhaust must not exceed the values documented in the table below:

Noise Source	Maximum Sound Power Level (dB re: 10^{-12} W) per Octave Band Center Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Exhaust	132	130	125	122	117	118	118	114
Mechanical	115	122	120	120	117	115	118	124

2.2 VIBRATION ISOLATORS

A. General Properties
1. All vibration isolators shall have markings indicating un-deflected heights.
2. All isolators shall operate in the linear portion of their load-versus-deflection curve. Load-versus-deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.
3. The ratio of lateral-to-vertical stiffness shall not be less than 1.0 or greater than 2.0.
4. The vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than □10%.
5. Isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system, with a minimum isolation of 50 decibels above 150 Hz
6. All neoprene mountings shall have a shore hardness of 50 to 60 after minimum aging of 20 days or corresponding oven aging.
7. All vibration isolation equipment exposed to moisture or an outdoor environment shall be coated as follows:
   a. All hardware is to be zinc-plated and epoxy-powder-coated.
   b. All bolts and springs are to be epoxy-powder-coated or electro-galvanized.
   c. Bases shall be cleaned, primed, and painted on-site with approved corrosion-resistant paint.
8. All isolators shall have an OPA approval number.

B. Isolator Types and Descriptions
1. Type AS is a complete vibration isolation system consisting of minimum of three air springs, height sensing valves and associated interconnecting air tubing. Air tubing

and connection shall also be provided to a source of compressed air providing a minimum 100 psi. An air compressor is required and is included in this work. One height control valve shall be provided at each mounting location. If there are two or more air springs per location, they shall be connected to the outlet of the height control valve in parallel. The air spring shall operate at its normal operating height and the maximum pressure shall not exceed the manufacturer's recommendations. The air system shall maintain an elevation of 1/8 inch, once adjusted. Height limit stops shall be provided to preclude more than 1/4-inch change in elevation in the event of failure. Basis of design: Mason Industries type MT, or approved equal.

2. Type HMN is a neoprene isolator incorporating steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also includes floor mounting holes. The isolator shall have a rated deflection of 0.20 inches (5 mm) compression, 0.175 inches (4.5 mm) in tension and 0.125 inches (3.2 mm) in shear. The isolators shall be Mason Industries Type BR or approved equal.
3. Type HN is a suspension hanger with a steel box frame and a molded neoprene in shear element. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so no metal to metal contact occurs. Basis of design: Mason Industries type HD, or approved equal.
4. Type HS is a suspension hanger with a steel box frame and a steel spring resting on a neoprene cup. The cup shall contain a steel washer designed to distribute the load evenly to the neoprene and prevent its overload or extrusion. The spring diameter and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so no metal to metal contact occurs. Hangers shall be provided with an eye bolt on the spring end. Basis of design: Mason Industries type 30, or approved equal.
5. Type MSL is a bare, stable, steel spring with a ribbed neoprene pad under the base plate. Bolt holes shall be provided in the baseplate to permit attachment to the building structure. Limit stops shall be provided to prohibit spring extension if the load is removed. These stops may also serve as rigid blocking during erection so that the installed and operating heights shall be the same. Clearance shall be maintained around restraining bolts and between the limit stops and the housing so as not to interfere with the spring action. Basis of design: Mason Industries type SLR, or approved equal.
6. Type UFB is a unistrut assembly, comprised of UV and weather-resistant closed-cell polyethylene foam with embedded unistrut channels, equivalent to FNW type 7701.
7. Type WMN is a neoprene isolator incorporating a steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also includes floor mounting holes. The isolator shall have a rated deflection of 0.15 inches compression, 0.12 inches in tension and 0.09 inches in shear. Basis of design: Mason Industries type RBA/RCA, or approved equal.

2.3 FLEXIBLE CONNECTIONS

A. Conduit over 1 inch OD: Make electrical connections to vibrating equipment via flexible expansion/deflection conduit coupling sized as required. Coupling shall have a flexible and watertight outer jacket, an internal grounding strap, plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit. Acceptable units include:
   1. XD Expansion Deflection Coupling by Crouse-Hinds of Syracuse, N.Y.
   2. Type DF Expansion and Deflection fitting by Spring City Electrical Mfg. Co. of Spring City, PA.

B. For conduit under 1 inch OD: Use flexible conduit with slack at least 3 feet long.

2.4 EQUIPMENT FRAMES

A. General
1. Mounting frames and/or brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

B. Frame Types
1. Type A frame is a wide flange structural steel frame with brackets as shown on the drawings. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005 inch. A wide flange section depth greater than 1/10th the length of the longest frame member will be accepted as satisfying the deflection requirement.
2. Type B frame is a channel steel structural frame with brackets as shown on the drawings. The section depth shall be greater than 1/10th the length of the longest frame member.
3. Type C frame is a steel bracket or gusset welded or bolted directly to the machine frame in order to accommodate the isolator.

2.5 SEISMIC RESTRAINTS

A. Cable Restraints
1. For vibration-isolated equipment or piping, seismic sway braces shall consist of galvanized steel aircraft cables.
2. Steel aircraft cables shall be pre-stretched to establish a certified minimum modulus of elasticity. Cables braces shall be designed to resist seismic tension loads and steel braces shall be designed to resist both tension and compression loads with a minimum safety factor as specified by the structural engineer. Brace end connections shall be steel assemblies that swivel to the final installation angle. Do not mix cable and steel braces to brace the same system.
3. The bracing system shall have an Anchorage Preapproval OPA Number from OSHPD in the State of Arizona verifying its capability to resist seismic forces.
4. Basis of Design: Cable brace assemblies shall be Type SCB as manufactured by Mason Industries, Inc.

B. Snubbers
1. Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
2. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
3. Resilient Isolation Washers and Bushings:
   a. Oil- and water-resistant neoprene.
4. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.

2.6 EXECUTION

2.7 INSTALLATION OF VIBRATION ISOLATION DEVICES

A. The contractor shall coordinate his work with other trades to eliminate rigid contact between isolated transformers, raceways and the building. Contractor shall inform other trades following work contact between vibration isolated electrical equipment and other building systems is not permissible.

B. Transmission of perceptible vibration or structure borne noise to occupied areas by equipment installed under this Contract will not be permitted.

C. Install vibration isolators per manufacturer's directions.

D. The contractor shall obtain inspection and approval from the architect of any installation to be covered or enclosed prior to such closure.

E. The contractor shall obtain written and/or oral instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices and seismic restraints.

F. Provide a maximum of four vibration isolators located at the corners of the equipment unless approval is obtained for additional isolators.

G. Flexible electrical connections.
1. Installation of flexible electrical connections to vibration isolated equipment shall in no way impair or restrain the function of the aforementioned vibration isolation.
2. Option 1: Install the flexible conduit in a grossly slack loop form or shallow U form. Install the stranded conductors with sufficient slack to accommodate maximum possible movement.
3. Option 2: The flexible coupling shall be free and not in contact with any nearby building construction and shall be installed slack and free of strain in any direction. Install stranded conductors as above.

H. All vibration isolation devices, including auxiliary steel bases shall be designed and furnished by a single manufacturer or supplier, who will be responsible for adequate coordination of all phases of this work.

I. The vibration isolation manufacturer, or his representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Architect in writing, certifying the correctness of installation and compliance with approved submittal data.

. Vibration Isolation Hangers
1. The isolators shall be installed with the isolator hanger box as close as possible to the structure.
2. Hanger rods shall be aligned to clear the hanger box and be plumb.

. Neoprene Pads
1. Anchor bolts that penetrate neoprene pads, or would otherwise short-circuit the pad or other vibration isolators, must be fitted with neoprene washer bushings with steel washers.
2. Anchor bolts must be installed so that they are centered in the washer bushing with a steel washer between the anchor bolt head and the washer bushing. When the anchor bolts are set in place they must not over-compress the washer bushing assembly.

L. Cable Restraints
1. Cables shall be installed with sufficient slack to avoid short circuiting the vibration isolation.

2.8 COORDINATION

A. The contractor shall coordinate his work with other trades to avoid rigid contact between isolated equipment and raceways with the building. He shall inform other trades following his work to avoid any contact which would reduce the vibration isolation.

2.9 ELECTRICAL EQUIPMENT SEISMIC AND VIBRATION ISOLATION SCHEDULE

A. Notes:
1. Seismic restraint is built into the vibration isolator.
2. Cable restraints – see 2.5A Cable Restraints.
3. Snubber restraints – see 2.5B Snubbers.
4. Only allowed for units 100 VA and less on walls without adjacent occupancies.

Equipment Type		Design Deflect.	Isolator		Frame		Mounting Detail	Seismic Restraint	
			Type	Detail	Type	Detail		Type	Detail
Transformers	Floor-mounted	0.3 inch	HMN	29	—	—	—	(Note 1)	—
	Suspended	0.2 inch	HN	3	—	—	—	(Note 2)	SE-2,4
	Wall-mounted	Not permitted.							
Distribution Panels Connected to Transformers	Floor-mounted	0.3 inch	HMN	29	—	—	—	(Note 1)	—
	Wall-mounted	0.1 inch	WMN	62	—	—	(Note 4)	(Note 1)	—
Emergency Generator Sets		2.0 inch	MSL	5	A	14	—	(Note 1)	—
Emergency Generator Mufflers/Diesel Particulate Filters and Associated Piping		2.0 inch	HS	6	—	—	—	(Note 2)	SE 2,4
Emergency Generator Fuel, Oil, and Water Piping		—	UFB	—	—	—	8	—	—
Suspended Raceways within Unit Substation Rooms (inc. Department of Water and Power)		0.2 inch	HN	3	—	—	—	(Note 2)	SE-2,4
Unit Substations	On-grade	0.2 inch	HMN	29	—	—	—	(Note 1)	—
	Above Grade	—	AS	7	A	14	—	(Note 3)	SE-1

END OF SECTION 26 05 48

SECTION 262450

GROUNDING

1.0 GENERAL

1.1 REFERENCES

A. N.E.C.: Article 250 "Grounding".

B. Underwriter's Laboratories (U.L.). Standard A67 - "Grounding and Bonding Equipment". STD 869 - Grounding and Bonding.

C. ITEE - Standards 142 and 241.

1.2 DESCRIPTION OF SYSTEM:

A. A permanent grounding system with methods and materials in accordance with applicable Codes and Standards, able to conduct ground fault currents to the grounded neutral of electrical distribution systems, and limit potential differences between grounding conductors, raceways and enclosures.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's data on grounding systems and accessories.

B. Shop Drawings: Submit layout drawings of grounding systems and accessories including, but not limited to, ground wiring, copper braid and bus, ground rods, and plate electrodes.

1.4 QUALITY ASSURANCE:

A. Installer qualifies with at least 3 years of successful installation experience on projects with electrical grounding experience similar to that required for project.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Handle electrical grounding accessories and components carefully to avoid damage. Store in location that will protect from dirt and weather.

2.0 PRODUCTS

2.1 GROUND RODS:

A. Copper clad steel, unless indicated otherwise. Minimum dimension of 5/8" diameter by 8' long or larger if indicated and sectional rods with couplings where lengths exceeding 12' are specified or indicated, or where added driving depth is required to achieve a specified minimum resistance.

2.2 GROUNDING ELECTRODE:

A. Bare stranded copper, 3/0 AWG unless indicated otherwise, for installation in soil or embedded in concrete and cable with type TW insulation when installed in raceway. Install without splice from connection to connection.

2.3 GROUNDING CONDUCTORS:

A. Type TW insulation, unless specified or indicated otherwise with a continuous green outer insulating jacket for size #6 AWG and smaller and with green tape banding for #4 AWG and larger, marked at each access point (e.g.: Junction boxes, Enclosures).

2.4 CLAMPS AND PRESSURE CONNECTORS:

A. Cast copper, copper alloy, or bronze alloy suitable for use with aluminum and copper. Double bolt type with formed shoe and "U" cable clamp for connection to pipe or conduit; Single bolt type with cable shoe and "U" clamp for connections to flat bar or metal; and double bolt, parallel conductor split clamp type for cable to cable connections.

2.5 WELDED CONNECTIONS:

A. Exothermic process (Cadweld or Thermoweld).

2.6 EQUIPMENT ROOM GROUND TERMINAL BAR:

A. Copper 1/4" X 2-1/2" X 24", unless otherwise indicated. Two rows of holes on 1-1/2" centers for 1/2" bolt, to receive cables from two directions.

3.0 EXECUTION

3.1 GENERAL:

A. Ground conductive raceways, cable trays and enclosures for electrical systems wiring. Make ground circuits complete to form permanent conductive paths. Solidly ground each low voltage electrical system unless indicated or specified as ungrounded, or grounded through an impedance of a specified value. Provide bare conductors when in open air or soil and provide 600 volt, green, insulated conductors when in raceway.

3.2 MAIN GROUNDING JUMPER:

A. Install a main grounding jumper between the system neutral and the enclosure ground bus (or directly to enclosure where ground bus is not present) at each location where system grounding is required. Main grounding jumper:

1. Formed bus in switchboards and panelboards.

2. Formed bus or copper cable in transformers not coupled in unitized assembly with distribution equipment.

3.3 GROUND CONNECTIONS:

A. Make grounding electrode connections electrically ahead of any overcurrent or disconnect device or tap connection such that disconnection of neutral load conductors does not interfere with or remove the system ground connection. Use separate lugs on the

transformer neutral terminals for neutral and main grounding jumpers when cable is used for transformer connections.

3.4 SEPARATELY DERIVED SYSTEMS:

A. For each separately derived system, grounded or ungrounded, install a grounding electrode conductor between each system enclosure ground bus (or bolted connection to enclosure where ground bus is not present) and a cold water pipe or building structural steel of one (1) inch size or larger near the separately derived system ground connection. Make connections to water pipes or steel accessible for easy inspection. Provide a separate ground conductor for each audio, video, isolated panels and UPS as noted on the plans.

3.5 SERVICE GROUND:

A. For each low voltage service, install a grounding electrode conductor between the system enclosure ground bus and the water service entrance to the building and install bonding jumpers around insulating unions and removable fittings in the water pipe between the grounding electrode conductor connection to the water pipe and the water service entrance.

3.6 GROUNDING ELECTRODE SYSTEM:

A. Install a complete grounding electrode system with interconnecting cables and terminations at the equipment room ground terminal bar. Make connections to the grounding electrode system accessible. Install the following grounding electrode systems:

1. Metal frame of building.

2. Grounding electrode encased by at least two inches of concrete, within and near the bottom of the building foundation or footing of the type specified in Part 2 - Products, at least 20 feet in length without splice from connection to connection.

3. Connection of other metal piping systems as required by National Electrical Code Article 250.

4. Driven ground rods.

5. Driven steel piles.

6. Connection to water service with bonding jumper around water meter.

3.7 GROUNDING ELECTRODE CONDUCTORS:

A. Install grounding electrode conductor in PVC or other non-conductive, non-metallic enclosure where a raceway system is indicated or necessary for conductor installation. Install grounding electrode conductors without splice from the enclosure ground bus to the connection at the grounding electrode system.

3.8 GROUND RODS:

A. Install a vertical position, full length below grade unless specified otherwise, and with conductor and top of rod 6" minimum below grade. Provide exothermic welds at all connections.

3.9 EQUIPMENT ROOM GROUND TERMINAL BAR:

A. Install in equipment rooms where indicated. Mount bar by anchors and bolts using 1-1/2" long segments of 1/2" rigid conduit as spacer between bar and wall. Use a minimum of two supports, 18" on center. Connect grounding electrode system conductors, system enclosure ground bus, and other indicated electrode systems to the terminal bar. Label permanently all ground conductors as to destination location, e.g. TR1, panel IPS, etcetera.

3.10 EQUIPMENT GROUND:

A. Form the equipment ground circuits with rigid metallic raceways (e.g., EMT, rigid steel conduit) unless indicated otherwise. Make all threaded coupling connections wrench tight. Install bonding jumpers for continuity around fittings and terminations where the conductive raceway is made non-continuous. Where indicated or specified, install ground conductors in raceways to augment the circuits formed by the metallic raceway system. Bond the conductors to boxes or enclosures in which access is possible. Size conductors as specified, indicated, or required by code, whichever is larger. Install grounding bushings and bonding jumpers to enclosures or ground bussing for the following: Service entrance feeder; each location where multiple ring knockouts are damaged during conduit installation; each location where conduits are stubbed up into floor mounted and each conduit termination at a painted enclosure where paint is not removed before installation of raceway.

3.11 FLEXIBLE RACEWAY GROUNDING:

A. Install a ground conductor inside all flexible raceways (e.g., Flexible steel, liquid tight) regardless of length. Bond the conductor to the enclosure or ground bus in the nearest box or access on either side of the flexible section. Size conductor as specified, indicated, or required by code, whichever is larger.

3.12 NON-CONDUCTIVE RACEWAY:

A. Install a ground conductor in raceways of non-conductive materials. Bond conductor to conductive enclosures in which access is possible. Bond non-current carrying conductive equipment contained in a non-conductive enclosure. Install insulated or bare conductors, sized as specified, indicated, or required by code, whichever is larger.

3.13 SECTIONAL RACEWAY:

A. Install a ground conductor in sectional raceways with removable covers for access (e.g., Plug-in strips, surface raceway systems, and wireways) unless specified otherwise. Size conductor in accordance with the N.E.C. for the largest phase conductor size installed in raceway, or as indicated. Bond sections of the raceway to the ground conductor. Connect receptacle ground terminals in the raceway to the ground conductor, and make other ground connections indicated on the drawings.

3.14 CABLE SUPPORT SYSTEMS:

A. Ground elements of the cable support system to panelboards, cabinets and switchboards from which their circuits originate. Install a ground conductor sized as required by code, as indicated, or #12 AWG, whichever is larger.

3.15 MULTI-CONDUCTOR CABLE, METALLIC SHEATH:

A. Use multi-conductor cable with metallic sheath or armor approved for use as ground circuit conductor or install ground conductor(s). Size ground circuit conductor as required by code, as specified, or as indicated on the drawings, whichever is larger. Terminating devices for cable using the sheath or armor as the ground circuit conductor shall be approved for use as the connecting device between the cable and the enclosure. Terminate internal ground circuit conductors by lug to the interior of the enclosure or to the contained ground bus where present. Use bare or clearly identified internal grounding conductors.

3.16 MULTI-CONDUCTOR CABLE, NON-METALLIC SHEATHED:

A. Use only non-metallic sheathed multi-conductor cables having a ground circuit conductor enclosed in the sheath the same size as the ungrounded conductors. Use bare or clearly identified internal grounding conductors. Terminate ground circuit conductor by lug to the enclosure ground bus where present or to the interior of the enclosure.

3.17 GROUND CONDUCTOR BONDING:

A. Bond grounding conductors to boxes or enclosures at each access point. Do not use building steel as equipment grounding path. Use welded ground connections, at least where such are buried in soil, installed below slabs on grade, or embedded in concrete.

END OF SECTION

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SECTION 262510

LIGHTING FIXTURES

1.0 GENERAL

1.1 SUMMARY

A. Section includes:

1. Lighting fixtures, including lamps, accessories and support materials.

B. Related work:

1. Submittals: Section 26 0000.

2. Outlet and Junction Boxes: Section 26 0130.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Fixtures schedule lists one or more acceptable manufacturers for each fixture type.

B. Provide all lighting fixtures of each type from the same manufacturer.

C. Provide sockets for screw base lamps of plated steel, brass or bronze.

D. Provide lighting fixtures manufactured in the USA.

E. Flexible steel metal conduit systems connecting individual tandem wired lighting fixtures.

1. Conductors carrying line voltage and current shall be sized in accordance with the overcurrent device protecting the circuit indicated.

2. Provide a #12 AWG minimum size ground conductor.

F. Provide electronic ballasts/drivers approved for use in Title 20 for all fixtures

3.0 EXECUTION

3.1 INSTALLATION

A. Provide a lighting fixture for each lighting outlet indicated.

B. Provide recessed and semi recessed fixtures with mounting frames compatible with the ceiling and wall systems employed and secure fixture mechanically to frame.

C. Align rows of suspended and surface mounted fluorescent fixtures to form straight lines

at uniform elevations.

D. Provide swivel ball type hangers which will allow a minimum of 45 degrees angle for fixtures indicated as pendant mounted.

E. Make recessed fixture fit snugly against ceiling to prevent light leakage.

F. Support suspended and surface mounted fluorescent fixtures as follows:

1. Fixtures not over 12 inches wide and not over 50 inches long, a minimum of two fastenings.
2. Fixtures not over 12 inches wide and over 50 inches long, a minimum of three fastenings.
3. Fixtures over 12 inches wide and not over 50 inches long, a minimum of four fastenings.

G. Support pendant mounted fixtures as follows:

1. Single fixtures not over 12 inches wide, a minimum of two single pendants.

2. Single fixtures over 12 inches wide, a minimum of two single pendants at each end or one double pendant at each end.

3. Continuous rows of fixtures not over 12 inches wide, a minimum of one single pendant for each fixture plus one for each row.

4. Continuous rows of fixtures over 12 inches wide, a minimum of two single pendants or one double pendant for each fixture plus one for each row.

5. Locate pendants for continuous row fixtures at each joint and each end of row.

6. Rigidly fasten continuous row fixtures together with fixtures manufacturer supplied joiner.

H. EMT shall not be used to support suspended fixtures of any type. Suspension shall be by means of standard hangers, where available and applicable, by rigid threaded conduit and fittings, or by rods.

I. Where fixtures are to be mounted on, or suspended from concrete ceiling, provide cast in place inserts.

J. Fixtures shall not be supported by outlet box cover screws alone; provide a fixture stud or “hickey” for added support.

K. Provide a junction box at each exit light fixture indicated.

L. Provide weatherproof boxes and connectors and liquid tight flexible conduit to each light fixture.

M. All suspended fixtures will be installed with 1/8-inch safety cable and four Crosby clamps (two top and two bottom) to be used as a fixture support backup.

END OF SECTION

SECTION 264901

GENERAL CONTROL DEVICES

1.0 GENERAL

1.1 SUMMARY

A. Section includes:

1. Pushbutton and selector switches.
2. Control stations.
3. Relays.
4. Time delay relays.
5. Control power transformers.
6. Control panels.

1.2 REFERENCES

A. NEMA ICS 1 General Standards for Industrial Control Systems.

B. NEMA ICS 2 Standards for Industrial Control Devices, Controllers and Assemblies.

C. NEMA ICS 6 Enclosures for Industrial Controls and Systems.

D. NEMA ST 1 Standard for Specialty Transformers (Except General Purpose Type).

E. NFPA 70 - National Electrical Code.

1.3 SUBMITTALS

A. Submit under provisions of Section 26 0000.

B. Shop Drawings: Submit to NEMA ICS 1 indicating control panel layouts, wiring connections and diagrams, dimensions, support points.

C. Product Data: Provide for each component showing electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.

1.5 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and indicated.

2.0 PRODUCTS

2.1 MATERIAL AND FABRICATION

A. Contactors:

1. Mechanically and Electrically Held Contactors: Open type, 120V coil, number of poles and ampere rating as indicated. Factory wired and installed in lighting panelboard compartment.

2. Square D Co. Class 8903.

B. Time Switch:

1. Intermatic time switch as shown on the drawings.

C. Photo Control With Time Delay:

1. Rated for 1000W load or 1800 VA, sp st, in weatherproof enclosure.

2. ABB. Cat. No. CR174H651, or equal.

D. Control Relays:

1. 120 VAC coil, 10A rated contacts with number of poles indicated. Square D Co. Class 8501 Type X.

2. 48 VDC coil, 10A rated contacts. Square D Co. Class 8501 Type KDP 12.

3. 24 VDC coil, 10A rated contacts, plug in Type 3PDT. Square D Co. Class 8501 Type KDP 13 with NR62 socket.

4. Pneumatic Time Delay Relay: Square D Co. Class 9050 Type B.

E. Control Units, Such as Push Buttons, Pilot Lights, Selector Switches: Heavy duty, oil tight - Square D Co. Class 9001.

1. Push buttons, standard, full guard. Red for stop, green for start.

2. Pilot lights, transformer type, with color caps as indicated.

3. Selector switches, 3 position (Hand Off Automatic) manual return.

4. Legend Plates: Standard, with legends as indicated.

2.2 LABELING AND IDENTIFICATION

A. Provide engraved plastic nameplates with 1/4 inch minimum height letters indicating circuit designation of panel or device controlled on controls which are individually enclosed.

B. Secure nameplates with at least two screws or rivets. Cementing and adhesive installation not acceptable.

END OF SECTION

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SECTION 27 00 00- GENERAL COMMUNICATIONS REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. This includes - but is not limited to - furnishing and installing cable, cable supports, cable ties, inner duct, racks, cabinets, termination components, ancillary equipment, testing, and labeling and documentation of cables and connectors, for a complete end-to-end solution.

B. Refer to the contract documents for locations of Telecom Rooms (TRs), Server Room (SR), and telecommunication outlets (TOs). Note that the port and cable count at each TO may vary by location.

C. Complete installation shall comply with the Owner provided latest telecommunication and IT standards documents.

D. It shall be the responsibility of the contractor, to work with the Owner and provide the necessary assistance to make any connections from the owners' outside plant, service provider to establish services which shall ride on the new cabling system. These activities include, but are not limited to patch cords, cross connects, general wiring, documentation, and cable pair identification.

1.2 RELATED DOCUMENTS

A. General and Supplementary Conditions

1.3 RELATED SECTIONS

A. Division 01 – General Conditions

B. Division 07 – Penetration Fire stopping

C. Division 26 - Grounding and Bonding

D. Division 26 - Raceway and Boxes

E. Division 26 - Wiring Devices

F. Division 27 - Communications

1.4 ACRONYMS AND DEFINITIONS

A. BICSI: Building Industry Consulting Service International

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross- connection

C. EMI: Electromagnetic interference

D. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect

E. IDC: Insulation displacement connector

F. LAN: Local area network

G. NRTL: Nationally Recognized Testing Laboratory, an independent agency, with the experience and capability to conduct the testing indicated, as defined by OSHA in 29 CFR 1910.7

H. RCDD: Registered Communications Distribution Designer, a BICSI-certification

I. RMC: Rigid metallic conduit

J. TR: Telecom Room

K. UTP: Unshielded twisted pair

1.5 CONTRACTOR QUALIFICATIONS

A. The contractor shall be a company specializing in the installation of communication cable and accessories with a minimum of five years documented experience on similar systems.

B. Must be a current certified partner of the solutions being furnished and installed in order to meet the requirements for the manufacturers extended warranty and service programs.

C. Must hold a current communications cabling license within the State the project is taking place and must be verifiable for good standing.

D. Contractor must have a current affiliation with BICSI.

E. Within the project's onsite team, 15% of installers shall hold a BICSI Installer 1 certification, 15% of installers shall also hold a BICSI Installer 2 certification (Both Optical Fiber and Copper). 10% of the team shall hold a BICSI ITS Technician certification and a minimum of (1) team member shall hold a current and valid BICSI RCDD certification.

F. All BICSI certified field installers shall take on roles of Foreman or Team Lead to ensure installations are deemed compliant per codes and standards.

G. Contractor must have satisfactorily completed (3) projects within the past 5 years of similar scope and amount within the same state.

H. The selected Contractor shall provide a Project Manager to act a single point of contact for all activities performed under this section. The Project Manager shall be a Registered Communications Distribution Designer (RCDD). The RCDD shall have a minimum of 3 years experiences in design and installation. The designer must have sufficient experience in this type project(s) as to be able to lend adequate technical support to the field forces during installation, during the warranty period and during any extended warranty periods or maintenance contracts. The Contractor must attach a resume of the responsible designer to the Contractor's submittal for evaluation.

I. The Project Manager, or designee thereof, shall be required to attend project meetings as required until project closeout/signoff.

J. Should the Project Manager assigned to this project change during the installation, the new Project Manager assigned must meet all qualifications stated in this section, and must also submit a resume for review by the Consultant.

K. If, in the opinion of the Consultant, the Project Manager does not possess adequate qualifications to support the project, the Consultant reserves the right to require the Contractor to assign a designer whom, in the Owner's opinion, possesses the necessary skills and experience required of this project.

1.6 REGULATORY REFERENCES

A. ANSI/NFPA 70

B. City of Los Angeles Building Code.

C. ANSI/IEEE C2 - National Electrical Safety Code (NESC)

D. NFPA 70-2011 - National Electrical Code (NEC)

E. ANSI/TIA-568-C.0 – Generic Telecommunications Cabling for Customer Premises, published February 2009 and all latest addenda derived from ANSI/TIA 568-B

F. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standard, published February 2009 and all latest addenda derived from ANSI/568-B

G. ANSI/TIA-568-C.2 – Balanced Twisted Pair Telecommunication Cabling and Components Standard, published August 2009 and all latest addenda derived from ANSI/TIA 568-B

H. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard, published June 2008 and all latest addenda derived from ANSI/TIA 568-B

I. ANSI/TIA/EIA 569-B - Commercial Building Standard for Telecommunications Pathways and Spaces

J. ANSI/TIA-606-B – Administration Standard for Telecommunications Infrastructure, published June 2012 including all latest addenda derived from TIA-606-A

K. ANSI/TIA-607-B – Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises

L. ANSI/TIA-758-A Customer Owned Outside Plant Telecommunications Infrastructure Standard

M. IEEE 142 "Green Book"- Recommended Practice for Grounding of Industrial and Commercial Power Systems

N. UL 444 - Standard for Communications Cable

O. Rural Electrification Administration (REA) PE-89 - specification for filled telephone cables with expanded insulation

P. Rural Electrification Administration (REA) PE-39 - specification for filled telephone cables

Q. CEC Article 18-27-300.22© (1)

R. NEC Article 250 for System Grounding

S. NEC Articles 770 and 800 for Cable Listing Requirements

T. Work performed should additionally comply with and follow guidelines established in the latest edition/revision, as of the date of the Contract Documents, of the following publications:

U. BICSI Telecommunications Distribution Methods Manual (TDMM)

V. BICSI Outside Plant Design Reference Manual (OSPDRM)

W. National Electrical Contractors Association (NECA)/BICSI ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling

X. All materials shall be new and listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

Y. Notify Consultant of all material believed to be inadequate, unsuitable, in violation of law, ordinances, rules or regulations of authorities having jurisdiction.

1.7 CONFLICTING REQUIREMENTS

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

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

1.8 SUBMITTALS

A. Submittals shall include complete documentation of the system, products and accessories in a single submittal. Incomplete submittals will be returned reviewed.

B. Prior to the start of work the Contractor shall submit shop drawings in an electronic form. Plans shall be fresh designs by the contractor; they cannot be overlays of the Consultant's package which are indicative as the contract documents. Shop drawings shall contain:
   1. Full size floor plans showing proposed cable routing, wire basket routes, labeling of all outlets, locations of pull boxes.
   2. Full size floor plans and elevations of all telecommunication room racks and cabinets; also include all walls with equipment.
   3. Elevations shall indicate part numbers and quantities for all equipment.
   4. Elevations of all type of outlet faceplates which shall include the configuration for jacks, blanks and the intended outlet labeling schemes.
   5. Floor plans shall include all ladder rack or overhead cable distribution hardware within the telecommunications rooms to be installed per manufacturer's instructions.

6. Outside plant manhole and hand hole designs coordinated with electrical as well as the site environment if required.
7. Outside plant conduit arrangement details within ductbank and within the manholes and handholds as necessary if required.
8. Outside plant conduit ductbank overall routing coordinated with electrical as well as the site environment if required.
9. All seismic bracing and support details shall be provided in coordination with the general contractor as needed.

C. Where applicable, dimensions should be marked in units to match those specified.

D. Work shall not proceed without the consultant's "no exception taken" of the submitted items.

E. Floor plans will be provided to the Contractor in electronic (AutoCAD, ".dwg") formats to be utilized by the contractor in creating complete submittals and as-built documentation. These modified documents shall be provided to the Owner as part of the Record Documents.

F. All submittal documentation shall bear the stamp of a currently verifiable BICSI RCDD.

G. Plans shall be fresh designs by the Contractor; they cannot be overlays of the Consultant's package which is indicative as contract documents.

H. Contractor must submit documentation to support all Contractor Qualifications and Requirements under Section 1.5 which is to include but not limited to the following:
1. End to end solution and partner documentation indicating contractor's staff has gone through proper channels and training support a minimum 25 year warranty and service program by the manufacturers.
2. BICSI affiliations by contractor.
3. BICSI cabling team's RCDD.
4. Current copy of the State contractor's license for Communications Cabling.
5. Documentation of (3) similar projects within the past 5 years in the same State.

I. Contractor shall include data sheets and literature of test equipment to be used for fiber and copper cabling and components.

1.9 MANUFACTURER CERTIFIED WARRANTY

A. The manufacturer shall be a company specializing in communication cable and/or accessories with a minimum of five years documented experience in producing cable and/or accessories similar to those specified below.

B. The system shall be comprised of components from a single manufacturer or a combination of manufacturers entering into a partnering agreement that allows for a warranty of the system.

C. System warranty program documents must be from that of the cabling and component manufacturer and associated partners. Cabling and component warranty programs offered by the contractor alone are not acceptable.

D. The warranty period shall be for not less than 25 years and warranty the cabling system and components will perform to the stated specifications for the warranty period.

1.10 QUALITY ASSURANCE

A. 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.

B. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

C. Requirement for specialists shall not supersede building codes and regulations governing the Work.

D. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material and design.

1.11 QUALITY CONTROL

A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

B. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.

C. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work.

D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1.12 OWNER STANDARDS

A. Work performed should additionally comply with Owner Standards.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall follow standard industry installation practices as described in the latest release of the BICSI TDMM.

B. Contractor shall be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work.

All damage to interior spaces caused by the installation of cable, pathways or other hardware must be repaired by the Contractor. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor- damaged ceiling tiles are to be replaced to match color, size, style and texture.

C. The installation shall be supervised on site by a BICSI certified installer.

D. The contractor shall have on staff a BICSI certified RCDD. RCDD certification shall be current and each submittal shall bear the stamp of the RCDD.

E. Outlets shall be mounted flush on a wall-mounted box, on Surface Raceway and in Modular Furniture. Information Outlet locations are identified on Project Drawings.

F. Avoid abrasion and other damage to cables during installation. Any cable damaged during installation shall be removed and a new cable installed.

G. Cables shall be a continuous run. No in-line splices are permitted except were explicitly indicated on the drawings.

3.2 DELIVERY AND STORAGE

A. Receive, handle, and store telecommunications system items and materials at the project site. Materials and items shall be so placed that they are protected from damage and deterioration.

3.3 INSTALLATION

A. The drawings for work under Division 27 Sections related to communication systems are diagrammatic and are intended to convey the scope of work and indicate the general arrangement of conduit, boxes, equipment, termination hardware, fixtures and other work included in the Contract.

B. The Contractor shall verify all dimensions and clearances before procuring any equipment.

C. Location of items required by the drawings or specifications not definitely fixed by dimensions are approximate only and exact locations necessary to secure the best conditions and results shall be determined at the site and shall be subject to the approval of the Architect/Telecom Design Engineer.

D. Follow drawings in laying out work, check drawings of other trades to verify spaces in which work will be installed, and maintain maximum headroom and space conditions at all points.
   1. Where space conditions appear inadequate, the Architect/Telecom Design Engineer shall be notified before proceeding with installation.
   2. Minor conduit and cable tray rerouting and changes shall be made at no additional cost to the Owner.
   3. As necessary, adjust elevations of rack-mounted termination hardware and horizontal wire management panels so as to compensate for rack unit sizes of actual hardware used, as compared to hardware rack unit sizes depicted in Contract Drawings.

E. Perform all work with skilled mechanics of the particular trade involved in a neat and workmanlike manner.

F. Perform all work in cooperation and coordination with other trades and schedule.

G. Furnish other trades advance information on locations and sizes of frames, boxes, sleeves and openings needed for the work, routes for conduit and cable tray raceway, and also furnish information and shop drawings necessary to permit trades affected to install their work properly and without delay.

H. Where there is evidence that work of one trade will interfere with the work of other trades, all trades shall assist in working out space allocations to make satisfactory adjustments and shall be prepared to submit and revise coordinated shop drawings.

I. With the approval of the Architect/Consultant and without additional cost to the Owner, make minor modifications in the work as required by structural interferences, by interferences with work of other trades or for proper execution of the work.

J. Work installed before coordinating with other trades so as to cause interference with the work of such other trades shall be changed to correct such condition without additional cost to the Owner and as directed by the Architect.

K. Minor changes in the locations of outlets, fixtures and equipment shall be made prior to rough in at the direction of the Architect/Consultant and at no additional cost to the Owner.

L. Contractor shall cooperate with other trades and coordinate work so that conflicts with other work are eliminated.

M. Equipment shall be installed with adequate space allowed for removal, repair or changes to equipment. Ready accessibility to removable parts of equipment and to wiring shall be provided without moving other equipment which is to be installed or which is in place. Contractor shall verify measurements. Discrepancies shall be brought to the Architect/Telecom Design Engineer's attention for interpretation.

N. Determine temporary openings in the buildings that will be required for the admission of apparatus furnished under this Division, and notify the Architect/Consultant accordingly. In the event of failure to give sufficient notice in time to arrange for these openings during construction, assume all costs of providing such openings thereafter.

O. Location of telecommunication outlets and raceway pathways are approximate and exact locations shall be determined on site.

P. Contractor shall refer to contract documents for details, reflected ceiling plans, and large scale drawings.

3.4 COORDINATION

A. The Contractor shall be responsible for the coordination of telecommunications work with the work of all other trades and shall, in preparing the drawings, check the work of other trades in order to avoid possible installation conflicts arising therefrom. It shall be understood that the work shown on the shop drawings has been so coordinated. In the event of conflicts or interference that cannot be resolved in the field, the Contractor shall request a written clarification from the Architect/Consultant.

B. Coordinate service entrance arrangement with local exchange carrier(s).
   1. Meet jointly with local exchange carrier representatives and Owner to exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in meetings and distribute to other participants.

C. Where work covered by this Section connects to equipment furnished under other Sections, verify telecommunications work involved in the field and make proper connection to such equipment.

END OF SECTION 27 00 00

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SECTION 27 05 26- GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. This includes grounding and bonding of all passive and active equipment supplied by contractor and owner.

B. This Section includes grounding of communications systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   1. Comply with UL 467.

1.3 RELATED DOCUMENTS

A. General and Supplementary Conditions

1.4 RELATED SECTIONS

A. Division 26 - Grounding and Bonding

B. Division 26 - Raceway and Boxes

C. Division 26 - Wiring Devices

D. Division 27 - Communications

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by approved manufacturers listed in Division 26 section, “Grounding and Bonding for Electrical Systems.”

B. Materials and equipment shall conform to the respective standards and to the Quality Standards stated herein. Electrical ratings shall be as indicated. Except where specifically required approvals and/or labels. Materials shall conform to the requirements of UL 467 where applicable.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section “Conductors and Cables.”

B. Communications Copper Bonding Conductors: As follows
   1. Telecommunications Bonding Conductor (TBC) and Telecommunications Bonding Backbones (TBB): No. 3/0, stranded copper conductor, insulated.
   2. Telecommunications Equipment Bonding Conductor (TEBC): No. 6 AWG, stranded copper conductor, insulated.

C. Conductor, UL 83:
   1. Ground and bonding conductors shall be green-insulated, soft-drawn stranded copper conductors, unless otherwise indicated, installed with sufficient slack to avoid breaking due to settlement and movement of conductors or attached points.

2.3 SYSTEM GROUNDING CONDUCTORS SHALL BE MINIMUM OF NO. 6 AWG AND A MAXIMUM OF 3/0 AWG BARE COPPER, UNLESS OTHERWISE INDICATED OR REQUIRED BY CODE, AND SHALL BE CONTINUOUS WITH NO JOINTS OR SPLICES CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long- barrel, two-bolt connection to ground bus bar.

C. Wire Connectors and Terminals for use with copper Conductors: UL 468A.

D. TELECOMMUNICATIONS GROUNDING BUSBAR

E. Comply with ANSI/TIA-607-B.

F. Telecommunications Main Grounding Bus bar (TMGB): Electro-tin plated copper, minimum 1/4 inch thick by 4 inches wide by minimum 20” long, with holes sized, spaced and in minimum quantities as follows:
   1. 5/16” holes at 5/8” spacing, minimum quantity of 27
   2. 7/16” holes at 1” spacing, minimum quantity of 3
   3. Provide longer TMGB as necessary to accommodate quantity of actual bonding connections required in field.
   4. Provide CPI, Lyncole XIT, or equal subject to review.

G. Telecom Grounding Bus bar (TGB): Electro-tin plated copper, minimum 1/4 inch thick by 4 inches wide by minimum 12” long, with holes sized, spaced and in minimum quantities as follows:
   1. 5/16” holes at 5/8” spacing, minimum quantity of 6
   2. 7/16” holes at 1” spacing, minimum quantity of 3
   3. Provide longer TGB as necessary to accommodate quantity of actual bonding connections required in field, per communications room.
   4. Provide CPI, Lyncole XIT, or equal subject to review.

PART 3 - EXECUTION

3.1 INSTALLATION

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

B. Bond metallic raceways used for routing of communications bonding conductors, to the communications bonding conductor at each end.

3.2 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanic ally compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Equipment Grounding Conductor Terminations: Use pressure-type grounding lugs.

C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

D. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer.

E. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.3 TELECOMMUNICATIONS GROUNDING AND BONDING

A. Comply with NEC, ANSI/TIA-607-B and UL 467.

B. Comply with telecommunications ground details and riser diagrams in Contract Drawings.

C. Telecommunications Grounding Bus bars: TMGB and TMB within facility to provide for telecommunications grounding system.
   1. Locate grounding terminals in each telecommunications room.
   2. Mount on wall of telecommunications entrance facility, equipment room, and closet, with standoff insulators.

D. Bonding Conductors:

1. Extend a TBC from TMGB to electrical entrance facility and connect to grounding electrode system.
2. Extend a TBB from TMGB to each TGB.
3. Extend a TEBC from TGB to ground terminals at communication relay racks, wall-mount communication racks and cabinets, primary protection blocks, overhead ladder rack runway systems and cable basket tray systems.

E. Special Requirements:
1. Bonding conductors shall be insulated copper, sized as noted in Contract Drawings.
2. Bonding conductors shall be installed without splices unless as noted in telecommunications grounding riser diagram, or as approved by Architect because of special circumstances. Where splices are necessary, they shall be accessible. Splices shall be by irreversible compression connectors or by exothermic welding.

F. Primary Protectors
1. Primary protectors shall be installed on each cable end, in the appropriate building entrance protector.
2. Primary protector enclosure shall be bonded to the building grounding system utilizing a minimum #6 AWG ground wire.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION 27 05 26

SECTION 27 05 28- PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. This includes pathways for distribution and protection of cabling and components.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467.

C. General Requirements: Comply with ANSI/TIA-569-B.

D. Cable Support: NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

E. Support brackets with cable tie slots for fastening cable ties to brackets.
   1. Lacing bars, spools, J-hooks, and D-rings.
   2. Straps and other devices.
   3. Bridle rings not permissible unless furnished with cable saddles.

1.3 RELATED DOCUMENTS

A. General and Supplementary Conditions

1.4 RELATED SECTIONS

A. Division 26 - Grounding and Bonding

B. Division 26 - Raceway and Boxes

C. Division 26 - Wiring Devices

D. Division 27 – Communications

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by approved manufacturers listed in Division 26 section, “Grounding and Bonding for Electrical Systems.”

2.2 CONDUIT AND ELECTRICAL BOXES

A. Comply with requirements in Division 16 Section “Raceways and Boxes.” Flexible metal conduit shall not be used, except as indicated in Contract Drawings. Coordinate with layout and sizing details and requirements as indicated in Contract Drawings.
   1. Outlet boxes shall be no smaller than 4 inches wide, 4 inches high and 2-1/8 inches deep.
   2. Minimum conduit to telecom outlet locations: Trade Size 1, unless otherwise noted in Contract Drawings.
   3. Provide a complete and function conduit pathways system with required pull boxes between the MDF/TR facility and each Telecommunications service point per Telecommunications Drawings.

2.3 J-HOOK

A. J-Hook shall have a flat bottom and provide a minimum of 1-5/8 inch cable bearing surface.

B. J-Hook shall have 90-degree radius edges to prevent damage while installing cables.

C. J-Hook shall be designed so the mounting hardware is recessed to prevent cable damage.

D. J-Hook shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

E. Factory assembled multi-tiered j-hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

F. Manufacturer: Stiffy, Erico Caddy, or Approved Equal

2.4 FLEXIBLE NON-METALLIC INNERDUCT

A. Innerduct shall be corrugated plastic.

B. Nominal duct size shall be minimum 1-inch.

C. Innerduct shall be riser, plenum, or OSP rated as required by the installation environment.

D. Manufacturer: ENDOT, Eastern Wire, or Approved Equal

2.5 CABLE TIES

A. Bundle and support all cables and to provide a neat and orderly cabling installation.

B. Velcro tie wraps shall be used in the telecom room. Zip ties and wraps that cannot be adjusted once installed are not acceptable.

C. Wraps shall be Black in color.

D. Velcro wraps shall be plenum rated in all areas outside the telecom rooms.

2.6 DISTRIBUTION RINGS (D-RINGS).

A. Must be used to support and dress out cables on plywood backboards vertically and horizontally. Cables shall not be supported by cable ties alone on backboard.

PART 3 - EXECUTION

3.1 GENERAL

A. Cable shall be neatly dressed out in telecom rooms.

B. Secure cabling with Velcro type cable wraps only.

C. Install distribution rings on plywood backboards to support cables.

3.2 J-HOOKS

A. Provide J-hooks to support communications cables at locations where cable tray and/or conduit is not provided.

B. Provide J-hooks assemblies on 4-5 foot intervals to support all outlet cables. Install J-hooks approximately 12 inches above lay-in ceiling. Use J-hooks to support not more than 50 cables per hook. Provide additional hooks in rows as required to support more than 50 cables.

C. Secure J-hooks to concrete slab using submitted and consultant approved method.

D. Coordinate location with HVAC duct and lights. Do not install above fluorescent lighting fixtures.

3.3 FLEXIBLE NON-METALLIC INNERDUCT

A. Innerduct segments shall be spliced using couplings designed for that purpose.

B. All vacant inner duct shall be equipped with a pull cord and capped at both ends.

C. Innerduct shall extend to the ladder rack above the termination enclosure.

D. All exposed inner duct shall be labeled at 50-foot intervals with tags indicating the cable type it contains.

END OF SECTION 27 05 28

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SECTION 27 08 00- COMMISSIONING OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a testing, documenting, and commissioning of an operable end to end structured cabling system.

B. Complete installation shall comply with the owner's and consultants latest telecommunication and IT standards documents.

1.2 RELATED SECTIONS

A. Division 27

1.3 PROJECT AS-BUILT AND CLOSEOUT DOCUMENTS

A. Accurately record exact sizes, locations, heights and quantities of cables and Information Outlets.

B. As-built drawings shall indicate all final cable routes and final outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

C. Drawings shall indicate final MDF & TR locations along with their final build out conditions at end of the project.

D. Submit (1) bound folders of product used in the project for record.

E. Submit cable tester calibration reports.

F. Submit all copper and fiber optic test results as indicated in Part 3 of this specification. This should include every cable channel installed in the project.

G. Plans shall be provided in full size PDF, AutoCAD or REVIT format within (1) CD or DVD along with (1) hard copies.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor shall follow standard industry installation practices as described in the latest release of the BICSI TDMM.

3.2 IDENTIFICATION AND LABELING

A. All backbone and station cables, faceplates and termination components shall be clearly labeled in accordance with EIA/TIA 606-B.

B. The Contractor shall obtain the labeling scheme from the Owner.

C. Labels strips shall be covered with a protective plastic coating. Labels shall be machine printed. No handwritten label shall be accepted. Stick-on labels are not acceptable.

D. Components
1. The labeling made for each component should be:
   a. Unique, to prevent confusion with similar components.
   b. Legible and permanent enough to last the lifecycle of the component.
   c. The following infrastructure components should be labeled:
      1) Telecommunications spaces
      2) Telecommunications pathways
      3) Telecommunications cables
      4) Zone boxes
      5) Connecting hardware
      6) Grounding (earthing) system

E. Telecommunications Spaces
1. Telecommunications spaces include:
   a. Equipment/Server rooms (ER/SRs)
   b. Telecommunication rooms (MDF/IDF/TRs)
   c. Telecommunication enclosures (TEs)
   d. Work areas

1. Spaces should be labeled at their entrances, as follows:
   e. In small, single-story buildings, a simple sign on the door is sufficient.
   f. In larger buildings, the labeling should provide a unique identifier, since there may be a number of telecommunications spaces.

F. Telecommunications pathways
1. Labeling of pathways helps prevent inadvertent installation of cables from systems that may interfere with each other.
2. When labeling pathways, the following guidelines should be met:
   a. Labeling should be affixed at the ends of each pathway.
   b. Pathways should be labeled at regular intervals and wherever they are accessible.
   c. In a basic system, the conduits should be marked from the main SR by painting or using a permanent-colored tape-wrap made for this purpose.
   d. In systems utilizing zone boxes for consolidation or distribution of low-voltage systems, each box label should include the information about the room of origin and system usage.
   e. In complex systems or large buildings:
      1) A striped tape should wrap pathways with the base color identifying them as telecommunications pathways and tracer color identifying the individual uses.
      2) Each pathway should be assigned a unique alphanumeric identifier.
      3) All wall or floor penetrations should be labeled.
3. Telecommunications cables
   a. When labeling telecommunications cables:

1) Cables should be identified at each end with a permanent label or physical/electronic tag. The same alphanumeric identifiers should be used at both ends of the cable.
2) Cable should be identified at regular intervals throughout its length with its alphanumeric identifier when cables are rearranged, rerouted, or removed in spite of the added cost.

b. In systems that are:
1) Basic, the labeling scheme can be a simple number sequence.
2) Complex, the labeling may indicate the type, function, and terminating position.

G. Connecting hardware
1. Connecting hardware items (e.g., cross-connect fields and telecommunications outlet/connectors) require a unique, alphanumeric identification such as the following three-level scheme:
a. First level – Termination field or patch panel. Color-coding or other labeling should be used to uniquely identify each termination field on a common mechanical assembly.
b. Second level – Terminal block within a given field or patch panel, which could be a row of insulation displacement connectors (IDCs), optical fiber connectors, or modular jacks.
c. Third level – Defines the individual position within a given terminal block or patch panel.

H. Grounding (Earthing)
1. Grounding system components (e.g., ground bars and grounding conductors) require special labeling for safety and noise control purposes and for simplifying and expediting ground system audits.
2. All equipment grounding conductors should be labeled to indicate the:
a. Grounded rack, cabinet, or shelf.
b. Ground bar to which the grounding conductors are connected.
3. Each grounding conductor in a building should be labeled, including those connecting building steel, grounding electrodes, water pipes, radio towers, and telecommunications structural components.

3.2. TESTING AND COMPLIANCE

A. The Contractor is responsible for supplying all equipment and personnel necessary to conduct the acceptance tests. Testing shall be executed by technicians holding proof of successful installation certification from the system manufacturer.

B. Cable testers are to be calibrated within four (4) months of use.

C. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type including equipment to use, set-up, test frequencies or wavelengths, results format, etc.

D. 100% of the installed cabling links must be tested in accordance with ANSI/TIA/EIA-568-B standard and must pass the requirements described under the heading for each cable type. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation.

E. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the

accuracy of the field tester. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

F. Manufacturer: Fluke

3.3. CABLING ADMINISTRATION DRAWINGS

A. Prepare Cabling Administration Drawings showing building floor plans with cable administration-point identification labeling. Depict all telecommunications outlets and their associated label, provide callouts indicating locations of telecom rooms and spaces and, where applicable, indicate zone line demarcations denoting areas served by each respective telecom room. Coordinate drawing features with shop drawing requirements outlined in Section 27 00 00.

B. Prepare Drawings for use as part of cabling installation work. Periodically update Drawings to reflect constructed conditions, including any moves, changes or additions to the communications infrastructure. At completion, Cabling Administration Drawings shall reflect as-built conditions.

C. Interim Submission: Issue two (2) half-size printed copies of in-progress draft Cabling Administration Drawings to Owner no later than five (5) weeks after Substantial Completion, for Owner's use in preparation of patch schedules and to support other internal move-in planning processes. Coordinate exact timing with Owner's IT personnel.

3.4. TEST RESULTS DOCUMENTATION

A. Upon completion of the installation, the contractor shall provide (1) full electronic documentation sets to Ownership for approval.

B. Documentation shall be submitted within ten (30) working days of the completion of the testing phase. This includes draft as-built drawings. Draft drawings may include annotations done by hand.

C. All documentation, including hard copy and electronic forms shall become the property of the Owner.

3.5. WARRANTY

A. The Contractor shall guarantee all materials, equipment, etc., for (1) year from date of substantial completion of this work. This guarantee shall include all labor, material and travel time. This warranty is in addition to the cabling system manufacturer's warranty.

B. The Cabling Contractor shall provide a SCS (Structured Cabling Systems) manufacturer's warranty providing for applications assurance and protection against all product defects for a minimum period of (20) years.

END OF SECTION 27 08 00

SECTION 27 11 00- COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. Including equipment for the Telecomm Rooms.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.3 RELATED DOCUMENTS

A. General and Supplementary Conditions

1.4 RELATED SECTIONS

A. Division 26 - Grounding and Bonding

B. Division 27 - Communications

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS PLYWOOD BACKBOARD

A. Backboards shall be 4'W x 8'H x ¾"D.

B. FIRE RETARDENT Finished grade of A-C or better. A-side shall face the interior of the room.

C. All sides of each backboard should be finished with (2) coats of white paint prior to installation. Plywood grade and fire rating stamps on plywood shall remain exposed and not painted over.

D. If the walls where plywood backboard will hang are fire rated or there's a requirement for fire rating per codes, the plywood backboard and finish paint must meet the same fire rated requirements.

E. A fire retardant paint additive may be used and the associated documentation should be applied to the painted backboard as proof of usage.

2.2 EQUIPMENT RACKS

A. Equipment Racks, Cable Management and Ladder Style Cable Runway shall be provided in all TR, SR, IDF, and MDFs as show on the Telecommunications Drawings and specified herein to house the Design Builder provided Patch Panels, Horizontal Cable Management, and Fiber Enclosures, and the Owner provided Network Equipment.

B. Equipment Racks and Cable Management shall be Standard (i.e. not Custom Designed or Built for this Project). All Equipment Room Fittings shall be of a single Manufacturer.

C. All Racks and Ladder Rack will be UL Listed.

D. Racks

1. 4-Post Quad Frame Equipment Racks shall be Standard 84" High EIA 19" wide and 29" deep. It shall contain front and rear C-shaped mounting rails with .375" mounting holes for cage nut or equal mounting hardware and provide a minimum of 43U of Rack Space.
   a. Manufacturer: CPI - Quadra Frame, Panduit or Approved Equal

2.3 VERTICAL CABLE MANAGEMENT

A. Vertical Cable Management shall be provided between and at the end of each row of racks as specified on the Telecommunication Drawings, and shall extend from top to bottom of each rack.

B. Vertical Cable Management shall be Double Sided and have a minimum width of 6".
1. Manufacturer: CPI, Panduit or Approved Equal

2.4 HORIZONTAL CABLE MANAGEMENT

A. Horizontal Cable Management shall be provided be provided on the front of each rack below and between each 48-Port Patch Panel and Fiber Enclosure.
1. Manufacturer: CPI, Panduit or Approved Equal

2.5 LADDER RACK

A. Ladder Rack shall be provided in TR, SR, IDF, BDF, and MDF and shall wrap the perimeter of the room.

B. Ladder Rack Shall be UL listed.

C. Ladder Rack shall have a minimum width of 12" with cross members at 9" centers. There will be 8" of open space in-between each cross member.

D. Ladder Rack shall be supported
1. Manufacturer: CPI, Panduit or Approved Equal

2.6 LADDER RACK SUPPORTS AND ACCESSORIES

A. Triangular and Wall Angle Support Brackets are to be of Aluminum or Steel construction, and need to be rated to support a minimum 80lbs.

B. The Brackets shall be attached with a minimum of ¼ " Lag Bolts to Plywood Backboards or as required to properly support the cable runway system.

C. Radius drops or "waterfalls" used to maintain the bend Radius of the cables as they exit or enter the ladder rack/tray will be manufactured from aluminum extrusion. The extrusion will be formed in a 90° arc with a minimum bend radius of 3". Radius drops will attach to either the side stringer or the cross member of the ladder rack/tray using a clevis pin. Radius drops will include 1-1/2" high cable spools that attach to the top of the radius drop to guide cables.

D. All Equipment Room Fittings shall be of a single manufacturer.

2.7 FIBER OPTIC ENCLOSURES

A. Rack-mounted Fiber Optic Patch Panel shall be capable of supporting fiber modular distribution coupler panels.

B. Fiber optic connectors shall be LC style.

C. Must comply with TIA-568-C standards.

D. Rack mount fiber patch panels shall be mountable in a standard 19-inch rack, cabinet, etc.

E. Front panel must have tray that slides out for front access.

F. Fully populate any unused bays with blank panels.

G. Manufacturer: Corning, Panduit, Commscope or Approved Equal

2.8 CATEGORY 6A PATCH PANELS

A. Compliance: Listed and third party verified to comply with TIA 568-C Category 6A specifications and associated addendums.

B. Conductive cabling and associated components shall comply with Article 800 of the NEC (2008)

C. Application: Use for termination of Category 6A, 4-Pair horizontal distribution cable.

D. Shall support either 24 or 48 Ports and be 1U or 2U, respectively.

E. Shall be flat in design.

F. Manufacturer: Leviton, Panduit, Commscope or Approved Equal

2.9 UNINTERUPTABLE POWER SUPPLY

A. 19” x 2RMS Rack Mountable Uninterruptible Power Supply.

B. 3kVA/2.7kW line interactive pure sine wave type.

C. Automatic voltage regulation with 208/30A Power input.

D. Shall include a IEEE 802.3 compliant Network Interface Card.

E. Shall include (8) 5-15R for connection to telecommunications equipment..

F. (1) UPS Shall be provided for each installed 4 post quad frame rack.

G. Manufacturer: APC SMT3000VA, Minuteman, or Approved Equal

PART 3 - EXECUTION

3.1 RACKS, CABLE MANAGEMENT, SUPPORTS, ACCESSORIES:

A. Provide all components of the ladder rack/tray system (ladder rack/tray, turns, splices, supports, and accessories) from a single manufacturer.

B. Ground all racks independently to the equipment ground bus bar with a dedicated #6 copper wire.

C. Rack elevations to be coordinated with Ownership prior to install.

D. Ladder rack/tray shall be installed with side stringers facing down so that the ladder forms an inverted U-shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.

E. Ladder rack/tray shall be secured to the structural ceiling, building truss system, wall, floor or the tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

F. Ladder rack/tray splices will be made in mid-span, not over a support, with the manufacturer's recommended splice hardware.

G. Ladder rack/tray shall be supported every 5' or less in accordance with TIA-569. Ladder rack/tray shall be supported within 2' of every splice and within 2' on both/all sides of every intersection. Support ladder rack/tray within 2' on both sides of every change in elevation. Support ladder rack/tray every 2' when attached vertically to a wall.

H. When the pathway is overhead, ladder rack/tray shall be installed with a minimum clearance of 12" above the ladder rack/tray. Leave a minimum of 12" in between ladder rack/tray and ceiling/building truss structure. Leave a minimum of 3" in between ladder rack/tray and the tops of equipment racks and/or cabinets. Multiple tiers of ladder rack/tray shall be installed with a minimum clearance of 12" in between each tier of ladder rack/tray. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the ladder rack/tray.

I. All threaded rod used in support of overhead cable trays shall have cable guard protectors installed over the exposed threaded rod in the area of the tray. The exposed end of the threaded rod hangers shall be cut flush with the mounting brackets, filed, and painted to match site conditions. Install rubber-finishing caps on any exposed metal end rail or potential sharp point.

J. Within each telecommunications room, ladder rack/tray should be bonded together, electrically continuous, and bonded to the Telecommunications Grounding Bus bar (TGB), unless otherwise noted in the specifications and contract documents. Ladder rack/tray and turns shall be bonded across each splice with a bonding kit. Ladder rack/tray shall be bonded to the (TGB) using an approved ground lug on the ladder rack/tray and a minimum #6 grounding wire or as recommended by the AHJ. Remove paint from the ladder rack/tray where bonding/ground lugs contact the ladder rack/tray so that the lug will contact bare metal. Use antioxidant joint compound in between the bare metal on the ladder rack/tray and ground lug. Use antioxidant joint compound in between the bus bar and the ground lug. Verify continuity through the bonds at splices and intersections between individual ladder rack/tray sections and turns and through the bond to the TGB.

K. The quantity of cables within the ladder rack/tray will not exceed a whole number value equal to 50% of the interior area of the ladder rack/tray divided by the cross-sectional area of the cable. The interior area of ladder rack/tray will be considered to be the width of the ladder rack/tray multiplied by a height of 2", unless cable-retaining posts are added to the ladder rack/tray. The interior area of ladder rack/tray equipped with cable retaining posts will be considered to be the width of the ladder rack/tray multiplied by a height of 6". Actual cable fill for ladder rack/tray that is not equipped with cable retaining posts will not exceed 2" in height. Actual cable fill for ladder rack/tray equipped with cable retaining posts will not exceed 6" in height.

L. The combined weight of cables within the ladder rack/tray will not exceed the stated load capacity of the ladder rack/tray as stated in the manufacturer's product specifications or load/design tables.

M. Cables (cable bundles) will be secured to the cross members of ladder rack/tray with ¾" wide reusable straps. Straps are not required when ladder rack/tray is equipped with cable retaining posts.

N. Use a radius drop to guide cables wherever cable exits overhead ladder rack/tray to access a rack, cabinet or wall-mounted rack, and cabinet or termination field. Provide a support other conductors that should be physically separated from cables within the ladder rack/tray as defined by local code or the authority having jurisdiction (AHJ).

O. Whenever possible, maintain a 2' separation between ladder rack/tray used for communications cables and pathways for other utilities or building services.

P. The installer will provide touch-up paint color-matched to the finish on the ladder rack/tray and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack/tray system.

3.2 FIBER OPTIC ENCLOSURE

A. Coordinate exact rack elevation prior to installing fiber optics patch panel.

B. Install new adapter panels from left to right in new housing.

3.3 CATEGORY 6A PATCH PANELS

A. Coordinate exact rack elevation prior to installing copper patch panels.

B. Install and terminate per manufacturer's recommendations.

END OF SECTION 27 11 00

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SECTION 27 13 00- COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a testing, documenting, and commissioning of an operable end to end Communications Copper Backbone Cabling System.

B. The work covered under this Section shall consist of a testing, documenting, and commissioning of an operable end-to-end Communications Fiber Optical Backbone Cabling System.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NEC, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. All cable and equipment shall be installed in a neat and competent manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Consultant or Consultant Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

C. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

D. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
1. ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
2. TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
3. ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual

1.3 SUBMITTALS

A. Cable Manufacturer’s data, including part numbers, cut sheets and detailed descriptions, for all proposed equipment

B. The Contractor shall submit a copper cable pulling plan for all multi-pair copper cables with a pair count of 100 pairs or greater, that includes, but is not limited to, the following:

C. Each cable run and route.

D. Date and duration of the pull.

E. Product data for all termination and test equipment to be used by Contractor to perform work.

F. Equipment shall be calibrated with traceability to National Institute of Standards and Technology (NIST) requirements.

G. Contractor shall include copy of calibration and certification that equipment calibration meets NIST standards and has been calibrated at least once in the previous calendar year.

1.4 RELATED DOCUMENTS

A. General and Supplementary Conditions

1.5 RELATED SECTIONS

A. Division 27

PART 2 - PRODUCTS

2.1 INTRA-BUILDING COPPER BACKBONE FOR ANALOG/ VOICE ONLY

A. UL-listed CMR cable: Solid copper conductors with high-density polyolefin insulation and overall low smoke PVC jacket to achieve riser (i.e., non-plenum) rating by UL standards

B. UL-listed CMP cable: Solid copper conductors with FEP insulation and overall low smoke PVC jacket to achieve plenum rating by UL standards

C. LSZH cable: Solid copper conductors with non-halogen HDPE insulation and low smoke, zero halogen, compound jacket to achieve LSZH rating by:
1. IEC 60754—Part 2.
2. IEC 61034—Part 2.
3. IEC 60332—Part 1.
4. Def Stan 713.

D. Cable shall meet the requirement of ANSI/TIA/EIA-568 series Standards for Category 3 performance.

E. Approved Manufacturer: General, Commscope, Berk Tek or Equavalent.

2.2 INTER-BUILDING COPPER BACKBONE FOR ANALOG/ VOICE ONLY

A. All cable shall be manufactured and constructed for use in the Outside Plant Environment.

B. Cable shall meet the requirement of ANSI/TIA/EIA-568 series Standards for Category 3 performance

C. Approved Manufacturer: General, Commscope, Berk Tek or Equavalent.

2.3 BUILDING ENTRANCE PROTECTORS

A. Building entrance protection for copper cabling shall be installed utilizing a two (2) foot fuse link between outside plant cable plant splice and the protector module with IDC-type input and output terminals, 100 pair-pair capacity and female mounting base, equipped with 230-volt solid-state protector modules. Sufficient protector modules shall be provided to completely populate all building entrance terminals.

2.4 INTRA-BUILDING FIBER OPTIC BACKBONE CABLING

A. Indoor Cables - All cable shall be listed for use indoors per the National Electrical Code (NFPA-70) and shall meet one of the following, per bid document.
   1. Indoor Riser Rated Tight Buffer - UL-listed OFNR: Tight buffer optical fibers, aramid strength yarn, and riser-rated outer jacket.
   2. Indoor Plenum Rated Tight Buffer UL-listed OFNP cable: Tight buffer optical fibers, aramid strength yarn, and plenum-rated outer jacket.
   3. Indoor Low Smoke/Zero Halogen Riser Rated Tight Buffer LSZH cable: Solid copper conductors with non-halogen HDPE insulation and low smoke, zero halogen, compound jacket to achieve LSZH rating.
   4. Indoor Armored Riser Rated Tight Buffer - UL-listed OFCR: Tight buffer optical fibers, aramid strength yarn, a riser-rated jacket, aluminum interlocking armor with an overall riser-rated sheath jacket to provide additional protection and security.
   5. Indoor Armored Plenum Rated Tight Buffer UL-listed OFCP cable: Tight buffer optical fibers, aramid strength yarn, a plenum-rated outer jacket, aluminum interlocking armor with an overall plenum-rated sheath jacket to provide additional protection and security.

B. Approved Manufacturer: Circa, Commscope, Marconi or Equivalent

2.5 INTER-BUILDING FIBER OPTIC BACKBONE CABLING

A. All cable shall be manufactured and constructed for use in the Outside Plant Environment and shall meet one of the following, per bid document.
   1. Outside Plant (OSP) loose tube all dielectric - Dielectric design with MDPE sheath jacket and no metallic elements to provide environmental protection.
   2. Outside Plant (OSP) loose tube metallic sheath - Metallic sheath design with MDPE sheath jacket to provide environmental protection. Metallic armor of corrugated polymer coated steel tape to provide added crush protection. Armor shall meet Telcordia requirements for superior armored cable.

B. Buffer tubes and optical fibers
   1. Industry standard buffer tubes stranded around a central strength member and compatible with standard hardware, cable routing, and fan-out kits.
   2. Optical fibers shall be industry-standard color coded and separated into 12-fiber color-coded binder groups surrounded by plastic core tubes

C. Water blocking
   1. OSP Fiber Cables are available as either fully dry or dry core with gel in the buffer tubes. The bid document will specify the cable type.
      a. Dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications in cable and buffer tubes.
      b. Dry water-blocking compound suitable for underground conduit, direct burial, and aerial applications with gel filled buffer tubes.

D. Approved Manufacturer: (Leviton Cabling Systems / Berk Tek)

2.6 VOICE BACKBONE CABLING

A. Voice backbone cables shall have a minimum 10-foot service loop when terminated in the ER and TR, and at any splice points in telecommunications manholes.

2.7 110 WIRING BLOCKS

A. Application: Use to terminate copper backbone cabling installed between the termination points as indicated on drawings

B. Characteristics: 110 Wiring Blocks shall:
1. Facilitate Cross-connection and/or interconnection using either cross connect wires or patch cord.
2. Be manufactured using fire retardant molded plastic with the base consisting of horizontal index strips for termination up to 25-Pairs of conductors.
3. Support terminations of 22-26 AWG solid connectors.
4. To be wall mountable

C. Approved Manufacturer: Panduit, Commscope, or Equivalent

2.8 FIBER OPTIC ENCLOSURES

A. Rack-mounted Fiber Optic Patch Panel shall be capable of supporting fiber modular distribution coupler panels.

B. Fiber optic connectors shall be LC style.

C. Must comply with TIA-568-C standards.

D. Rack mount fiber patch panels shall be mountable in a standard 19-inch rack, cabinet, etc.

E. Front panel must have tray that slides out for front access.

F. Fully populate any unused bays with blank panels.

G. Manufacturer: Corning, Panduit, Commscope or Equivalent

2.9 INNER DUCT

A. The use of Innerduct is require for the placement of backbone fiber optic cabling. The Inner duct shall be at least a thin wall polyethylene meeting the UL specifications 2024.

B. Inner duct shall be rated for all environments in which they are installed.

C. Inner duct shall have a minimum inside diameter of 1 inch.

D. Approved Manufacturers: Carlon, Essex, General or approved equal.

2.10 COMMUNICATIONS OSP FIBER SPLICE CLOSURE

A. This section includes the minimum requirements for OSP Fiber Splice Closures.

B. OSP Closures are to be designed for aerial, buried and manhole applications and to be used with all types of Optical Fiber, Single-mode and Multimode.

C. A Closure line with different sizes of OSP Closures is required to accommodate a range of fiber counts and cable sizes.

D. The OSP Closure line is to have several different sizes to accommodate up to 384 fiber single fusion splices and to accept loose tube and central tube cables, both armored and all dielectric.

E. The Outside Plant Fiber Splice Closure must have at least one set of Express Ports to allow mid span splicing of one cable.

F. The Outside Plant Fiber Splice Closure must have at least two Drop Ports.

G. The Outside Plant Fiber Splice Closure must have a grommet system that allows for more than one cable per Drop Port, depending on cable size.

H. The Outside Plant Fiber Splice Closure must have a tray system that allows the use of multiple trays. Tray count is dependent on the number of fibers to be spliced.

I. The Outside Plant Fiber Splice Closure tray system must allow for easy access to all trays: top, inner and bottom.

J. The Outside Plant Fiber splice closures are to be designed:
   1. To comply with Telcordia GR-20 for environmental sealing and water immersion
   2. For re-entry and not require the use of an encapsulant
   3. With a flash testing port
   4. With a security locking tab
   5. With an operating temperature: Operating Temperature -40 °C to +66.5 °C (-40 °F to +151.7 °F)

K. Closure for 2 to 48 Fibers
   1. Dimensions
      a. Diameter: 127.0 mm (5.0 in)
      b. Length: 515.6 mm (20.3 in)
   2. Mechanical Specifications
      a. Cable Entry Drop Port Size: 25.0 mm (1.0 in)
      b. Cable Entry Drop Port, quantity: 2
      c. Cable Entry Express Port Size: 25.0 mm (1.0 in)
      d. Cable Entry Express Port, quantity: 2

L. Closure for 48 to 288 Fiber
   1. Dimensions
      a. Diameter: 165.1 mm (6.5 in)
      b. Length: 622.3 mm (24.5 in)
   2. Mechanical Specifications
      a. Cable Entry Drop Port Size: 25.0 mm (1.0 in)
      b. Cable Entry Drop Port, quantity: 3
      c. Cable Entry Express Port Size: 25.0 mm (1.0 in)
      d. Cable Entry Express Port, quantity: 2

PART 3 - EXECUTION

3.1 GENERAL

A. Provide all necessary products for installation of Copper Backbone cablings to include cable attachments, etc.

B. Backbone cable shall be installed following industry standard practices.

C. All Outside Plant Backbone cable shall terminate on Primary protection (per the NEC) upon entering the building.

D. Contractor shall terminate the 25-Pair copper cabling to a 110-style block. With (4) C4 clips and (1) C5 clip.

E. All installations shall comply with:
1. ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
2. TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
3. ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual

F. All cabling shall be rated for the environment in which they will be installed.

G. Cable shall be continuous from end to end unless otherwise noted on drawings or directed by Owner.

H. Adhere to all manufacturer's requirements regarding pulling tension and allowable lubricants.

I. All fiber optic cabling shall be installed in 1" inner duct in conduits between terminations points, unless noted on drawings or approved by Owner.

J. All fiber runs must have a 15' service loop at each end.

K. Test, Label, and document as per section 27 08 00 requirements.

3.2 BACKBONE CABLE TESTING

A. All multi-pair copper cable pairs installed shall be tested to TIA/EIA 568A, Category 3 equivalent performance specifications. In addition, provide loop resistance measurements in ohms and dB loss at 1 KHz, 8 KHz, and 256 KHz.

B. 100% of all pairs in backbone copper cables shall be tested for continuity and wire-map.

C. Complete end-to-end test results for all Fiber Optic cables installed are required.

D. All fiber optic cable must be visually inspected and optically tested on the reel upon delivery to the installation site. Using an Optical Time Domain Reflectometer (OTDR), an access

jumper with like fiber, a pigtail, and a mechanical splice, all fibers shall be tested for continuity and attenuation.

E. Testing for continuity and attenuation on the reel must confirm factory specifications to ensure that the fiber optic cable was not damaged during shipment. The test results must match the results of the factory- attached tag on the reel, or the fiber shall not be used. Reel data sheet must be provided showing test results.

F. End to end (bi-directional) test measurements shall be provided (unless otherwise noted) for single- mode and multimode fibers (2 wavelengths per test are required). Test results must be submitted for review as part of the installation inspection requirements. Test results shall be in paper form and electronic form, and must contain the names and signatures of the technicians performing the tests.

G. Testing shall be performed on 100% of the fibers in the completed end-to-end system. ANSI/TIA-568-A, Annex H, provides the technical criteria and formulae to be used in fiber optic testing.

H. Additionally, all fiber optic cable links must pass all installation and performance tests both recommended and mandated by the cable manufacturer.

I. Testing Format: Test Results must be submitted in two (2) formats. First, must be original file(s) down loaded from tester. Second, the file must be cohesively placed in Excel or PDF format with the following fields:

J. ER/TR RM # / RM # of drop / Port # / all relevant test information in as many fields as necessary.

K. All test results are to be recorded and submitted to the Consultant.

3.3 SPLICE CASE INSTALLATION

A. Contractor shall comply applicable codes, standards and with all local codes and requirements. It is the responsibility of the contractor to identify and adhere to any unique codes or requirements governed by the region where the work is to be performed.

B. Splice Closures and Cables shall be installed following industry standard practices.

C. Slack cable is mandatory and shall be stored properly for the application.

D. Splice Closures shall be supported with the proper hardware for the application. Use of the appropriate Pole, Aerial and Maintenance Hole Hardware from the manufacturer shall be used.

E. Contractor shall not exceed the maximum pulling tension or the minimum bending radius for OSP cables per manufacturer’s specifications.

3.4 CABLE SUPPORTS

A. Provide cable supports and clamps to attach cables to backboards and walls.

B. Attach horizontal and vertical backbone cables at 2-foot intervals using Owner approved supports; such as D-rings or jumper troughs utilized for wire management.

C. Attach cables to manhole racks using Owner approved methods

D. Backbone cabling shall be secured to the cable/ladder tray following manufacturer recommended procedures, and appropriate installation hardware and methods as defined by local code or the authority having jurisdiction (AHJ).

3.5 AS-BUILT DRAWINGS

A. CAD Files: Provide CAD files in .dwg or .dgn formats showing floor plans with room numbers and actual backbone cabling and pathway locations and labeling. The deliverable is required within 5 business days of final cable testing.

B. Red Line Drawings: Contract must kept one (1) E size set of floor plans on site during work hours showing installation progress marked and backbone cable labels noted. Contractor may be asked to produce these drawings for examination during construction meetings or field inspections.

END OF SECTION 27 13 00

SECTION 27 15 00- COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the minimum requirements for Copper Horizontal Cables.

B. Horizontal (to desktop) cable shall consist of Category 6A copper cable for all Data and Voice applications.

C. Outlets for wall-mounted or other “telephone only” installations shall consist of one Category 6A cable as a minimum.

D. Outlets for wireless access points (APs), IP Camera locations (SCs) and ancillary IP network appliances shall consist of Category 6A cables as a minimum.

1.2 QUALITY ASSURANCE

A. All cable and equipment shall be installed in a neat and skillful manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Owner or Owner Representative. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where “approved equal” is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.

B. Strictly adhere to all Building Industry Consulting Service International (BICSI), Electronic Industries Alliance (EIA) and Telecommunications Industry Association (TIA) recommended installation practices when installing communications/data cabling.

C. Material and work specified herein shall comply with the applicable requirements of the current adopted revision of the following:
1. ANSI/TIA – 568 Series Commercial Building Telecommunications Cabling Standard,
2. TIA – 569 Commercial Building Standard for Telecommunications Pathways and Spaces,
3. ANSI/TIA – 606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. ANSI-J-STD – 607 Joint Standard for Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
5. NFPA 70 – National Electric Code
6. BICSI – Telecommunications Distribution Methods Manual
7. TIA/EIA-568-C.1 – Commercial Building Telecommunications Cabling Standard
8. TIA/EIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards
9. ISO/IEC 11801 - Generic Cabling for Customer Premises
10. CENELEC EN-50173 - Generic Cabling Systems

1.3 CABLE CONSTRUCTION

A. Listed CMR cable: Solid copper conductors with high-density polyolefin insulation and an overall low smoke polyvinyl chloride (PVC) jacket to achieve a riser (i.e., non-plenum) rating by applicable NEC requirements.

B. Listed CMP cable: Solid copper conductors with fluorinated ethylene propylene (FEP) insulation and an overall low smoke PVC jacket to achieve plenum rating by applicable NEC requirements.

C. LSZH cable: Solid copper conductors with non-halogen high-density polyethylene (HDPE) insulation and a low smoke, zero halogen, compound jacket to achieve a LSZH rating by applicable IEC standards

D. LC cable: Solid copper conductors with FEP fluoropolymer insulation and overall FEP fluoropolymer jacket to achieve CMP 50 rating by UL standards

E. OSP outdoor cable rated for wet locations: Solid copper conductors with polyethylene insulation, polyolefin fluted center member with flooding compound, and black polyethylene jacket

F. Comply with following general physical specifications:
   1. Maximum pulling tension: 110 Newton's (25 pound-force)
   2. Operating temperature: –20 to 60 degrees C [–4 to 140 degrees F]

1.4 SUBMITTALS

A. Provide product data for the following:
   1. Manufacturers cut sheets, specifications and installation instructions for all products (submit with bid).

1.5 COORDINATION

A. Coordinate layout and installation of cable tray with other trades.

1.6 RELATED SECTIONS

A. Division 27

PART 2 - PRODUCTS

2.1 HORIZONTAL STATION CABLING

A. Unshielded Twisted-Pair Category 6A Cable (UTP)
   1. Cable shall be listed for the environment where it will be installed (Plenum, Riser, LSZH, etc.).
   2. Shall Consist of (4) 23 AWG Twisted Pairs.
   3. The overall diameter of the cable shall not exceed 0.28 inches.
   4. Cabling shall be rated to a minimum of ANSI/ TIA Category 6A Rating.
   5. Shall meet the TIA 568-C Transmission Characteristics Standard for Category 6A UTP Cable.
   6. Approved Manufacturer: Commscope, Berk Tek, Essex or Equivalent

2.2 CATERGORY 6A JACKS

A. Physical Characteristics
   1. Shall be functional from 14 degrees F to 140 degrees F.
   2. Shall be tested in accordance with ANSI/ TIA-568-C for Category 6A performance.

3. Shall be modular RJ45 Jacks that snap into user configurable faceplates meeting the durability requirements specified in IEC 603-7.

B. Shall be 110 IDC, RJ45 type suitable for 22-26 AWG wires and be certified Category 6A compliant.

C. Conductors shall be separated and aligned internally by jack comb.

D. Wired in accordance with TIA T568C polarization sequence

E. Color(s) to be submitted to owner prior to installation.

F. Acceptable Manufacturers: Panduit, Commscope, Leviton or Equivalent.

2.3 FACEPLATES

A. Faceplates shall:
1. Comply with TIA 606-A Standard specifications.
2. Be UL listed.
3. Be from the same manufacturer as the Modular Jacks.
4. Have a recessed designation window to facilitate labeling and identification in all offices and cubicles.
5. Single gang faceplates shall support a maximum of (6) Modular Jacks.
6. Blank Fillers shall be installed when extra ports are not used.

2.4 ACCEPTABLE MANUFACTURERS: WALL PHONE FACEPLATES

A. Shall be constructed of stainless steel.

B. Shall have mounting lugs to support phone mounting.

C. Phone manufacturer and model number to be provided by Owner.

D. Shall be capable of being mounted to a single gang box.

E. Shall be wired to TIA-568B

F. Acceptable Manufacturers: Commscope, Leviton, Allen Tel or Equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. UTP Cabling
1. Maximum Length shall be 90 meters (295') from termination point (patch panel) to termination (wall outlet)
2. Cable above accessible ceiling shall be supported at every 5 feet on center with cable supports attached to the building structure.
3. All cables to be terminated to manufacturers recommended guidelines.
4. Cable shall have no physical defects such as cuts, tears, or bulges in the outer jack. Cable with defects shall be replaced.
5. Install cable in a neat and skillful manner. Neatly bundled and tie all cabling in accessible ceilings.

6. Maintain the following clearances from EMI sources.
   a. Power Cables = 6 inches.
   b. Fluorescent lights = 12 inches
   c. Transformers = 36 inches
7. Do not install UTP cable with more than 110N (25lbs) pull force, as specified in TIA and BICSI practices. Utilize appropriate cable lubricant in sufficient quantity to reduce pulling friction to acceptable levels on:
   a. Long pulls inside conduit.
   b. Pulls of multiple cables into a single small-bore conduit.
   c. Conduit runs greater than 100 lineal feet with bends of opposing direction.
   d. Conduit runs that exceed 180 degrees of accumulated bends.
8. Cable jackets that are chaffed or burned exposing internal conductor's insulation or have any bare copper ("shiners") shall be replaced.
9. Fire stopping will be installed in all openings where communications cabling is installed through a fire barrier.
10. All cables will be terminated with high-density modular jacks that snap into a faceplate mounted on a wall outlet.
11. Any extra openings in faceplates will be filled in with a blank insert.
12. Terminate cabling per TIA T568B standard pin assignment.
13. All horizontal cabling is to be of a single manufacturer from Termination to Termination.

END OF SECTION 27 15 00

SECTION 27 41 16 – INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes
1. Contractor is to provide Owner's Representative with a line-item proposal outlining each room type and a total all equipment and labor for each room. The proposal shall be broken down by room type, the quantity of each room type and the grand total of all rooms. This is required so that the Owner's Representative may select which rooms they will outfit during construction, and which will be outfitted at a future date. Infrastructure shall be installed in all rooms to allow future AV installation when and if required.
2. Provide all labor, materials, transportation, and equipment to complete the furnishing, installation, assembly, set up, and testing of the Audio, Video and Control Systems work indicated on the drawings and specified herein. Notwithstanding any detailed information in this Section, provide complete, working systems. General design intent for this project is shown on the drawings and described in the specification.
3. All equipment requiring coordination with other trades must be tested and verified for proper operation. Contractor is fully responsible for the coordination and must resolve all conflicts with AV equipment that connect or interact with other systems.
4. Design, engineer and provide complete means of support, suspension, attachment, fastening, bracing, and seismic restraints (hereinafter "support") of the Work of this Section, including future installed equipment, in accordance with local building codes and regulations. Provide engineering of such support by parties licensed to perform work of this type in the Project jurisdiction. Contractor shall obtain the services of an engineer licensed to perform this work within the state or jurisdiction it is to be performed.
5. Use skilled mechanics that are capable of returning surfaces to the appearance of new work when modifying millwork.
6. Conduit and common back boxes including four square, pull boxes, junction boxes, etc. are supplied and installed by Division 26 Electrical Contractor. Connection panels that install in these boxes are supplied by AV Contractor.
7. Provide Power Over Ethernet switches and injectors where required.
8. Provide all cable and wire associated with this specification section and related documents.
9. All systems shall be completely installed with all of the necessary interconnection, power supplies, patch cords, snakes, portable equipment cables and wiring to provide a fully functioning system.
10. The governing overall requirement for this project is a complete and functional system.
11. Include work not usually shown or specified, but necessary for proper installation and operation of the system or piece of equipment.

C. Related Sections
1. Division 9.
2. Division 10.
3. Division 11.
4. Division 26.

1.2 REFERENCES

A. Comply with all applicable governing codes.

B. Comply with the following applicable organizations and standards:
1. AES Audio Engineering Society
2. ANSI American National Standards Institute
3. ASTM American Society for Testing and Materials
4. ATSC Advance Television System Committee
5. BICSI Building Industry Consulting Service International, Inc.
6. BTSC Broadcast Television Stereo Committee
7. CEDIA Custom Electronic Design and Installation Association
8. EIA Electronic Industries Alliance
   a. RS-310-C: (ANSI C83.9) Racks, Panels, and Associated Equipment
   b. RS-453: Dimensional, Mechanical, and Electrical Characteristics Defining Phone Plugs and Jacks
9. ETL Electrical Testing Laboratories, Inc.
10. FCC Federal Communications Commission
11. ICIA International Communications Industries Association
12. IEC International Electrotechnical Commission
13. IEEE Institute of Electrical and Electronic Engineers
14. INCITS InterNational Committee for Information Technology Standards
15. ISO International Organization for Standardization
16. ITU International Telecommunications Union
17. NAB National Association of Broadcasters
18. NCTA National Cable and Telecommunications Association
19. NEC National Electrical Code
20. NEMA National Electrical Manufacturers Association
21. NFPA National Fire Protection Association
22. NSCA National Systems Contractors Association
23. OSHA Occupational Safety and Health Administration
24. SMPTE Society of Motion Picture and Television Engineers
25. TASO Television Allocation Study Organization
26. TIA Telecommunications Industry Association
27. UBC Uniform Building Code
28. UL Underwriters Laboratories Inc.

C. Comply with the following Technical Guidelines:
1. INFOCOMM Best Practices Guidelines
2. Middle Atlantic Thermal Management White Paper
3. Middle Atlantic Power distribution and grounding of Audio, Video and Telecommunication Equipment including addendum one.

1.3 DEFINITIONS

A. Definitions of Terms: The following definitions and conditions apply to each of the respective parameters and the measurements of those parameters, unless specifically stated otherwise:
1. Frequency Response: The minimum acceptable frequency band over which the amplitude response is within 3 dB (or any specified range), or the specified limits of the response relative to the reference frequency (1 kHz for audio, 1.0 MHz for video) under design load conditions, at any operating level up to and including the specified maximum output while fully in compliance with all other performance specifications.
2. Maximum Output Level: The minimum acceptable maximum signal output level (voltage, current or power) attained under design load conditions attained while fully in compliance with all other performance specifications.

3. Harmonic Distortion: The maximum acceptable harmonic distortion measured at any operating level, up to and including the specified maximum output, with an applied sine wave signal of any frequency in the range of the specified frequency response.
4. Audio Intermodulation Distortion: The maximum acceptable intermodulation distortion resulting from the introduction of 60 Hz and 7 kHz signals in a ratio of 4:1 under design load conditions at any operating level up to and including the specified maximum output level.
5. Signal to Noise Ratio: The minimum acceptable ratio of signal to noise levels derived from broadband measurements under design load at maximum output over the entire range of the specified frequency response.
6. Clipping Level: The minimum acceptable maximum level of signal applied to the device under design load conditions while fully in compliance with all other performance specifications.
7. Sensitivity: The maximum acceptable level of input signal applied to the device that is necessary to provide the maximum output under design load conditions.
8. Design Load: The load (in ohms) specified by usage of the particular device input or output.

B. Signal Levels: The following voltage levels shall be considered the standard operating levels for the particular circuitry, unless specifically noted otherwise (0.775 Volt = O dBu = O dBm for a 600 ohms terminated circuit):
1. Microphone Circuits: -30 dBu or less.
2. Audio Line Level Circuits: -30 dBu to +24 dBu; equivalent to -30 dBm to +24 dBm for a 600 ohms terminated circuit.
3. Loudspeaker Level Circuits: More than +24 dBu.
4. Video Line Level Circuits: 1.0 Volt, peak to peak composite signal.
5. Radio Frequency (RF), Television (MATV) Circuits: +6 to +72 dBmV (0 dBmV = 1,000 microvolts).

C. Characteristic Impedances: The following operating impedances shall be considered to be the standard operating impedances for the particular circuitry, unless specifically noted otherwise:
1. Microphone Circuits: 50-250 ohms source, 150-1500 ohms terminating, electrostatically and electromagnetically balanced to ground.
2. Audio Line Level Circuits: 600 ohms maximum source, 600 ohms minimum. terminating, line to line, electrostatically and electromagnetically balanced to ground.
3. Video Line Level Circuits: 75 ohms maximum source, 75 ohms minimum terminating to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.
4. Radio Frequency (RF) Television Circuits: 75 ohms nominal to shield and signal ground, with Vertical Standing Wave Ratio (VSWR) not to exceed 1.2.

1.4 SYSTEM DESCRIPTION

A. Design Requirements
1. General
a. The Slauson Connect Recreation Center, audio-visual system includes a Multipurpose, Childcare, Afterschool Classrooms and Roof Garden.
b. All audio processing functions for the system shall be implemented with Digital Signal Processing equipment (DSP). The system shall connect to the Local Area Network for monitoring. Functions provided by this system include but are not limited mixing, level control, automatic mixing, equalization, adaptive equalization, delay, routing, dynamics, filters, processors, presets, etc.

c. Where required, an integrated High-Definition multimedia presentation matrix switcher shall be provided. The switcher shall have flexible routing of digital and analog sources, microphone mixing, audio DSP, amplifier, and control system capabilities. The switcher shall support analog and digital video formats including DVI, HDMI, and Display Port (HDMI compatible).

d. Where distributed loudspeakers are required, the location and spacing of the loudspeakers shall be designed to provide even coverage throughout the space with a minimum level of variation while integrating aesthetically into the overall ceiling plan. The system shall meet the following criteria:
   1) 85 dBA minimum acoustical output with speech, 100 dB minimum acoustical output with music, measured in audience area, at listener height, with applicable program material.
   2) Plus or minus 3 dB variation with frequency measured from 100 Hz to 4 kHz, at all locations in the audience area.
   3) 6 dB minimum acoustical gain with talker 12 inches from microphones.

e. The contractor shall utilize the HDBaseT connectivity standard for transmitting and receiving audio, video, ethernet, control and low voltage power to and from remotely located audio visual equipment

f. Flat Panel LED Displays - Use the following guidelines to determine the diagonal size required in a space.
   1) Display screen height shall be equal to a minimum of 1/7 the distance from the screen to the least favored viewer.
   2) The bottom of the screen shall be no lower than 48 inches above finished floor.

g. Projection Systems
   1) Motorized projection screen height shall be equal to a minimum of 1/6 the distance from the screen to the least favored viewer.
   2) DLP Laser video projectors shall be capable of at least 3840 lines of horizontal resolution and greater than 400 Lux per square meter of light output when measured at the projection screen.
   3) The bottom of the projection screen shall be no lower than 48 inches above finished floor.
   4) Contractor shall use lens shifting when projector cannot be aligned properly to the screen. Use of keystone correction is not allowed. Provide projector lifts where required to align projector to screen.

h. Where required, a software configured, web enabled, integrated central control system shall be provided to control all aspects of the audio and video system's functions, signal routing, lighting, shades and audio levels.

i. Infrastructure will be provided for the installation of AV equipment that will be installed at a future date. This infrastructure will be labeled to allow easy identification of these devices. Back boxes will be labeled with Device ID.

2. Multipurpose Classroom
   a. The Multipurpose classroom shall be provided with a presentation system adequate for the display of high-resolution computer graphics and pre-recorded audio-video media. In addition, the system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
   b. The Multipurpose classroom system shall consist of a dual 16:9 multimedia laser projectors with motorized projection screens. Audio playback and speech reinforcement shall be accomplished using overhead mounted loudspeakers and a 70 V amplification system.

c. The system shall consist of two loudspeaker zones to allow maximum gain in the audio system. The first zone shall include loudspeakers directly over the audience area; the second zone shall include loudspeakers directly over the lectern or microphone position. The contractor shall adjust the system for maximum gain before feedback.
d. A wired handheld, lectern mounted gooseneck and single channel wireless microphone shall be provided for voice reinforcement
e. A connectivity panel shall be provided at the lectern position. The panel shall include HDMI and audio connections. These connections shall be inputs to an HDBaseT transmitter located within the lectern.
f. A connectivity plate shall be located in a floor box directly below the lectern position. The connection plate shall include an HDBaseT (RJ45) and a microphone input.
g. Rack mounted source equipment shall include a Blu-Ray player.
h. A presentation system shall be provided to route analog and digital signals from sources to the projector.
i. A software configurable control system and wall mounted touch panel user interface shall be provided.
j. Equipment shall be mounted in a freestanding equipment rack located in a conditioned room.
k. Provide Local Area Network (LAN) and CATV drops at the equipment rack location.

3. Classrooms
   a. These rooms have the capability of being combined or separated as needed. The system will allow each room to function separately where audio and video signals will route from each AV connectivity panel located on the wall to their associated video display / video projector or combined where AV signals will route from one AV connectivity panel to the video projectors / all video displays.
   b. A partition sensor shall be provided to facilitate the room combining presets in the control system.
   c. The classrooms shall be provided with a presentation system adequate for the display of high-resolution computer graphics and pre-recorded audio-video media. In addition, the system shall provide speech reinforcement (including ADA compliant assistive listening devices) features.
   d. The classrooms system shall consist of 4K multimedia ultra-short throw laser projectors with wall mounted fixed projection screens or appropriately sized wall mounted 4K video displays. Audio playback and speech reinforcement shall be accomplished using wall mounted loudspeakers and a 70 V amplification system.
   e. The system shall consist of two wall mounted loudspeaker on the presentation wall. The contractor shall adjust the system for maximum gain before feedback.
   f. A lectern mounted gooseneck microphone shall be provided for voice reinforcement
   g. A connectivity panel shall be provided at the lectern position. The lectern panel shall include HDMI and audio connections. These connections shall be inputs to an HDBaseT transmitter located within the lectern.
   h. A connectivity plate shall be located on the wall. The connection plate shall include an HDBaseT (RJ45) and a microphone input.
   i. A presentation system shall be provided to route analog and digital signals from sources to the projectors or video displays.
   j. A software configurable control system and wall mounted touch panel user interface shall be provided.
   k. Equipment shall be mounted in a freestanding equipment rack located in a conditioned room.

l. Provide Local Area Network (LAN) and CATV drops at the equipment rack location.

4. Roof Garden
   a. The Roof Garden system shall consist of a 16:9 multimedia laser projector enclosed in a weatherized outdoor enclosure.
   b. A connectivity panel shall be provided to connect a portable laptop or other video source equipment.
   c. Audio playback shall be accomplished using two portable self-powered loudspeakers on appropriate tripods that shall connect directly to the laptop audio output.

B. Software Programming
   1. General
      a. Except when otherwise agreed in writing the Owner shall retain legal and beneficial ownership of all Intellectual Property, including source code, created by the Contractor, their employees, and sub-contractors.
      b. The Contractor must allow sufficient time for the programming of all software configurable audio, video and control systems. Contractors must evaluate the systems functional requirements and user interface and then allow time in their bid accordingly. The system description as well as the end user interview will provide the Contractor with the necessary information needed to proceed with the programming. Any questions as to the systems functional requirements must be sent in written RFI form to the Owner's Representative. All programming schemes must be submitted to the Owner's Representative for approval before programming starts. This includes the appearance of all user interfaces, touch panel layouts, preset and sub-preset information (acquired through Owner's Representative interviews), and speaker control schemes. The Contractor will also submit a narrative for the control system concept to the Owner's Representative for approval. The Contractor is to interview the Owner's Representative and their representatives to acquire the necessary information needed to allow for the proper programming of this system. The Contractor, after interviewing the Owner's Representative, will then submit a written report stating his interpretation of the Owner's Representative's requirements. Only after the Owner's Representativehas approved the programming report may the Contractor proceed with the programming of this system.
      c. All equipment that is connected to the Owner's local area network and is configurable via the local area network must have its equipment software installed onto dedicated computers provided by the city. The Contractor is to allot time to install and test equipment software onto a minimum of two of the City's computers which are to be identified by the Owner's Representative and/or architect of record. The computers will be programmed to emulate user interfaces throughout the facility. The Contractor shall coordinate all software deployment over IP with the Owner's Information technology department.
   2. Control system minimum programming outlined below:
      a. The Contractor shall allot 4 hours for on-site control system programming with the Owner's Representative's representative.
      b. The Control System in this project shall connect to the Owner's Local Area Network (LAN). This connection will provide desktop computers control of the audio-visual system as well as make available remote troubleshooting via the internet. The Contractor shall provide time to install control system interface software on at least three desktop computers. Coordinate work with the Owner's Information Services personnel.

c. Provide password protection to each control surface in this facility. Touch panels shall be activated and deactivated by password. Upon start up a password dialog box shall be presented to the user to enter his/her password. Only after entering a password will the user have access to the system. The system shall be programmed to shut down automatically after being idle for a time to be specified by the user. Coordinate this feature with operations staff.
d. Touch panel layout design will conform to the InfoComm International “Dashboard for Controls” guidelines. Touch panel designs are to be custom to this project. Re-purposed touch panel designs are not acceptable.
e. Technical users shall have the ability to access individual speaker zone controls via the touch panel interface.
f. The contractor shall provide a default audio level preset button, in the control system user interface, to allow a user or technician to recall all gain levels that were set when the system was commissioned.
g. Control Help File: Each touch panel will include a help file that will explain each layer of the touch-panel control scheme.
h. All serial controlled devices must have bi-directional communication with the control system. All control functions locally available on each device must be accessible via the remote control system. All locally gestured control functions must mirror on the control system user interface. In other words, if a volume control is adjusted on a DSP interface that adjustment must register on the control interface.
i. Control system shall be used to power up and down connected equipment at control system start up and shut down.
j. Control system shall control both lighting and motorized window shades in each room.
k. The control system shall monitor the connected power amplifiers and report overheating that may occur.

3. Complexity of Programming:
   a. It is required that the Contractor be experienced in programming systems of this complexity. Contractors shall allow enough time in their bid to permit extensive programming of all software configurable audio, video, and control systems to the requirements of the Owner's Representative. Contractor shall break out cost associated with programming of these systems for review by the Owner's Representative. By submitting this bid, the Contractor agrees that they understand systems of this type and that all programming services are included to the satisfaction of the Owner's Representative. The Contractor further agrees that they will not make any claim for additional monies because of misinterpretation of programming requirements.

C. System Performance Standards and Requirements (meet or exceed)
1. Audio Systems:
   a. Electrical Performance; Source Input to Power Amplifier Output:
      1) Frequency Response (Equalizer flat): +/- 0.2 dB 20 Hz to 20 kHz.
      2) Total Harmonic Distortion (THD): Less than 0.05%, 20 Hz to 20 kHz, 4 ohms.
      3) Noise: At least -105 dB, 20 Hz to 20 kHz, referenced to input of +4 dBm.
      4) Crosstalk: At least -60 dB, 20 Hz to 20 kHz.
      5) Damping Factor: Greater than 500 (below 1 kHz)
   b. Electro/Acoustic Performance; Distributed Systems: 103 dB Consistent with devices specified herein.
      1) Equipment: Specified individually.
      2) Audio signal paths: Shall not degrade performance of connected equipment.
   c. NEC - Article 640: Audio Signal Processing, Amplification and Reproduction Equipment.

2. Video Systems:
   a. Video signal system: ATSC 1.0 or 3.0, where applicable.
   b. Video signal paths: To EIA RS-250C short haul where equalized or fiber optic transmission, otherwise to the performance limit of the specified video cable.
   c. ANSI IT7.228 (ANSI Lumens): Measurement method for light output of fixed resolution video projection systems.
   d. ANSI IT7.228 (ANSI Contrast Ratio): Measurement method for the contrast ratio of fixed resolution video projection systems.
   e. JPEG: Joint Photographic Experts Group. Proposes and publishes video standards for Still Images.
   f. MPEG: Motion Picture Experts Group. Proposes and publishes video standards for Broadcast.
   g. EIA RS 170 & 170A The original specs for Monochrome and Color TV in the US. Has been replaced by SMPTE 170M.
   h. EIA 770-1: The US spec for Enhanced Component video, similar to ITU-R BT1197/ETSI 300 294 for PAL-Plus.
   i. EIA 770-2: The US specs for Standard Definition TV (SDTV) Baseband Component Video.
   j. EIA 770-3: The US spec for High-Definition TV (HDTV) Baseband Video.
   k. ITU-R BT.470: Harmonized spec for SDTV worldwide, including NTSC, PAL, and SECAM.
   l. ITU-R BT.601: Universal Sampling spec for SDTV and HDTV Broadcast Video. Similar to SMPTE125M.
   m. ITU-R BT1197/ETSI 300 294: Spec for PAL Plus Enhanced TV in Europe.
   n. SMPTE 125M: Similar to ITU-R BT.601.
   o. SMPTE 170M: Has replaced EIA RS 170A, color spec for NTSC.
   p. SMPTE 253M: RGB Analog Video Interface spec for SDTV Studio applications.
   q. SMPTE 274M: Component spec for 1920x1080 HDTV.
   r. SMPTE 296M: Spec for 1280 x 720 RGB and YPbPr Baseband Video. Similar to PAL Plus.
3. Data and Communications Systems:
   a. TIA/EIA 568-C series: Commercial Building Telecommunications Cabling Standard.
   b. ANSI J-STD-607-A: Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
   c. Comply with ITU-T (International Telecommunications Union – Telecom) for video conferencing systems.
4. Control Systems:
   a. RS485 (TIA-485): Electrical characteristics of generators and receivers for use in balanced digital multipoint systems.
   b. RS232 (TIA-232): Interface between data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.
   c. RS 422 (TIA-422): Electrical characteristics of balanced voltage digital interface circuits.

1.5 SUBMITTALS

A. General
1. In addition to the requirements of Division 1, submit all materials for review arranged in the same order as the Specification, individually referenced to the Specification paragraph and Contract Drawing number. Submit 8 1/2" x 11" items bound in volumes and drawings in edge-bound sets. Submit all drawings on sheets of the same size.
2. The Contractor is to provide two copies of each hardcopy submittal and an electronic format copy (Shop drawings must be submitted as .DWF. All other submittals will be provided as .PDF). All submittals must be original files or documents, scanned copies will not be accepted.

3. Make each specified submittal as a coordinated package complete with all information specified herein. Incomplete or uncoordinated submittals will be returned with no review action.
4. Should the Contractor proceed with the Work of this Section in the absence of submittals for such work submitted and returned with action "No Exception Taken" or "Make Corrections As Noted", the Contractor proceeds at the Contractor's sole risk.
5. In the event that the Contractor deviates from the design shown on the audio-visual Contract Documents when preparing their shop drawings, the Contractor shall indicate with architectural style clouding, those deviations. The Contractor shall also submit with the Shop Drawings, a list of those deviations and substitutions, including the following:
   a. The deviation item number which shall also correspond to a number designation applied to each cloud on the shop drawings.
   b. Section of the specification that applies to these changes.
   c. The applicable shop drawing sheet number for each item.
   d. The corresponding audio-visual Contract Document sheet number for each item.
   e. A clear description of the deviation.
   f. The Contractor's rational for the deviation (i.e. what benefit the deviation provides, why it is required, any cost impact, etc.).

B. Infrastructure
   1. Provide drawings indicating boxes and conduit require for the AV system.
   2. Coordinate, power, HVAC and structural requirements for the AV system with electrical, mechanical and structural engineers.

C. Product Data
   1. Manufacturer's Product Data
      a. Contractor is to submit submittal in electronic format (i.e. PDF)
      b. List of materials (i.e. Table of Contents) categorized by room type: For each item specified in PART 2, include:
         1) Drawing device ID code.
         2) Manufacturer.
         3) Model number.
         4) Listing: UL or other lab.
         5) Quantity.
      c. In sequence of List of Materials, provide a data sheet for each item, including all accessories marked for the proposed product.

D. Shop Drawings
   1. Field (Installation) Drawings: Collate in sequence:
      a. Contractor is to submit shop drawings in .DWF format.
      b. Drawing index/symbol sheet.
      c. Floor plans. At scale of Contract Documents. Show:
         1) Device rough-in boxes with ID number.
         2) Mounting height.
         3) Conduit size.
         4) Wire type.
         5) Wire fill.
      d. Sections/Elevations. At scale of Contract Documents:
         1) Mounting location reference to nearest gridline.
            a) Provide sections for each room containing AV equipment.
            b) Provide elevations for each wall in rooms containing AV equipment.
            c) Show all equipment, including speakers, monitors, projectors, podium, floor boxes, facility boxes, etc.
            d) Provide vertical dimensions referenced above finished floor to each piece of equipment.

e) Provide horizontal dimensions reference to gridlines.

e. Enlarged Plans. At scale of Contract Documents or larger as required for trade coordination. Show:
1) Items indicated in "floor plans" above.
2) Architectural features.
3) Rack cabinets.
a) Ventilation details.
b) Power distribution detail.
4) System furniture.
5) Clearances required by applicable Code.

f. System Conduit Riser Drawing, Show:
1) Terminal cabinets.
2) Coordination with floor plans.
3) Wire runs not shown on floor plans.
4) Wire type.
5) Wire fill.

g. Mounting details:
1) Stamped and signed by an Engineer licensed in the Project jurisdiction for work of this type, where required by code.
2) Show loads, type and strength of connections, sizes, dimensions, materials, etc.
3) Show calculations on drawings or in bound volume for review by Authorities having jurisdiction.
4) Provide details for:
a) Equipment rack anchorage.
b) TV Monitor mounts.
c) Loudspeaker mounts.
d) Video projector mounts.
e) Video displays.
f) Projection screens, both fixed and motorized.
g) Attachment to building structure.

h. Installation details as required:
1) Terminal cabinets: Terminations.
2) Audio-Visual panel details.

i. Wire run sheets. Show:
1) Wire number.
2) Source.
3) Designation.
4) Signal type.
5) Wire type.
6) Operating level or voltage.
7) Timing reference, where applicable.
8) Physical length.

2. Shop (Fabrication) Drawings: Collate in sequence:
a. Contractor is to submit shop drawings in .DWF format.
b. Drawing index/symbol sheet (if separate set from Field Drawings).
c. System functional drawings. Submit separate drawings for each system/subsystem. Show at least:
1) Equipment:
a) Function, make, model.
b) Rack number, module frame and slot number.
2) Field device information
a) Terminal cabinets.
b) Pull boxes.
c) Audio-visual panel connector designations.

3) Wiring
   a) Wire number.
   b) Wire type.
4) Shield condition at both ends (float, ground, location of ground).
5) Connector wiring details, each type.
6) Audio: Nominal operating level, Polarity. Note deliberate polarity inversions where required to maintain absolute polarity.
7) Video: Physical length. Electrical length in nanoseconds or degrees of sub-carrier, as applies. Equalization required.
8) Twisted pair, transmit and received devices: Transmission range at 60 Hz., cable length and signal quality.

d. Provide drawings for the following systems, if applicable:
1) Audio.
2) Video.
3) Control.
4) Data transmission.
5) Coordinated grounding scheme.

e. Equipment rack elevations: Show:
1) All racks scaled at 1 1/2" equals 1 foot, or larger.
2) Rack: Make, model.
3) Equipment: Function, make, model.

f. Rack wiring drawings: For each rack, show:
1) Power strip: Receptacles, circuiting.
2) Sequencing power and surge suppression systems.
3) Equipment.
4) Grounding.
5) Wiring, all systems.
6) Wiring harness scheme.
7) Ventilation detail.

g. Fabrication details: Submit for:
1) Receptacles.
2) Panels.
3) Special mounting provisions.

h. Legends/engraving details. Half or full size:
1) Receptacles.
2) Audio-visual panels.
3) Equipment designations.

E. Samples
1. Of all finishes/materials that will be visible to the public, including but not limited to:
   a. Receptacles and controls with associated trim plate.
   b. Each type of loudspeaker baffle and/or grille.
   c. All audio-visual panels.
   d. Audio-visual devices in public areas.

F. Programming
1. Control Programming Scheme Submittal
   a. Contractor is to submit submittal in electronic format (i.e. PDF)
   b. Provide a password-protected link to a folder on the Contractor’s network to remotely access the touch panel from the Owner's Representative’s computer. Contractor is to have a dedicated control processor utilized on their network.
   c. Provide a graphic layout of each user control interface (touch panels, push buttons, etc.).
   d. Provide a list of devices that are controlled by each control user interface, including:

1) Device.
2) Brand.
3) Model Number.
4) Control Method.

e. Provide a logic tree for each page for each control interface.
f. Provide a system routing sheet for each control user interface, including:
1) Source.
2) Switcher / device input.
3) Switcher / device output.
4) Final destination.
g. Provide help file content on each user interface.

G. Shop and Project Site Test Reports
1. Contractor is to submit in electronic format (i.e. PDF)
2. Schedule: Submit test reports in a timely manner relative to the Project schedule such that the Owner's Representative may conduct Verification of Submitted Test Data without delay of progress.
a. Shop test report: Submit prior to shipping completed equipment racks to Project Site.
b. Project Site test report: Submit project site test report for this section after system completion and prior to Acceptance Review and Testing.
3. Content: Include at least:
a. Time and date of start of burn-in.
b. Time and date of test.
c. Personnel conducting test.
d. Test equipment, including serial and date of calibration.
e. Procedures used.
f. Results of test - numerical or graphical presentation.

H. Close Out Submittal
1. Contractor is to submit submittals in electronic format (i.e. PDF)
2. Operation and Maintenance Manuals
a. Index.
b. Systems operating instructions.
c. Reduced set of system Record Drawings.
d. Key schedule.
e. Maintenance and spare parts schedules.
f. Shop and Field Test Reports.
g. Equipment manuals. Collate alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals in color for each equipment item. Provide tabbed dividers between each product. Manuals provided by the Manufacturer in an individual binder may be submitted in that form.
3. Framed Operating and Maintenance Instructions: Provide adjacent to each ensemble of equipment racks. Provide sturdy frame with clear glass or non-scratching plastic cover. Provide permanent, non-fading media. Blueprints shall not be acceptable. Include:
a. Sequence for system start-up and shutdown.
b. System Functional Diagrams.
c. Signal levels and impedance at accessible system signal and test ports, where applicable.
4. Record Drawings
a. As work progresses, maintain records of "as installed" conditions. Update the set at least weekly. After successful completion of Project Site testing specified herein, and after completion of Punch List corrections, copy all records of "as installed" conditions on to final Record Document drawings, as specified in Division 1.

b. Content: All drawings required under "Field and Shop Drawings". Show "as installed" condition. Where room designations according to Project permanent signage differ from construction designations in the Contract Documents, show both designations.

5. Provide four copies on CD-ROM containing the “as built” drawings, all manuals, training manual and programming code.
   a. Submit un-compiled programming code.
6. Training Submittal
   a. Provide all training materials for review prior to scheduling training sessions.
      1) Training manual.
      2) Agenda for the training session.
      3) The final punch list, indicating that all equipment is fully functional.
   b. See the section under Owner's Representative’s Instructions for training manual requirements.
   c. No training session will be scheduled until final punch list is completed and submitted.
7. Warranty Certificates
   a. Comply with Division 1.

1.6 QUALITY ASSURANCE

A. Qualifications
   1. The bidder shall, prior to the bid, in accordance with the Instruction to Bidders, submit at least the following information to verify that the bidder has the necessary experience and qualifications to perform the specified work:
      a. A detailed brochure describing the bidder’s capabilities in terms of facilities, personnel (include a personnel organization chart followed by resumes), experience, background, examples of similar installations (at least two projects within the past two years), distribution arrangements with manufacturers and financial capability, including certificates of insurance and satisfaction of the project bonding requirements.
      b. Contractor must, at the time of this bid submittal, have distribution or a dealership agreement with all manufactures whose products are specified in the bid documents. Contractor must also have completed manufactures training and certification before bids are submitted.
      c. AIA Document A305 “Contractor’s Qualification Statement”.
      d. Information identifying any and all local agents and/or subcontractors that will assist in the work and their role in the project.
      e. Identification of sources of labor for all fabrication and installation throughout the duration of the project.
      f. Evidence that he has acquired all necessary licenses, certificates and approvals to perform the specified work within the state or jurisdiction the work is to be performed.
   2. Projects that include networked audio or video systems will require the Contractor to submit the name of the person, in their employment, qualified to perform this work. This person shall have certification in computer network technology and hold one of the following certifications:
      a. CNP – Certified Network Professional Program.
      b. Computing Technology Industry Association - Network+ certification.
      c. MCSE – Microsoft Certified Systems Engineer.
      d. CNE – Certified Systems Engineer.
      e. CCNA – Cisco Certified Network Associate.

3. Projects that include software configurable, integrated central control systems must include, as a sub-contractor, an authorized independent programmer who is fully engaged in the work of programming. This person shall hold a CAIP - Crestron Authorized Independent Programmer or ACE – AMX Approved Certified Expert.
4. The Contractor is to enter into an agreement utilizing the authorized independent programmer as a sub-contractor. Under this agreement, the Contractor will retain all of the responsibility for a complete and working system. The Contractor must include in their bid time to work out any programming glitches that may occur in the initial programming stage. These items include working through the initial and final programming stage with the authorized independent programmer to provide a functional system, testing the programmer's graphical user interface for intended functionality and provide onsite support for the programmer in the uploading and testing of programming revisions. The control systems programmer shall be present either by web meeting or in person at the end user interviews to acquire information first hand. The control systems programmer shall submit a report outlining the meeting results to Contractor for approval. Only when the Contractor approves this report shall it be submitted to the Owner's Representative for review. The Contractor will provide information on how and by whom the requirements of the warranty period will be fulfilled.
5. The submittal must justify, in the judgment of the Owner's Representative, that the Contractor has the capability to manage and install a project of this size and scope and that he is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service. Contractor may be disqualified as a bidder if all of the submittal does not meet the approval of the Owner's Representativeand his/her representative.
6. Company: Work of this Section shall be performed by a Sound or Audio-Visual Systems Contractor who has at least five years direct experience with the devices, equipment and systems of the type and scope specified herein, and who has a fully staffed and equipped maintenance and repair facility, and who is licensed to perform work of this type in the Project jurisdiction. The company must be NSCA R-ESI or CTS certified.
7. Personnel: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section. Supervisors shall have at least five years direct experience in similar work. Installation and maintenance personnel shall have at least three years direct experience in similar work. Contractors shall have at least 60% of their installation staff CTS or C-EST certified.
8. Designated Supervisor: Provide a designated supervisor present and in responsible charge in the fabrication shop and on the Project Site during all phases of installation and testing of the Work of this Section. This supervisor shall be the same individual throughout the execution of the Work unless illness, loss of personnel, or other circumstances reasonably beyond the control of the Contractor intervene.
9. Staff Engineer: The Contractor shall have on his full-time payroll at least one staff engineer having five years minimum experience as an electronics engineer covering systems and projects comparable in substance and complexity to the project described herein. The staff engineer shall have NICET certification in Electrical/Electronics Engineering Technology and Audio Systems or equivalent. The signature of that engineer shall appear on all shop drawings and submittals.
10. Coordination: Coordinate the Work of this Section with the Work of all other Separate Contracts. Comply with Division 1.
11. Help Desk: The Contractor must employ a fully staffed help desk department that shall provide knowledgeable responses to inquiries regarding system operation. This department must also have the ability to provide remote diagnostics to identify equipment faults for troubleshooting.

B. Cutting and Patching
   1. Cut, patch and extend existing work using skilled mechanics that are capable of matching existing quality of workmanship.
   2. Assign work of moving, removal, cutting and patching, to trades qualified to perform the work in a manner to cause least damage to each type of work, and provide means of returning surfaces to appearance of new work.
   3. Perform cutting and removal work to remove minimum necessary, and in a manner to avoid damage to adjacent work. Cut finish surfaces such as masonry, tile, plaster or metals, by methods to terminate surfaces in a straight line at a natural point of division.
   4. When new work abuts or finishes flush with existing work, make a smooth and workmanlike transition. Patched work shall match existing adjacent work in texture and appearance so that the patch or transition is invisible.
   5. Protect existing finishes, equipment, and adjacent work that are scheduled to remain, from damage.
   6. Promptly repair damages caused to adjacent facilities by demolition operations, at no change in Contract Amount.

C. Painting
   1. Use skilled mechanics that are capable of painting audio-visual equipment and hardware to match architectural surroundings, where applicable.

D. Regulatory Requirements
   1. Regulations Applicable: including but not limited to those defined in Division 1.
   2. Comply with all applicable federal, state, and local labor regulations, and applicable local union and trade regulations.
   3. Installation practices shall be in accordance to industry-accepted standards (ANSI, Cal-OSHA, IEC, IEEE, FCC, NEC, NFPA, ICIA, NSCA, CEDIA, BICSI) or local acts, codes and standards enforced at the place of work, whichever is most stringent.
   4. Procure and pay for all necessary permits, licenses, inspections, and observe any requirements stipulated therein.
   5. Provide UL/ULC fire rated enclosures around all audio-visual floor and back boxes where required by code.

E. Programming
   1. User Group Interview:
      a. Conduct interviews with the end-users to acquire programming requirements. Submit written results of the interview and the requirements set forth by the user group. Associate the user group requirements into the programming of each sub system. Submit to the Owner's Representative a report that outlines the interviews conducted.

F. Pre-installation Meetings
   1. Attend a pre-installation meeting at the project site with the Owner's Representative and his representatives in order to coordinate related work and scheduling issues.

G. Verification
   1. Verify dimensions and conditions at the Project Site. Submit any conflicts in timely manner for resolution.

H. Shop Fabrication and Testing

1. Assemble and fully wire equipment racks at a fabrication shop off the Project Site. Burn-in for not less than 120 hours. Following burn-in, perform specified adjustment procedures. Provide test equipment and test according to procedures specified herein. Submit verification of shop test in timely manner. Following verification of shop test and when installation locations are ready as specified herein, deliver equipment racks and equipment to the Project Site and install.

I. Project Site Installation and Testing
   1. Install as specified herein.
      a. Perform specified adjustment procedures. Provide test equipment and test according to procedures specified herein. Request verification of Project Site test in timely manner.

J. Verification of Submitted Test Data
   1. Re-test in presence of designated representative(s) of the Owner's Representative at reasonable mutual convenience. Provide services of the designated supervisor and an additional technician familiar with work of this Section. Provide all test equipment. Provide complete set of latest stamped submittals of record for reference. Provide complete set of Shop and Project Site Test Reports, as applies. Provide a complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

K. Reference/Project Record Documents
   1. At all times when the work is in progress, maintain at the workplace, fabrication shop or Project Site as applies, a complete set of the latest stamped, action submittals of record for reference. Also maintain a separate, clean, undamaged set for preparation of Project Record Documents. Also maintain at the workplace a complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

1.7 DELIVERY, STORAGE AND HANDLING

A. Packing, Shipping, Handling and Unloading
   1. Deliver materials in manufacturer's original undamaged packages or in bulk packing which provides equivalent protection from rough handling, dust and dirt.
   2. Deliver all assembled equipment racks in custom manufactured wood crates to avoid damage during shipping. Contractor is to hire a crate manufacturer to build crates prior to delivering racks to the jobsite.
   3. All packing, shipping, insurance, handling and storage costs of equipment and materials shall be the responsibility of the Contractor.
   4. The Contractor shall be responsible for insuring all equipment and installation materials stored in their shop facilities until it is delivered to the Project Site and a delivery acknowledgement is received from the Owner's Representative or its authorized representative.
   5. Equipment unpacked for inspection but not ready for permanent installation must be returned into its protective packing.
   6. The Contractor shall be responsible for furnishing a temporary substitute for equipment that could not be delivered in time for system operation. All costs associated for renting, shipping and handling temporary substitute equipment shall be the responsibility of the Contractor.

7. In the event the equipment or installation material delivery is delayed, the Contractor must employ the fastest means of delivery service available to deliver the equipment on time. All costs for expediting the delivery of equipment shall be the responsibility of the Contractor.
8. Store packaged materials off of the ground or slab in a manner to protect them from elements, especially moisture damage.
9. Deliver completed, wired, tested equipment racks to associated equipment rooms at the Project Site when major work of all other separate contracts is complete, equipment room ventilation is operating with clean filters in place, the area is clean and free from airborne contaminates, and continuing work of other trades will not produce airborne contaminates or permit transport of such airborne contaminates to the equipment rooms.

B. Acceptance at Site
1. All equipment and installation material delivered to the Owner's Representative shall be properly documented in the form of delivery receipts.
2. Equipment delivered to the Project Site must have a delivery acknowledgement receipt signed by the Owner's Representative or its representative. Issue a signed copy of the delivery receipt to the Owner's Representative and file the signed copy for future reference.
3. The Contractor shall be responsible for the insurance coverage and security of equipment delivered to the Project Site until it receives an acknowledgement of delivery from the Owner's Representative.

C. Storage and Protection
1. The Contractor shall provide a safe and secure storage location for all equipment and installation materials until they are delivered to the Project Site, and it receives an acknowledgement of delivery from the Owner's Representative.
2. For equipment assembled and tested at the Contractor’s shop facility and delivered to the Project Site, ensure that the equipment is properly protected from improper handling, rain, water, humidity, moisture, heat, direct exposure to sunlight, dust and dirt during delivery and storage on or off the Project Site.
3. Do not remove protective packing from equipment until they are ready to be installed.
4. If, after equipment is installed, the Project Site cannot be cleaned or is still not clean because of on-going work by others, provide protective covering and protection to prevent airborne dust and dirt originating from damaging equipment.

1.8 PROJECT SITE CONDITIONS

A. Environment Requirements
1. The spaces where audio-visual system assemblies are installed shall meet the following requirements:
   a. Free from dust generated from construction.
   b. The room temperature shall be within the specified operating temperature recommended by the manufacturer.

1.9 SEQUENCING

A. Submit all testing documentation to the Owner's Representative for review prior to requesting the Fabrication Inspection and Substantial Completion inspections.

B. Allow adequate time for corrections to be made after inspections to maintain the Project Schedule.

1.10 SCHEDULING

A. Comply with the Project schedule.

B. Make all Submittals specified herein in a timely manner. Failure to make timely submittals complete as specified herein is considered to be lack of substantial progress of the Work of this Section. Contractor is to work around Owner's Representative's schedule throughout the duration of the project.

C. Deliver all equipment, devices and materials required for the Work of this Section and install, test and ready all work for Acceptance Testing at least fourteen days prior to the completion date for the associated area of the Project, unless specifically instructed otherwise by the Owner's Representative.

D. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the Owner's Representative, in lieu of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven days prior to the completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

E. It shall be a common understanding that there is a time constraint when executing this work. The Contractor shall use all means and resources to complete this project on or before the specified schedule at no additional cost to the project contract. This includes working beyond normal business hours and days, additional manpower, additional tools, etc.

1.11 WARRANTY SERVICE

A. Warrant all Work of this Section to be free from defects in materials and workmanship for a minimum of 1 year from the date of Owner's Representative acceptance of the Work of this Section.

B. All manufacturers' equipment warranties shall be activated in the Owner's name and shall commence on the date of system acceptance. In the case of Contractor modified equipment, the manufacturer's warranty may be voided. In such cases, provide a warranty equivalent to that of the original manufacturer.

C. All high-level software shall follow the warranty conditions specified by the manufacturer. Immediately update or upgrade the City's installed software as soon as new versions, updates or patches become available from the manufacturer at no additional cost to the Project within this warranty period.

D. Response Time: Provide a qualified technician familiar with the work at the Project Site within 12 hours after receipt of a notice of malfunction. Provide the Owner's Representative with the telephone number attended 8 hours a day, 5 days a week, and an answering service or equivalent facility attended 24 hours a day, 7 days a week, to be called in the event of a malfunction. Provide repairs at no expense to the Ownerand at the Owner's Representative's request, alternate facilities, services, and systems for the duration of the repairs to any defective work of this Section. Provide a complete and operational System, within 48 hours after notification of a malfunction.

E. All work requested due to warranty issues shall be performed during regular working hours unless the Project agrees to pay the difference in labor rates for overtime or nighttime work.

F. The Contractor shall use qualified service personnel to respond to all warranty issues or calls.

G. Off Site Service: Conduct all warranty repairs and services at the Project Site, unless in violation of manufacturer's standard product warranty. Provide substitute systems, equipment, and/or devices acceptable to the Owner's Representative for the duration of off-site repairs. Provide transportation for substitute and/or test systems, equipment, devices, materials, parts and personnel to and from the Project Site.

1.12 OWNER'S REPRESENTATIVE'S INSTRUCTIONS

A. General
1. Conduct training on the completed system at a reasonable convenience of the Owner's Representative during normal business hours. Contractor is to assess the complexity of the system and shall fully train the operation and maintenance staff named by the Owner's Representative.
2. Do not start training until all systems have been commissioned, training manuals are approved and an agenda along with schedule of each departmental training session has been submitted to the Owner's Representative.
3. Training will be conducted in the actual room that is the topic of the training session.
4. The Owner's Representative asserts legal and beneficial ownership of all training materials which are specifically commissioned for this project.

B. Operator Training – Do not start training before system is in full operation and all components have been signed off by Owner's Representative's representative. Use the items covered in the commissioning portion of this specification as a basis for the training curriculum.
1. At least two 4-hour sessions of instruction will be given in order to familiarize the Owner's maintenance staff with the operation of the system.

C. Maintenance Training
1. At least two 3-hour sessions of instruction will be given in order to learn how to maintain and troubleshoot the system. A maintenance binder shall be provided by the Contractor with all manufacturer-specific operating and maintenance information for each piece of equipment used. On large jobs, the binders will be sub-divided into individual audio, video and control binders. Provide training on at least the following system features:
a. Firmware upgrades
b. Helpdesk features
c. Complete use of system as outlined in the Commissioning section plus advanced troubleshooting.

D. Training Video
1. A training video shall be produced and cover all aspects of the systems operation.
2. Each page of all user interfaces shall be explained and recorded while gestures are made on the screen. Each button on the user interface shall be explained and demonstrated.
3. All portable equipment that connects to the system shall be demonstrated both in their physical connection and routing method at the user interface.
4. All patch bays shall be explained and demonstrated.
5. All source equipment shall be explained in both physical loading of media and transport control as well as user interface control.
6. Demonstrate on basic troubleshooting.
7. Provide training on items as outlined in the Commissioning section of this document.
8. Demonstrate system start up and shut down.
9. Explain and demonstrate help files associated with touch panels.
10. Audio and video files shall be combined and burned to DVD for distribution to each department.
11. Provide professional DVD with searchable index of topics covered.
12. Provide label with the project's logo, room name/number, title, length, and topics covered.

E. A training manual specific to this system will be written covering the basic and advanced functional techniques necessary to operate the system in a reliable and fully-functional condition. The Contractor shall submit hard color copies of the training manual as well as a soft copy in PDF or DOC format. Provide a hard copy of the training manual for each person to be trained. This manual will include:
   1. All contact information, including emergency and after hours phone and pager numbers, for requesting service assistance from the Contractor.
   2. A 11x17 set of as-built drawings of the completed project (a full-sized set will be issued to the Owner's Representative for their use, a half-size set will be attached to the inside back door of the main equipment rack).
   3. A table of contents at the beginning of the manual.
      a. The manual will begin by explaining basic information such as manual references, abbreviations, any assumptions made by the author, prerequisites required, numbering convection, etc.
      b. It will then proceed to the manual objectives.
      c. Explain what the end user should understand after reading the manual.
      d. It will cover the basics of the user interface including start up and shut down procedures, log on procedures, access privileges, operator password, levels of security, file structure, etc.
      e. The manual will proceed to describe each user interface and its function. It will cover every layer of the interface and how to navigate through them.
      f. Each of the system presets will be explained and the physical setup of the equipment and floor plan during presets will be illustrated. Source equipment such as media players, blu-ray players, etc. shall have their routing scheme explained and illustrated. Portable equipment and its connection to the system shall be explained and illustrated.
      g. The manual will end by explaining basic troubleshooting procedures and equipment care instruction.
   4. The Contractor’s maintenance instructions, which will include the manufacturer’s maintenance instructions found on the factory manuals to keep the manufacturer’s warranty in force.
   5. A list of consumables (fuses, batteries, etc.) required to keep the system operating over time, along with sources of supply (if not readily available).
   6. The Contractor will compile and submit all factory warranty registration forms or cards for each piece of equipment furnished for this project.
   7. A form requesting feedback from the end user as to how the manual should be improved and a section to report errors discovered.
      a. The Contractor will make the corrections and improvement suggestions after receiving feedback from the users. This will be completed at no charge to the project. The manual will contain a date stamp and version number. Each feedback and error correction manual reissue will include a new version number.

F. Initial Use Support
   1. Provide standby trainer/system engineer during the first two public events.

1.13 MAINTENANCE

A. The Contractor shall, within the warranty period, schedule two visits to inspect and perform preventive maintenance on the system. The first visit shall be six months after the commencement of the warranty period. The last visit shall be just prior to the end of the warranty period.

B. Return 90 to 120 days after the system has been turned over to the Owner's Representative for additional programming, maintenance, and system fine-tuning. Conduct interviews with the user group via telephone to acquire information needed to complete this task. Allow for one full day of programming in your initial bid to complete. Provide a per hour programming fee that will be charged if additional programming is needed.

C. Cache for event logging must be set to record unlimited events until the Contractor's first maintenance site visit. After the Contractor's first maintenance site visit, the cache can be limited to the Owner's Representative's specified level.

D. The Contractor shall use qualified service personnel to conduct all maintenance work.

E. All maintenance work shall be performed during regular working hours unless the Owner's Representative agrees to pay the difference in labor rates for overtime or nighttime work.

PART 2 - PRODUCTS

2.1 GENERAL

A. Quality of Products
1. Materials and equipment specified herein have been selected as the basis of acceptable quality and performance and have been coordinated to function as components of the specified systems.
2. Where a particular material, device, piece of equipment or system is specified directly, the current manufacturer's specification for the same shall be considered to be a part of these specifications, as if completely contained herein in every detail.
3. Each material, device or piece of equipment provided herein shall comply with all of the manufacturer's published specifications for that item.
4. Equipment shall be from the manufacturers' current stock and shall not be stored longer than 1 year prior to installation, unless written approval to do otherwise is provided by the manufacturer and submitted for review by the Owner's Representative.
5. All products will be a product of firms regularly engaged in the manufacturing of electrical, electronic or optical equipment. The equipment will be the latest model or type offered which meets the applicable specifications at the time of the submittal. Discontinued items replaced by newer models or versions are prohibited and should not be submitted for review.
6. Quality of workmanship and fabrication of all equipment and components, which are custom fabricated, shall be comparable to professional equipment produced by specialized manufacturers of the trade involved and will be verified by inspection. Only firms having 5 years of experience in all aspects of the fabrication and installation of similar systems will be allowed to perform the work.
7. All materials and products will be new and of professional quality. Unless specifically stated in the drawings or specifications, no existing or used materials will be installed.

B. Quantity
1. Provide the quantity of products as shown on the Contract Drawings, or as otherwise indicated herein.
2. The equipment listed in section 2.2 consists of all major equipment for the project. The Contractor will integrate into the system design and provide any additional components, wiring, programming, etc., to complete a functional system operating as described within the specifications and the category AV drawings.

3. Components or equipment not specified or indicated on the drawings that are required to make a fully functional systems per the Owner's Representative's requirements and the design intent, shall be furnished and installed by the Contractor, and shall be submitted for Owner's Representative review.

C. Preference
1. Where more than one manufacturer is listed herein as acceptable or equivalent, no preference is intended or implied by the order of listing.

D. In the event that a specified piece of equipment or product has been superseded, discontinued or is no longer available from the manufacturer, the Contractor shall submit a request for substitution of the originally specified product. The substitute product shall be the manufacturer's most current model of the specified product, or if the line has been discontinued, a product by the same manufacturer with specifications meeting or exceeding, and as close as possible to those of the originally specified product. Refer to Alternatives and Substitutes section for clarification.

E. Provide Complete
1. Provide all auxiliary and incidental materials and equipment necessary for the operation and protection of the Work of this Section as if specified in full herein.

F. Provide New
1. All materials provided under the Work of this Section shall be new, shall be the manufacturer's latest design/model, and shall be permanently labeled with the manufacturer's name, model number and serial number.
2. Products and materials shall be clean, free of defects, damage and corrosion.

G. Similar
1. Similar devices shall be of the same manufacturer, unless specifically noted otherwise in these specifications.

H. Safety Agency Listing
1. All devices provided under the Work of this Section that are connected to the Project electrical system shall be listed by Underwriters Laboratories (UL) or other Nationally Recognized Electrical Testing Laboratory acceptable to the Authorities having jurisdiction at the Project site, and shall be so labeled. Absent such listing, comply with Regulatory Requirements applicable to Unlisted Equipment.

I. Unlisted Equipment
1. Certain equipment specified herein may not bear listing by a Nationally Recognized Testing Laboratory. Such equipment is specified herein only where no equipment is known to exist bearing such listing which that perform the function required by the Owner's Representative. In such case, apply for field inspection of such equipment. The Contractor is responsible for the payment of such inspection costs.

J. Power Rating
1. All devices provided under the Work of this Section that are connected to the Project electrical system shall provide stable performance in full accordance with these specifications when operated on main service which complies with ANSI standard tolerances for voltage, frequency, transients and related parameters.

K. Circuit Protection
1. All active devices shall have integral fuse or circuit breaker protection.
2. All circuit breakers shall be fully magnetic.
3. Protection devices shall be located to facilitate examination, resetting and/or replacement without the need to disassemble or demount the associated device.

4. Contractor-fabricated items shall be provided with either indicating type circuit breakers or fuses of the clear glass cartridge type, mounted in fuse holders which will indicate a blown or defective fuse.

L. Continuous Use
1. All active circuitry shall be solid state and shall be rated for continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and shall contain sufficient permanent identification to facilitate replacement.

M. Construction
1. All electronic equipment shall be of the "dead-front" type and shall be designed for standard 19" EIA rack mounting, unless otherwise indicated.
2. Steel frames and enclosures shall be designed and wired to eliminate all induced currents within both the units and the systems.
3. All bolted connections shall be made with self-locking devices.
4. Coordinate all consoles and panels so that the general appearance is similar, or as directed by the Owner's Representative.
5. All operating panels shall be at least 1/8" thick aluminum.
6. Provide locking panel covers on all recessed, semi-recessed or surface mounted control panels not located in the equipment rooms, unless specifically noted otherwise. Panel locks shall be flush with no protrusions beyond the panel face when the door is closed. Recessed control panels shall be recessed within the back box to a depth sufficient to permit a locking hinged panel cover to completely close without affecting any device within the enclosed area.

N. Circuit Boards/Modules
1. All printed circuit boards or modules shall be mechanically secured by bolt or friction-loading guide, in addition to any electrical connector attachment, and shall include an integral extraction grip.
2. Printed circuit boards shall be connected to associated circuitry via soldered connections or precious metal positively keyed card edge connectors.
3. All Contractor-fabricated printed circuit boards shall be at least 1/16" thick G-10 glass fabric epoxy base, copper plated to a minimum density of 2.0 oz./sq. ft. on one or both sides, and finished with 60/40 tin/lead solder either hot rolled or plated over the copper. All holes through the boards shall be plated through and solder filled. All boards shall be permanently identified with a designation that matches that of the mating connector or board position in the assembly.

O. Identification
1. Provide permanent intelligible identification on, or adjacent to, all connectors, receptacles, controls, fuses, circuit breakers, patching jacks, and the like. This identification shall clearly and distinctly indicate the function of the item and shall be numbered or lettered to correspond with the function, circuit and location consistent with field and shop drawings. Refer to section 3.5 for clarification.

P. Modular Products
1. The drawings show conventionally packaged components to convey design intent.
2. Card cages to have front and rear closure panels to provide a finished appearance.
3. Except as noted below, modules of different functional types are permitted to share the same card cage/mounting frame and/or power supplies as applicable and if mechanically and electrically compatible..
4. With amplifier input driven 10 dB beyond input level required to produce full rated output, amplifier shall withstand indefinitely any of the following load conditions without instability of operation of main over current protection (i.e. no blown fuses or circuit breakers).
   a. "Short" circuit of 0.1 ohm.

b. Open circuit (no load).
c. Rated load impedance.

5. Maintain sense of signal polarity from input to output.

Q. Keys

1. Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically. For each unique key type, provide a quantity of ten. Stamp each key with a reference designation.
2. Submit a schedule of keying to the Owner's Representative. Where so noted, provide Project Standard lock cylinders and keys; coordinate with the work of other Sections.

R. Lectern Power Cord

1. The power outlet connecting the lectern to the floor box must be twist-lock type. The power cord connecting the podium to the floor box must be 12 inches shorter that the low voltage cable connecting it. This will protect the low voltage cable from damage if the podium was to be moved inadvertently without disconnecting the cables. The power cable shall include a wire-rope strain relief to keep the power cord from damage. See cable detail on plan-set for more information.

S. Assistive Listening System (RF)

1. An assistive listening system using wireless radio frequency (RF) transmitter and headsets will allow personal monitoring of the audio program for the hearing impaired. The transmitter will be a frequency agile unit with no less than 30-channel capability and will broadcast the main audio program to personal headsets used by hearing impaired audience members. The system and quantity of headsets supplied shall conform to the ADA requirements (section 219 and 706) for the space. Stereo headset type and hearing aid compatible (T-Coil) listening devices are required; ear-bud type devices are not acceptable. Supply a drop-in type battery charging system capable of servicing multiple receivers, with sufficient charging capacity to charge each receiver simultaneously. Follow the table below for quantity requirements.

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Hearing Aid Compatible Receivers
50 or Less	2	2
51 to 200	2, plus 1 per 25 seats over 50 Seats *1	2
201 to 500	2, plus 1 per 25 seats over 50 Seats *1	1 per 4 Receivers *1
501 to 1000	20, plus 1 per 33 seats over 500 *1	1 per 4 Receivers *1
1001 to 2000	35, plus 1 per 50 seats over 1000 seats *1	1 per 4 Receivers *1
2001 and over	55, plus 1 per 100 seats over 2000 seats *1	1 per 4 Receivers *1

*1 Or fraction thereof

T. Projection Screens

1. The bottom of the projection screen shall be no lower than 48 inches above finished floor.
2. Verify screen drop requirements with architectural sections and elevations.
3. Provide extra screen material drop to locate the projection screen at the optimum viewing angle where required.

U. Provide enclosure systems including, but not limited to racks, cabinets, cases and related panels and accessories as specified herein, or approved equivalent. Provide size and quantity as shown on drawings. Provide color as specified by Owner's Representative. If no color is shown on drawings, submit manufacturer's standard color chips for selection.

V. Cable Tray: Provide aluminum ladder style cable tray with flange in side rails where called out in drawings. Size the cable tray to accommodate all wire that must pass through it. Provide all supporting hardware and accessories.
   1. Ladder Style Cable Tray
      a. P-W Industries.
      b. Equal by Hubbell.
      c. Approved equal.

W. Floor Mounted Equipment Racks: Provide each bay with basic frame, vented locking rear door, top panel with single 10" fan, certified seismic floor anchor kit, ganging hardware, except where otherwise indicated, at each ensemble of bays, provide end (side) panels to provide complete enclosure.
   1. Rack cabinet, heavy duty welded 14ga. CRS, single bay of maximum dimensions 83-1/8"(H) x 24"(W) x 32.5"(D); floor supported with accessory louvered side rack side panel.
      a. Mid Atlantic WRK Series.
      b. Equal by Atlas/Soundolier.
      c. Approved equal.
   2. Turret cabinet:
      a. Mid Atlantic Slim 2 Series.
      b. Equal by Atlas/Soundolier.
      c. Equal by Hammond Manufacturing.
   3. Wall cabinet, tilt out:
      a. Atlas/Soundolier AWR Series.
      b. Mid Atlantic WRS Series.
      c. Equal by House of Metal Enclosures (HOME).
      d. Equal by Hammond Manufacturing.
   4. Wall Mounted cabinet:
      a. Atlas/Soundolier 300 Series.
      b. Mid Atlantic DWR Series.
      c. Equal by Hammond Manufacturing.
   5. Floor mounted pivoting rack:
      a. Mid Atlantic SR-40-22 Swing Rack.
      b. Equal by Atlas/Soundolier.

X. Rack Panels and Accessories: Rack Mounting Screws: Screws 10-32; length as required for at least 1/4" excess when fully seated; oval head with black plastic non marring cup washer or equivalent ornamental head; nickel, cadmium or black plated; Phillips, Allen Hex, Square-Tip or Torx drive. Slotted screws are not acceptable.
   1. Blank Panels:
      a. Atlas/Soundolier S19 Series.
      b. Zero ZP112000 Series.
      c. House of Metal Enclosures (HOME) Series PM.
      d. Middle Atlantic Products BL, SB or HBL Series.
   2. Vent Panels:
      a. Middle Atlantic ETF Series.
      b. Equal by Atlas/Soundolier.
      c. Equal by Zero.
      d. Equal by House of Metal Enclosures (HOME).
   3. Shelf:
      a. Middle Atlantic Products U Series.
      b. Atlas/Soundolier SH19 Series.
      c. Zero A52 Series.
   4. Drawer:
      a. Atlas/Soundolier SD Series.
      b. Middle Atlantic Products UD Series.

c. House of Metal Enclosures (HOME) SD Series.
d. Zero A43/A36 Series.

5. Rackmount Computer Keyboard: Middle Atlantic RM-KB.
6. Equipment Custom Rackmount Shelf: Middle Atlantic Products Model RSH-4A Series.
7. Rackmount Computer Keyboard.
   a. Mid Atlantic RM-KB series.
   b. Approved equal.
8. Computer Monitor Rackmount.
   a. Mid Atlantic RM-MM series.
   b. Approved equal.
9. Horizontal Lacer Bars
   a. Mid Atlantic LBP-IR4, LBP-1S, LBP-1P.
   b. Equal by Atlas/Soundolier.

Y. Equipment Enclosure Ventilation: Provide UL Recognized devices. Connect to enclosure power, comply with applicable Codes.
1. Fan panel, 5 1/4" high painted steel rack panel with 4" diameter fans, each fan with chrome plated finger guard, low speed air flow, two fans per panel, total 120 CFM:
   a. Mid Atlantic QFP-2 Series.
   b. Atlas/Soundolier ES/IS Series.
   c. BGW Systems.
2. Thermostatic Fan control module, user definable temperature range with status LED's, temperature sensing probe.
   a. Middle Atlantic FC Series.
   b. Atlas/Soundolier CFT Series.

Z. Equipment Enclosure Power and Signal Grounding: Comply with applicable Codes and applicable portions of Division 26. Provide UL Listed devices, Specification or Hospital Grade. Provide all junction boxes, raceway, fittings, wire, supports and fastenings as required for complete installation. Unless otherwise noted, provide receptacles of NEMA 5-15R configuration.
1. Full height receptacle strip, Isolated Ground:
   a. Wiremold 3000 Plugmold IG Series.
   b. Middle Atlantic PD series vertical power strips.
2. Full height receptacle strip, three or more circuits, Isolated Ground:
   a. Wiremold 3000 Series with Specification Grade IG 5262 Series receptacles.
   b. Middle Atlantic PD series vertical power strip.
3. Wireway, lay in, NEMA 1: Any meeting NEMA 1 and UL870. Size as required.
4. Flexible metal conduit: Comply with Division 26.
5. Sequencing Power System:
   a. The Contractor is to design and build power sequencing and surge suppression systems that will control and distribute power in the equipment racks. The system will be designed to sequentially connect power to all of the audio-visual equipment in the equipment racks. Outlets are mounted to the unit's back plate or on a remote strip. If the project utilizes a control system, the sequencing power system will be controlled by the software configurable control system. The touch panel's shut down button will prompt a second time asking "Are you sure you want to shut the system down?" A positive response will activate system shut down. A push button control station's shut down button will be pressed twice to shut down the system. If the project does not include a control system, the Contractor is to provide a dedicated sequential controller in the equipment racks.
      1) 15 amp or greater power capacity.
      2) 3-prong 15 amp 120VAC isolated ground outlets (provide required amount).
      3) Individual sequencing steps for each outlet.
      4) Adjustable power-up time delay and outlet sequencing intervals.

5) Modular power raceway systems shall be constructed of 18-gauge min-spangle galvanized steel.
6) Remote controllable via contact closures (if applicable).
7) Status indicator on touch panel (if applicable).

b. Approved subject to above:
1) Middle Atlantic RLM-XX, RM-XX, R-XX or M-XX Modular Power Raceway Series.
2) Middle Atlantic USC-6R Universal Sequencing Controller.
3) Equal by Atlas Soundolier.

6. Signal Grounding bus bar, insulated from enclosure frame:
a. Atlas/Soundolier BBG Series mounted on standoff insulators.
b. Zero A32 Series.
c. Middle Atlantic.
d. Panelboard Isolated Ground bus kit by manufacturer of Project Panelboards specified in Division 26.

7. Multi-Outlet Assembly, Surge Suppressing, UL Listed. Comply with ANSI/IEEE C62.41-1980. Provide at least six receptacles. Provide equivalent to:
a. Surgex SX RT series.
b. EFI Electronics Corporation Model 153.
c. MCG Electronics, Inc. Model 296 (subject to UL Listing).

8. Computer Grade Uninterruptible Power System, UL Listed. Provide continuous, no-break power with sine wave output. Provide Transient Over-Voltage (TOV) Surge Suppression; comply with ANSI/IEEE C62.41-1980, Category A and Category B. Provide complete isolation from Line. Provide output voltage regulation to ANSI C84.1 for computing equipment. Provide output KVA, switch-mode power supply rated, not less than 150% of connected load indicated. Provide one for each Central Processing Unit, Digital Signal Processor and automated control console. Provide equivalent to:
a. Best Power Technology, Inc. "Micro-Ferrups" Series.
b. Best Power Technology, Inc. "Axxium" Series.

2.2 PRODUCTS

A. Major System Components
1. Assistive Listening System
a. The transmitter will be a frequency agile unit with no less than 17-channel capability.
b. Operating frequency: 72 – 76 MHz
c. Frequency Response: 22 – 16,000 Hz, +1, -3 dB (adjustable)
d. Signal-to-Noise Ratio: 74 dB transmitted
e. RF Field Strength: Does not exceed 80 mV/m at 3 m
f. The quantity of headsets supplied will conform to the ADA requirements for the space (i.e. 4% of the maximum seating capacity).
g. Accessories
1) Transmitters
2) Receivers
3) Antenna
4) Stereo Headset
5) Telecoil Compatible Neck Loop
6) ALS Signage Kit
h. Williams Sound, Listen Technologies or equal

2. Amplifier
a. 2, 4, or 8 Channels, 70V
b. Frequency Response 20Hz – 20kHz
c. Distortion: <0.01% THD
d. Input Clipping: 10 Vms (+22 dBu)

e. Input Sensitivity: 1.23 Vrms
f. QSC or equal

3. Equipment Rack – Cabinet Mounted
   a. Pulls out and rotates for equipment servicing
   a. Number of rack units: 12.
   b. Sliding rail system.
   c. Rack shall pull out 19”.
   d. Locks closed.
   e. Ball bearing slides.
   f. Cable carrier for cable management.
   g. Middle Atlantic or equal
4. Equipment Rack – Free Standing
   h. EIA Compliant 19” gangable
   i. Number of rack units: 44.
   j. Threaded rackrail.
   k. Rack shall pull out 19”.
   l. Cable carrier for cable management.
   m. Middle Atlantic or equal
5. HDBaseT Transmitter – Wall Mount
   a. 1-gang wall mount design
   b. Provides HDMI video input
   c. Performs automatic AV signal format management via EDID
   d. Video Format: HDMI HDCP content protection support, computer up to 4096x2160 DCI 4k & 3840x2160 4k UHD, NTSC or PAL
   e. supports up to 330 ft cable length
   f. Crestron or equal
6. HDBaseT Transmitter – Surface Mount
   a. Surface mount design
   b. Provides HDMI video input
   c. Built-in 2x1 AV switcher
   d. Performs automatic AV signal format management via EDID
   e. Video Format: HDMI HDCP content protection support, computer up to 4096x2160 DCI 4k & 3840x2160 4k UHD, NTSC or PAL
   f. Includes USB HID keyboard/mouse port
   g. supports up to 330 ft cable length
   h. Crestron or equal
7. HDBaseT Receiver
   a. Receiver and display controller
   b. Provides HDMI video input
   c. Video Format: HDMI HDCP content protection support, computer up to 4096x2160 DCI 4k & 3840x2160 4k UHD, NTSC or PAL
   d. Supports up to 330 ft cable length
   e. Provides one HDMI output
   f. Provides 10/100/1000 Ethernet connection for display device or control system
   g. Enables device control via CEC, RS-232, IR, or Ethernet
   h. Crestron or equal
8. Loudspeaker (Pendant)
   a. 6.5” woofer
   b. Aluminum dome tweeter
   c. Frequency range: 55Hz-20kHz, + or – 10dB
   d. Sensitivity: 88dB average
   e. 70 volt taps
   f. Directivity Factor (Q): 6.5 averaged 500 Hz to 4 kHz
   g. Back can enclosure and grille
   h. QSC or equal

9. Loudspeaker (Surface/ Wall)
   i. 5.25” woofer
   j. Aluminum dome tweeter
   k. Frequency range: 65Hz-20kHz, + or – 10dB
   l. Sensitivity: 86dB average
   m. 70 volt taps
   n. Directivity Factor (Q): 6.9 averaged 500 Hz to 4 kHz
   o. Enclosure and grille
   p. QSC or equal
10. Multimedia Lectern
   a. Adjustable shelf
   b. 4” Carpet casters
   c. Floor access opening
   d. Marshall Exec series or equal
11. Microphone - Gooseneck
   a. Cardiod polar pattern
   b. Frequency Response: 50–17000 Hz
   c. Impedance 180 ohms
   d. Phantom power 11 – 52 Vdc
   e. XLR connection
   f. Shure or equal
12. Microphone Input - Lectern
   a. Millwork microphone isolator with XLR connection
   b. FSR or equal
13. Microphone - Handheld
   a. Cardioid polar pattern
   b. Frequency response: 50Hz – 15kHz
   c. Sensitivity: –54.5 dBV/Pa (1.85 mV)*
   d. Output Impedance: EIA rated at 150Ω (300Ω actual)
   e. 25’ cable with XLR connection
   f. Shure or equal
14. Network Switch
   a. 10/100/1000 auto-sensing per port
   b. PoE, PoE+, PoE++ capable
   c. Standards: IEEE 802.3i, 802.3u, 802.3ab, 802.3x, 802.3af
   d. QSC or equal
15. Portable Sel-Powered Loudspeaker
   e. 2-Way Active loudspeaker
   f. 10” woofer
   g. Titanium diaphragm compression drive
   h. Frequency range: 50Hz-20kHz, + or – 10dB
   i. Nominal Coverage: 90 Degree Axisymetric
   j. Peak: 130dB
   k. Directivity Matched Transition (DMT)
   l. Amplifier: Class D, Peak: 1800 W (LF), 225 W (HF)
   m. Enclosure: Impact Resistant ABS
   n. QSC or equal
16. Projection Screen
   a. Diagonal: See Section 2.1.T above
   b. Aspect Ratio: 16:10
   c. Screen Material: Matte White
   d. Tab-Tensioned
   e. Mount: Ceiling Recessed
   f. Electrically operated roll-down
   g. Low Voltage Control

h. Draper or equal

17. Proximity Sensor
    a. Method of detection: Diffuse Reflective
    b. Infrared LED
    c. IR Sensitivity Adjustable
    d. Sensing Distance up to 4 feet.
    e. Crestron or equal
18. Video Presentation System (8x2)
    a. 4096x2160 DCI 4k & 3840x2160 4k UHD
    b. Inputs: HDMI & HDBaseT
    c. Outputs: HDMI & HDBaseT
    d. Control processor
    e. Audio DSP
    f. Automatic Mixer
    g. 6-Channel Microphone/Line Mixer
    h. Digital Video over Twisted Pair
    i. HDCP Compliant
    j. CEC Embedded Device Control
    k. Performs automatic AV signal format management via EDID
    l. Built-in 50W Power Amplifier
    m. Audio Frequency Response: 20Hz to 20kHz
    n. Memory: SDRAM – 512 MB, Flash 4 GB
    o. Communications: Ethernet, HDBaseT, HDMI, USB, RS-232, IR/Serial
    p. Crestron or equal
19. Touch Panel
    a. 5" touchscreen (Color LCD)
    b. 1280 x 720 resolution
    c. HTML5 and Smart graphics
    d. Dynamic menu objects
    e. Streaming video
    f. Programmable pushbuttons
    g. Single-wire Ethernet connectivity
    h. PoE network powered
    i. Crestron or equal
20. Video Display
    a. 4K Crystal UHD TFT LED
    b. 3840x2160 UHD resolution
    c. Energy Star qualified
    d. IP control
    e. (2) HDMI HDCP connections
    f. RF In/Antenna connection
    g. Stereo Speakers
    h. Miscellaneous Parts: Appropriate Wall Mount
    i. Samsung, NEC or equal
21. Video Projector (Ultra short-throw)
    a. Native Aspect Ratio: 16:10
    b. Connections: HDMI (HDCP Compliant)
    c. Resolution 1280x800
    d. Contrast Ratio 14,000:1
    e. Lamp light source
    f. SD/HD Signal Compatibility 480i, 480p, 576i, 576p, 720p
    g. PC Signal Compatibility VGA, SVGA, XGA, SXGA, SXGA+, WXGA, UXGA
    h. Epson or equal
22. Video Projector
    a. Native Aspect Ratio: 16:9

b. Connections: HDMI (HDCP Compliant) and serial control port
c. Resolution 3840x2160
d. Contrast Ratio 500,000:1
e. Laser light source
f. Variable Zoom Lens
g. SD/HD Signal Compatibility 480i, 480p, 576i, 576p, 720p, 1080i, 1080p, 4K UHD
h. PC Signal Compatibility VGA, SVGA, XGA, SXGA, SXGA+, UXGA, WUXGA
i. Lens Shift
j. NEC or equal

23. Video Projector Enclosure
    a. Weatherproof
    b. Outdoor Rated
    c. Bluetooth capable
    d. RJ-45 LAN capable
    e. Ventilation System
    f. Heating System
    g. App Capable
    h. Proietta or equal
24. Wireless Bodypack RF Transmitter
    a. RF transmitter output: 30mW max
    b. Frequency Response: 45 Hz – 15 kHz
    c. 8 hours continuous use
    d. 300 foot operating range
    e. Shure or equal
25. Wireless Lavalier Microphone
    a. Cardioid condenser microphone
    b. Includes miniature four-pin mini connector
    c. Impedance: 800 Ohms
    d. Frequency Response: 50 Hz – 17 kHz
    e. Output Level: -45.5 dBV/Pa
    f. Shure or equal
26. Wireless Handheld Microphone
    a. Handheld RF transmitter
    b. Cardioid dynamic microphone
    c. RF transmitter output: 30mW max
    d. Effective Range: 300 ft.
    e. Operating Range: 470 - 782 MHz
    f. Frequency Response: 50 Hz – 15 kHz
    g. Total Harmonic Distortion (ref. +/– 38 kHz deviation, 1 kHz tone) 0.5%, typical
    h. Audio Input Level: 8 dBV maximum at 0dB position
    i. Shure or equal
27. Wireless Microphone Receiver
    a. Wideband UHF FM modulation between 524 MHz and 865 MHz.
    b. Effective Range: 300 ft.
    c. Frequency Response: 45 Hz – 15 kHz
    d. Total Harmonic Distortion (ref. +/– 38 kHz deviation, 1 kHz tone) 0.5%, typical
    e. Preset frequency selection.
    f. True diversity receiver.
    g. Shure or equal

B. The above list of Major System Components only outlines the major items necessary to allow the system to function as designed. It lists no power supplies, balancing transformers, power splitters, modular cards or other auxiliary components required to achieve a functioning system. Contractor is required to supply all components needed to provide a complete and operable system as outlined in the contract documents. The full set of construction documents are to be used when preparing a bid. This list is not intended to provide a full bill of materials.

C. Patch bays shown on plans and elevations are for placeholder information only. Contractor is to determine the exact amount of patch needed as per single line diagrams.

2.3 FINISHES

A. Any item or component of the Work of this Section which is visible shall comply with the following. Finishes noted or scheduled on the Contract Drawings shall take precedence. Submit all color samples of all items visible to public for approval.
   1. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the Owner's Representative.
   2. Paint loudspeaker cabinets to match exactly the surrounding and adjacent surfaces. Submit paint sample to Owner's Representative's representative for approval.
   3. Unless otherwise noted, receptacle or device plates subject to connection or operating force shall be stainless steel or hard anodized aluminum. Provide plates which generally match the appearance of project standard receptacle or device plates in view in the same area. For anodized aluminum, submit samples of standard colors for selection by Owner's Representative.
   4. Operating panels shall be steel, primed, painted with thermosetting epoxy paint, with legends silk-screened in contrasting color, and coated with clear epoxy thermosetting coating; or aluminum, hard anodized, with legends engraved and filled with contrasting color, all coated with clear epoxy thermosetting coating.
   5. All steel surfaces shall be treated with primer equivalent to zinc phosphate and finish painted with baked enamel or painted with a thermo setting epoxy paint.
   6. All aluminum surfaces, except those used as operating surfaces, shall be anodized and then painted with a thermo setting epoxy paint.

B. Custom Fabricated Plate Screws
   1. Match the finish of the screws used to mount the custom fabricated plates with the finish of the custom fabricated plate.

C. Ceiling Loudspeaker Grilles
   1. Paint loudspeaker grilles to match exactly the surrounding and adjacent surfaces (when speakers are recessed). Apply paint to permit servicing of loudspeakers without damage to finish of adjacent or adjoining surfaces. Provide uniform appearance. Do not obstruct grille openings with paint. Submit paint sample to Owner's Representative for approval.

D. Manufacturer's logos
   1. Remove all manufacturers' names, logos, or other symbols from speakers or other objects placed in view of the public.

2.4 ALTERNATIVES AND SUBSTITUTES

A. Substitutions of equal equipment beyond the alternatives listed will be permitted only in accordance with Division 1. If a requested substitution requires a change in any of the contract drawings, a revised drawing must be submitted as part of the substitution request. The Owner's Representative will be the final judge of the acceptability of substitutions. The burden of proof of equivalence is the responsibility of the Contractor.

B. Acceptance of a product shall not, in any form or manner, relax the system performance requirements of this Specification and the performance characteristics of the product.

C. The Contractor shall submit for review a complete list of proposed substitutions for approved equipment listed in Part 2.

D. For all substitutions, the Contractor shall provide the manufacturer's independent test data to demonstrate that the proposed alternatives to the approved equipment comply with the specifications. Specifications shall contain at least all information available for the specified product.

E. The Contractor shall submit a description and drawings showing all changes to the Contract Documents that the proposed substitution will require for proper functionality and operation.

F. Proposed substitutions shall not affect dimensions shown on the Contract Document except as submitted for review and approved by the Owner's Representative.

G. Any redesign or construction costs required to integrate the proposed substitution shall be the responsibility of the Contractor. Any costs incurred by the Owner; Owner's Representative attributable to the integration of a proposed substitution shall be borne by the Contractor.

H. Any proposed substitution shall have no adverse effect on other trades, the construction schedule or specified warranty requirements.

I. The functionality, performance, general appearance and quality of the proposed substitution are equivalent to or superior to those of the specified item.

J. Any change to the Contract (deductive or additive cost) associated with a proposed substitution shall be submitted to the Owner's Representative for review at the time the substitution is proposed and accompanying a substitution request documentation.

K. The Contractor will provide the same warranty for the substitution that the Contractor would for the specified product.

L. The Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects equal to the designed system before the substitution was made. In the event that the substituted material or equipment fails to meet performance testing standards after installed, the Contractor will replace substituted material or equipment with those initially specified.

PART 3 - EXECUTION

3.1 GENERAL

A. Perform the Work of this Section in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein.

B. Furnish and install (herein, "provide") all materials, devices, components, and equipment required for complete, operational systems.

C. Contractor is to supervise the installation of back boxes and terminal cabinets installed by the Division 26 Contractor. Contractor is to verify that correct boxes are installed in their proper locations before any drywall has been installed.

3.2 EXAMINATION

A. Immediately report to the Owner's Representative any discrepancies between the specifications and drawings. This includes discrepancies between the technical specification documents and actual field dimensions or findings that may hinder installation work, conflict with other trades, or cause delays.

B. Carefully examine all details that affect all aspects of the systems described in the specifications and drawings.
   1. Examine, coordinate and confirm all drawings and details.
   2. Examine, coordinate and confirm all electrical power requirements, conduits, raceways, boxes, and etc.
   3. Examine, coordinate and confirm work of other trades that may influence the outcome of the design, specification, and performance of the systems.

3.3 PREPARATION

A. This installation section is only meant as a guideline for the Contractor. The Contractor shall be responsible for executing all installation work in a manner that is in accordance to industry-accepted standards or governing codes, whichever is more stringent. Installation activities shall be executed in an organized and orderly manner. These steps include, but are not limited to, pre-delivery testing, delivery, unloading, installation, equipment / cable labeling, programming, set-up / calibration / alignment / adjustment, testing, commissioning, training, and documentation.

B. Protect all existing work surfaces, furniture, equipment, fixtures and etc. before commencing installation work. Any damage to the existing physical and electrical property due to installation work shall be the responsibility of the Contractor.

C. Immediately hand over any de-installed equipment to the Owner's Representative for disposal or safe-keeping.

D. Carefully remove any obstructions such as fixed seating, ceiling tiles, furniture, equipment and etc. that would obstruct or hinder the installation work. Damage caused by undue care in moving these items shall be responsibility of the Contractor.

E. Examine, coordinate, and confirm the cleanliness of the work site before commencing the portion the installation work that involves dust-sensitive electronic or electrical equipment such as audio mixers, switchers, projectors, control processors, computers, cameras, etc. Dust-sensitive equipment that is installed in a work site with a lot of air borne dust and dirt shall be properly protected. For example, a video camera on a wall-mounted bracket is protected by a clean plastic bag to prevent dust from contaminating it. Seal the bag’s opening using adhesive tape.

F. Prior to commencing installation work, ensure that the surrounding areas are clean and promote ease of installation work.

G. Ensure that all equipment rack and equipment locations are clean before commencing installation work.

H. Unless specified otherwise, furnished products / equipment shall be tested, delivered and installed. And, all systems shall be tested and commissioned to fully operational and properly configured condition.

I. All electrical equipment shall be burned-in or tested at the Contractor's shop before delivery. This pre-installation test shall reveal any equipment that is faulty, malfunctioning or dead out of the box ahead of time.

J. All radio frequency (RF) operated devices shall be tested on-site prior to installation to determine blind spots, RF interference, or any other transmission / reception problems. The Contractor shall be responsible for costs associated with providing additional support or accessory equipment (antennas, amplifiers, cables, etc.) and / or services to improve signal transmission / reception.

K. Provide all support equipment (ladders, man-lifts, tools, etc.) required to complete the installation work in a safe and expeditious manner.

L. Obtain any plan approvals, permits and licenses required by inspection authorities prior to execution of any installation work. The Contractor shall be responsible for all associated fees and costs incurred while fulfilling this requirement.

M. Ensure that all equipment is accessible for operation and maintenance work. Under no circumstance shall equipment be inaccessible or inconveniently located.

N. Aside from the systems' operational features, provide equal attention to the overall aesthetics of the installed equipment and cabling. Special attention to aesthetics shall be extended to equipment or cabling in public spaces.

O. Firmly secure all fixed equipment and hardware in place and ensure that they are plumb and / or square. An exception to this shall be portable or movable equipment.

P. Structurally mounted equipment: All equipment shall be mounted in accordance to all applicable safety codes, standards and practices. The one that provides for the most stringent rule shall prevail. All mounting hardware shall have a load rating by, at least, a factor of 5 (500% or greater) in reference to the weight of the equipment to be mounted or suspended. An exception to the rule shall be existing local safety codes or standards requiring greater load capacities.

Q. Seismic restraints: Abide by all the seismic restraint requirements described in all applicable building codes in force at the work site. If no provisions exist for a particular situation, follow these minimal recommendations.
   1. Fixed equipment: Mount and brace to the building structure to minimize potential hazards to personnel and damage to property during any kind of seismic event.
   2. Floor mounted equipment: Bolt equipment securely to the floor to prevent from toppling during any kind of seismic event
   3. Vertical-mounted columns: Apply braces to the vertical column in four opposing directions back to the mounting surface. This will minimize sway in any direction. Provide a separate, flexible restraint (e.g. aluminum braided aircraft cable) with a capacity of 5 times the weight of the total mounting system. The same applies to the anchor to which the flexible restraint is attached and the method of attachment to the structure.
   4. No equipment, equipment supports, or mounts must fail before the structure fails.
   5. Seismic restraint measure must not interfere with fire stopping.
   6. Notwithstanding compliance with these minimum recommendations, it is the Contractor's responsibility to ensure that the seismic restraint measures taken are adequate for the circumstances, including, if required, verification by an independent structural engineer. The cost of all such engineering shall be the responsibility of the Contractor.
   7. Penetration of the Slab: Verify that any mounting or restraint work that requires deep or thorough penetration of the slab shall not damage embedded materials including, but not limited to, slab tensioning devices or conduit. Verify the slab by X-ray or other method before proceeding. The Contractor shall be responsible for all costs associated with this investigation.

3.4 INSTALLATION

A. Follow manufacturer's instructions for installing, operating, configuring, and programming their equipment. Do not perform modifications to equipment that would void its warranty.

B. Pull and terminate all cables, and interconnect all equipment and components in accordance with approved drawings. Install audio-visual cover plates and faceplates onto all boxes.

C. Loudspeaker Assembly Installation
   1. Loudspeakers:
      a. Verify proper installation of loudspeaker enclosures and related support.
      b. Verify that no loudspeaker assembly is subjected to stresses or loading effects in any way contributing to possible extraordinary failure.
      c. Connect loudspeaker assemblies to the appropriate 70 volt-line transformer tap as applies. Verify specified polarity. Use insulated crimp connectors or insulated "bobtail" splices applied with manufacturer's recommended ratchet tooling. Wago Wall-Nuts 773 Series or equal are acceptable. Wire nuts or "Scotchlock" connectors shall not be acceptable.
      d. Verify that loudspeaker grille openings and loudspeaker components are clear of paint after finishing.
      e. Perform preliminary loudspeaker tests specified herein. Correct non-conforming conditions.
      f. Adjust 70 volt-line transformer taps as required to realize uniform sound pressure level as specified herein. Document final 70 volt-line transformer taps on the Record Drawings.
      g. Correct all conditions giving rise to noise, rattle or other extraneous sounds owing to operation of a loudspeaker assembly under any specified operating condition.

D. Video Projectors
   1. Projectors shall be centered laterally to the projection screens.
   2. Contractor shall use lens shifting when projector cannot be aligned properly to the screen. Use of keystone correction is not allowed.
   3. Selected projectors shall have lamp replacement and filter cleaning doors located in such a way that these items may be serviced while the projector is installed.
   4. Projectors shall be mounted such that their optical zoom settings shall not be set at either their widest nor narrowest extreme, but shall be used in their mid-range.

3.5 Labeling and Identification

A. All cables and connecting blocks shall be clearly, logically and permanently marked and identified by the following means:
   1. Use cable labels similar to the Panduit Polyolefin Self-laminating Labels for inkjet or laserjet printers or any other means acceptable to the Owner's Representative. Cable labels should be machine printed and not handwritten.
   2. Cable labels should be placed approximately 12 cm. from each end of the cable.
   3. Labeling conventions shall be clear, logical, and must be acceptable to the Owner's Representative.
   4. Include all cable identification numbers on all wiring diagrams and cable schedules.
   5. For fiber optic cables, use cable identification products such as the Panduit Labelcore series or any other means acceptable to the Owner's Representative.
   6. For connector and terminal blocks, label using any means acceptable to the Owner's Representative.

B. All cover plate, switches, panels, outlets, etc. labeling shall be engraved and filled, or silk-screened or by any other means acceptable to the Owner's Representative. Do not use Dymo, Brother, or other similar labeling products.

C. Protective Devices
1. Identification of fuses and circuit breakers shall indicate protected circuitry, rating of protective device and voltage across open circuited protected device.

D. Panels and Receptacles
1. Panel surfaces shall be engraved and filled or silk screened with identification, or shall be provided with 1/16 inch (minimum) thick laminated plastic labels with engraved block characters at least 1/8 inch high fastened to the equipment by stainless steel screws or rivets. Provide white characters on black background unless otherwise noted. Embossed plastic (Dymo) labels shall not be acceptable.

E. All equipment shall be labeled in a clear, logical manner or by any other means acceptable to the Owner's Representative.
1. For Control Knobs and Sliders: Use 6mm (1/4”) round labels, such as the Avery 057xx series, to indicate level settings. Neatly draw an arrow on the label using a fine tip permanent marker to accurately indicate the position of the control knob. If a control knob or slider has multiple level settings, use a logical and consistent color scheme to identify each setting. Illustrate all equipment settings in the Operation Manual.
2. For equipment identification, use ‘badges’ made of aluminum or plastic or any other acceptable material with engraved and filled, or silk-screened labeling. Stick these badges using industrial-strength doubled-sided 3M adhesive tape. Note: Labels made using Brother-type label maker or similar machines can be used as long as industrial-strength double-sided tape is used to hold the label in place. Label schemes should be clear, logical, and simple or by any other means acceptable to the Owner's Representative. Indicate equipment labeling schemes on all elevation and plan drawings showing the front and / or rear of the equipment racks. The reader should be able to easily reference the label description to specific equipment in the Operation and / or Maintenance Manuals.

3.6 WIRING

A. General
1. This section does not apply if the drawings incorporate a wire schedule.

B. Audio Signal Wiring Classification:
1. Type A-l: Microphone level wiring less than -30 dBu, 20 Hz to 20 kHz.
2. Type A-2: Line level wiring -30 dBu to +24 dBu, 20 Hz to 20 kHz.
3. Type A-3: Loudspeaker level or circuit wiring greater than +24 dBu, from 20 Hz to 20 kHz.

C. Video/Graphics and Related Signal Wiring Classification:
1. Type V-1: Baseband and composite video wiring 1 volt peak-to-peak into 75 ohms, 0 to 100.0 MHz.
2. Type V-2: Synchronization and switching pulse wiring 4 volts peak-to-peak into 75 ohms, 15.62 to 15.75 kHz.
3. Type V-3: Color subcarrier wiring 0 to 4 volts peak-to-peak into 75 ohms, 3.57 to 4.43 MHz.

D. Control Signal Wiring Classifications:
1. Type C-1: DC control wiring 0 to 50 volts.
2. Type C-2: Synchronous control or data wiring 0 to 40 volts, peak-to-peak.
3. Type C-3: AC control wiring 0 to 48 volts, 60 Hz.

E. Additional Wiring Classifications:
   1. Type M-1: DC power wiring 0 to 48 volts.
   2. Type M-2: AC power wiring greater than 50 volts, 60 Hz.

F. Wiring Combinations: Except as indicated herein, conduit, wire ways and cable bundles shall contain only wiring of a single classification. The following combinations are acceptable in conduit, or cable harnesses. Additional acceptable combinations may be indicated on the Contract Drawings.
   1. Types A-1, C-1, and M-1.
   2. Types A-2, C-l, C-2, and M-l, runs less than 20 feet.
   3. Types A-2, C-1, and M-1.
   4. Types A-3, C-1, C-2, and M-1.
   5. Types A-2, V-1, and V-3.
   6. Types V-1, V-2, V-3, and C-1.
   7. Types M-2 and C-3.

3.7 WIRE AND CABLE INSTALLATION

A. Provide permanent identification of run destination at all raceway terminations.

B. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

C. All shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels, connector shell or equipment enclosures.

D. Within buildings, make splices only in designated terminal cabinets and/or on designated equipment backboards. Outside buildings, make splices only in designated manholes and/or hand holes. Protect splices outside of buildings with splicing kits equivalent to Scotch-cast Re-enterable. Make splices only with connectors or terminal devices specified herein. Document all splices on Record Drawings.

E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

F. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

G. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

H. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes and at both sides of all fixed mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

I. Secure all wire and cable run vertically for continuous distances greater than 30 feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar approved devices appropriate to weight of cable. For all other cables, provide symmetrical conforming nonmetallic bushings or woven cable grips appropriate to weight of cable.

J. All Category type cable, connectors and plugs shall be color coded for easy visual distinction. Color coded insert type boots shall be installed on all Category type plugs. A colored coded ring will be provided on all chassis connectors (i.e., Neutrik ACRF-#). Cable connecters shall be equipped with Neutrik BSE-# color coded bushings. Coordinate and verify with Owner's Representative representative the color code scheme, if there is no standard or preference, the color code scheme shall be as follows:

1. Data LAN =Yellow
2. HDBaseT =Green
3. Audio Network =Red
4. AV LAN =Orange
5. KVM-USB Extenders =Grey
6. AV UTP =White
7. AV STP =Blue

3.8 CONNECTOR AND SIGNAL POLARITY CONVENTION

A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

B. Audio signal connector convention: AES14-1992 (ANSI S4.48-1992) AES standard for professional audio equipment - Application of connectors, Part 1, XLR-type polarity and gender.

Signal	Connector	Wire
Signal Phase	Pin 2	Red or White
Signal Anti-Phase	Pin 3	Black
Signal Ground	Pin 1	Drain Wire

C. Video and RF/MATV Connector Convention:

Signal	Connector	Wire
Signal Phase	Center Pin	Center conductor
Signal Anti-Phase	Shell	Shield
Signal Ground	Shell	Shield

D. Voice/Data Connector Convention: Comply with EIA/TIA-568C.

3.9 WIRING PRACTICE

A. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor's option, such terminals may be located in the equipment racks or at backboards provided. Coordinate such selection with Project construction sequence and test procedures specified herein.

B. Identify all wire and cable clearly with permanent labels wrapped about the full circumference within one inch of each connection. Indicate the number designated on the associated field or shop drawing or run sheet, as applies. Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Provide any of the following:
   1. Continuous permanent imprint; equivalent to Clifford of Vermont, Inc. "Quik-Pull".
   2. Direct hot stamp.
   3. Heat shrinkable factory hot stamped; equivalent to Brady sleeve Heat shrink.

4. Adhesive strip printed labels wrapped the full circumference of the wire and sealed with clear heat shrink tubing; equivalent to Thomas and Betts or Panduit Insta-code with clear heat-shrunk tubing equivalent to Alpha.

C. Apply all crimp connectors only with manufacturer's recommended ratchet type tooling and correct crimp dies for connector and wire size. Plier type crimp tooling shall not be acceptable.

D. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact type tooling set to recommended force.

E. Make all connections to screw-type barrier blocks with insulated crimp-type spade lugs. Lugs are not required at captive compression terminal type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markers equivalent to "Sharpie".

F. Tin terminated shield drain wires and insulate with heat shrinkable tubing.

G. Use only rosin core 60/40 tin/lead solder for all solder connections.

H. Dress, lace or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connection point. Provide service loops where harnesses of different classes cross, or where hinged panels are to be interconnected.

I. Termination and build out resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.

J. Correct any and all of the following unacceptable wiring conditions:
1. Deformed, brittle or cracked insulation.
2. Insulation shrunken or stripped further than 1/8-inch away from the actual point of connection within a connector, or on a punch block.
3. Cold solder joints.
4. Flux joints.
5. Solder splatter.
6. Non-grommet, non-bushed, or non-insulated wire or cable entries.
7. Deformation or improper radius of wire or cable

3.10 SIGNAL GROUNDING PROCEDURES

A. Comply with National Electrical Code.

B. Unless otherwise noted maintain a unipoint ground scheme.

C. Signal and electrical system grounds shall be isolated except at the Project ground field connection.

D. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

E. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively via the Isolated Ground conductors provided under Division 26. INSULATE RACK MOUNTING, ANCHORAGE, AND RACEWAY CONNECTIONS.

F. At each rack, provide an Isolated Ground bus within the rack. At each rack, provide a lug bonded to the rack frame with a #8 TW stranded wire to the rack Isolated Ground bus.

G. At each ensemble of racks, provide a single labeled Isolated Ground tubular-clamp bus bar terminal strip to land the individual rack Isolated Ground bus ground conductors. Connect the main Isolated Ground conductor from the Technical Power panel board at this point.

H. Equipment signal ground shall be to the Isolated Ground System via the green wire of the equipment power cord. Where equipment uses two wire power cord, provide #12 green bond wire to rack IG bus bar. At equipment, provide crimp lug and suitable hardware for bonding.

I. Shielded cables of this section shall be grounded exclusively to Isolated Ground by a single path. Shield shall be tied to Isolated Ground at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.

J. Unless otherwise noted, at audio jackfields, tie source shield at jackbay frame. Float shields at connections to output jacks. Bus each row of jack frames and run individual #12 green ground wire for each row to rack IG bus bar.

K. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

3.11 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.

B. Within each equipment enclosure, provide a full-height multi-circuit ISOLATED GROUND outlet strip with branch circuit count as shown on drawings; locate on the left side of the equipment enclosure, as viewed from the rear. In each enclosure provide number of receptacles required by present and future equipment indicated on drawings, plus at least two spare receptacles. Provide flexible steel raceway and junction box for connection of power service. Bond internal raceway to rack frame.

C. Provide a permanent label on the front of each equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

D. Maintain separation of wiring classifications as specified herein. Separately dress, route and land microphone and line level cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level and control cables on the left side of the equipment enclosure, as viewed from the rear.

E. Access shall not require demounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to insure complete access to terminals and interior components.

F. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop locks to hold all hinged panels and drawers in a serviceable position.

G. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

H. At jackfields, provide service loop to permit removal of jackfields from rack sufficient to conveniently access all jack contacts for routine cleaning and maintenance. Organize the service loop and harness such that reasonable reconnection of jacks and jack normals is possible without cutting apart the harness.

I. Coordinate the design and execution of wire harnessing of multi-bay rack ensembles with conditions of delivery to installation locations at Project Site, and with the requirement herein for test of the completely wired system in the shop prior to delivery to the Project Site. Organize the wiring harnesses such that they will fold within one shippable unit without risk of damage, or provide polarized multipin connectors and related interconnect systems as specified elsewhere herein.

J. At each equipment backboard, provide UL Listed surge suppressing multi-outlet assembly with at least six receptacles.

3.12 ADJUSTING AND TESTING

A. Test Equipment
1. Furnish, store and maintain test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section. Maintain all test equipment at the job site while work is in progress from installation of equipment racks until Owner's Representative's Acceptance of this Work; thereafter remove all of this test equipment from the job site. Provide all required test cables, jigs and adapters. Provide at least one of the following items or approved functional equivalents:
2. Audio Systems:
   a. Wide Band Oscilloscope (Tektronix THS700 Series).
   b. True RMS Analog / Digital Volt-Ohm Multimeter (Fluke 187 Series or equal).
   c. Low Distortion Audio Frequency Sine Wave Oscillator (Gold Line TS1).
   d. Measurement Microphones (Earthworks M30, Bruel & Kjaer 4007, Josephson 550).
   e. Sound System Optimization and Acoustic Measurement Analyzer (Goldline TEF, Meyers SIM, SIA Smaart, WinMLS, EASERA).
   f. Harmonic Distortion Analyzer (Sound Technology or Tektronix AA 501A) or Swept Spectrum Analyzer, HP 3580A, or Swept Test System, Audio Precision or Neutrik).
3. Video Systems:
   a. Wide Band Oscilloscope (Tektronix THS700 Series).
   b. Sync & Test Generator (Tektronix 1470).
   c. Waveform/Vector Monitor (Tektronix 1740).
   d. Color Picture Monitor, Precision.
4. MATV Systems:
   a. MATV Spectrum Analyzer (Sadelco DisplayMax 800CLI).
5. Communications and Related:
   a. Level II, Cat5e Cable Pair Tester (Microtest, HP, Scope, Fluke or Siemons set up to meet Category 5e parameters).
   b. Outside Plant Voice Cabling Plant Tester – capable of detecting shorts, opens, reversals, mis-wiring and crosstwists (Siemon STM-8 or equal by Mod-Tap).
   c. Metallic cable pair tester (Wavetek Corporation, Instruments Division, model LANTech 100).
   d. Tone Test Set.
   e. Optical Time Domain Reflectometer (OTDR) for fiber optics.
   f. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

B. System Performance Testing and Adjusting Procedures

1. Upon completion of the installation of all equipment in an area, perform the following tests and record results. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Correct all non-conforming conditions prior to requesting Acceptance Review and Testing. Perform at least the following procedures:
2. Mechanical: Verify:
    a. Integrity of all support provisions.
    b. Absence of debris of any kind, tools, etc.
3. Power and Isolated Ground: Verify:
    a. Isolation of Isolated Ground system from raceway and related ground.
    b. Grounding of devices and equipment. Integrity of signal and technical power system ground connections.
    c. Proper provision of power to devices and equipment.
4. Signal Wiring: Verify:
    a. Integrity of all insulation, shield terminations and connections.
    b. Integrity of soldered connections. Absence of solder splatter, solder bridges.
    c. Routing and dressing of wire and cable.
    d. Continuity, including conformance with wire designations on running sheets, field and shop drawings.
    e. Absence of ground faults.
    f. Polarity.
5. Use the proper sequence of energizing systems to minimize the risk of damage.
6. Audio Systems:
    a. Electronic Tests; confirm:
        1) Gain at 1 kHz.
        2) Maximum output.
        3) Input clipping level.
        4) Frequency response.
        5) Total harmonic distortion.
        6) Signal-to-Noise ratio.
        7) Signal-to-Crosstalk ratio.
    b. Electro/Acoustic Tests:
        1) Uniformity of coverage.
        2) Electronic and acoustic frequency response/one-third octave equalization. Transfer function measurement shall be as close to flat as possible. Measure at ear level. The Owner's Representative will direct final adjustment.
        3) Maximum continuous sound pressure level (in the reverberant field). Drive systems with broadband pink noise. Sustain for at least five minutes with no system damage. Measure for "A" and "C" weightings at ear level on loudspeaker axis. Turn off noise.
        4) Acoustic signal-to-noise ratio referenced to the specified maximum continuous sound pressure level in the reverberant field. Measure for "A" and "C" weightings at ear level on loudspeaker axis with mechanical systems operating. Present comparison with previous measurement.
        5) Acoustic gain before feedback. Locate acoustic source (4 inch loudspeaker/pink noise generator) two feet from system microphone. Measure at system microphone position and at most distant listener position at ear level. Present comparison.
7. Video Systems:
    a. Video Monitors:
        1) Apply crosshatch. Verify linearity.

2) Apply red field. Adjust purity.
3) Apply SMPTE bars and PLUGE. Adjust to standards.

b. Video Path Test: Use NTC-7 procedures. Use full field or line signals. Alternately, conduct copper time domain reflectometer test.

8. Diagnostic Monitoring System:
   a. Demonstrate complete operation.
9. System Overall:
   a. Verify levels.
   b. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and adjustment procedures have been successfully completed.

C. Loudspeaker Assembly Testing and Adjusting Procedures
1. Upon completion of the installation of all loudspeakers in an area, perform the following tests and record results. Correct non-conforming conditions, unless the cause is clearly outside the Work of this Section, in which case submit the apparent cause to the Owner's Representative.
2. Loudspeaker Line Impedance: At terminal cabinets at equipment rooms, measure the impedance of each loudspeaker line. Sweep from at least 20 Hz to at least 16 kHz.
3. Loudspeaker Polarity: Test the acoustic polarity of all loudspeakers using an Acoustic Polarity Tester.
4. Freedom From Buzzes, Rattles and Objectionable Distortion: Individually apply to each loudspeaker line a slow sine wave sweep from 50 Hz to 5 kHz at a level of 6 dB below rated power amplifier output voltage. Listen carefully for buzzes, rattles and objectionable distortion.
5. Uniformity of Coverage: Apply broadband Pink Noise. Adjust level to approximately 70-80 dBA at measurement locations. Measure in 4 kHz octave band at ear level. Adjust loudspeaker aiming and 70 Volt loudspeaker taps for uniformity of coverage.

D. Equipment Rack and Equipment Testing and Adjusting Procedures
1. Conduct procedures in fabrication shop. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report with color photographs of each equipment rack, front and back. Perform at least the following procedures:
2. Preliminary: Verify:
   a. Grounding of devices and equipment. Integrity of signal and electrical system ground connections.
   b. Proper provision of power to devices and equipment.
   c. Integrity of all insulation, shield terminations and connections.
   d. Integrity of soldered connections. Absence of solder splatter, solder bridges.
   e. Absence of debris of any kind, tools, etc.
   f. Routing and dressing of wire and cable.
   g. All wiring, including polarity and continuity, including conformance with wire designations on running sheets, field and shop drawings.
   h. Mechanical integrity of all support provisions.
3. Rig temporary power and grounding: Comply with all applicable Codes, regulations and ordinances.
4. Determine the proper sequence of energizing systems to minimize the risk of damage. Energize. Burn in for at least 120 hours.

E. Telecommunications Cabling Testing

1. Perform telecommunications cabling inspection, verification, and performance tests in accordance with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. Perform optical fiber field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
2. Visually inspect UTP and optical fiber jacket materials for UL or third party certification markings. Inspect cabling terminations in telecommunications rooms and at workstations to confirm color code for T568A or T568B pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1, TIA-568-C.2 and TIA-568-C.3. Visually confirm Category 6 marking of outlets, cover plates, outlet/connectors, and patch panels.
3. UTP backbone copper cabling shall be tested for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors, and between conductors and shield, if cable has overall shield. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connected.
4. For multimode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568- C.3 and TIA-526-14-A using Method A, Optical Power Meter and Light Source for multimode optical fiber. For single-mode optical fiber, perform optical fiber end-to-end attenuation tests in accordance with TIA-568- C.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source]. Perform verification acceptance tests.
5. Perform testing for each outlet as follows:
    a. Perform Category 6 link tests in accordance with TIA-568-C.1 and TIA/EIA-568-B.2. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
    b. Optical fiber Links. Perform optical fiber end-to-end link tests in accordance with TIA-568-C.3. E. Final Verification Tests
    c. Perform verification tests for UTP and optical fiber systems after the complete telecommunications cabling and workstation outlet/connectors are installed.

3.13 CLEANING

A. Clean each section or area of where the work was conducted after completion to permit immediate use of the area. Remove and discard all refuse, rubbish, and debris.

B. The Contractor shall ensure that all recyclable and environmentally-hazardous waste materials are disposed properly.

C. Make good all existing structures, surfaces, and utilities affected by cutting, coring, mounting, drilling, or other new work.

D. Clean all furnished equipment of dust, dirt, finger prints, smudge, and other material prior to calling for a Substantial Performance of Work Review or Completion of Work Review.

3.14 PROTECTION

A. During the installation phase and up to the date of achieving Substantial Performance of Work, protect finished or unfinished work against damage or loss. In the event of such damage or loss, immediately replace or repair such work or equipment at no cost to the City.

3.15 ACCEPTANCE REVIEW, TESTING PROCEDURES AND COMMISSIONING

A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawings. Notify the Owner's Representative in writing that the Work of this Section is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing by returning Attachment “A” to the Owner's Representative. The Owner's Representative will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These Procedures may be performed at any hour of the day or night as required by the Owner's Representative to comply with the Project Schedule and avoid conflict with these procedures from possible ongoing work of other Separate Contracts and/or the Owner's Representative's operations. Provide all specified personnel and equipment at any time without claim for additional cost or time.

B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.

C. In Addition, Provide:
   1. Set of hand and power tools appropriate for performance of adjustment of and corrections to this Work.
   2. Include spare wire and connectors and specified tooling for application.
   3. Ladders, scaffolding and/or lifts as required to access loudspeakers and other high devices.
   4. Test equipment to include but not limited to:
      a. Dual channel FFT-based audio analyzer
      b. Video test generator with color bars, grayscale, alternating pixel, multi-burst, crosshatch and % windows.
      c. InfoComm Projection Shoot-Out DVD
      d. Digital Video Essential Professional DVD
      e. Category cable tester, cable length, short, open and miswire test.
   5. Complete set of latest stamped, actioned submittals of record for reference.
   6. Complete set of Shop and Project Site Test Reports.
   7. Complete set of manufacturer's original operation, instruction and service manuals for each equipment item for reference.

D. Demonstrate: Complete operation of all systems and equipment, including Portable Equipment.
   1. General
      a. Configure room for each type of event and demonstrate audio-visual system.
      b. Connection of portable equipment. (Laptop, document camera, etc.)
      c. Demonstrate to the Owner's Representative that all functions and equipment for the system work properly when installed as a complete system.
      d. The Contractor shall demonstrate the satisfactory operation of all controls and adjustment circuits of the system.
      e. Demo room scheduling software where applicable.
      f. Room combining and dividing presets.
      g. Demonstrate system startup and shut down procedures.
   2. Audio
      a. Route audio to program speakers.
      b.
      c. Connect microphone to each panel input and route through system.
      d. Demonstrate and document gain structure through the system.
      e. Demonstrate and document with a dual channel FFT-based audio meter the following:
         1) Polarity of each driver in each cabinet.
         2) Crossover point of high, mid and low section of each loudspeaker.
         3) dB SPL levels from 1-4 kHz at various position in the audience area.
         4) dB SPL level of high, mid, low and sub frequency bandwidth at crossover.

f. Audio routed to ceiling speakers.
g. Wireless microphones.
h. Demonstrate that the audio system is properly time aligned and equalized.
i. Assistive listening system.

3. Video
   a. Route source equipment (DVD, Blu-ray Player, TV tuner, test generators, etc.) to video displays and projector.
   b. Set up rooms for each type of event that may take place and demonstrate each.
   c. Recording of a videoconferencing session.
   d. Recording of a distance learning session.
   e. Videoconferencing and distance learning presets.
4. Control
   a. Communication between control system and AV equipment, including feedback if device supports 2-way communication
   b. User interface operation.
   c. Password protection of user interface.
   d. Touch panel features and each page of control.
   e. Touch panel help file.
   f. Help desk features.
   g. All programmed presets.
   h. Lighting and window shade control.
5. The Contractor 's personnel and test equipment shall be made available to the Owner's Representative in order that:
   a. Selected tests and measurements previously made by the Contractor can re-run.
   b. Other tests may be made at Owner's Representative's discretion.
   c. Additional tests or measurements may be made due to changes in field conditions.
6. It is estimated that the acceptance tests and demonstrations will require approximately four hours unless construction or installation problems or deviations from the specifications are discovered.

E. Adjust: As directed by the Owner's Representative.

F. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the Owner's Representative.

G. Acceptance Documentation
1. Official acceptance of the system covered by this specification will occur when the Design-Builder receives the following written documents:
   a. A letter from the Owner's Representative acknowledging Final Acceptance of the system stating compliance with all articles of the specifications.
   b. A letter from the Owner's Representative to the Contractor stating that all related work has been completed to his satisfaction. Until these documents are received, the installation is not formally complete. The official date of acceptance shall be the date of the letter from the Owner's Representative to the Contractor described above.

3.16 CLOSEOUT

A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify Owner's Representative of completion of Punch List.

B. Portable Equipment: Furnish all portable equipment and spares to the designated Owner's Representative, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.

C. Operating and Maintenance Data: Install framed operating and maintenance instructions. Submit Manuals.

D. Project Record Documents: Submit.

E. Keys: If applicable, replace construction locks with permanent locks. Transmit keys to Owner's Representative.

F. Training: Conduct specified training and submit training manuals.

G. Warranty: Submit Warranty dated to run from date of Acceptance of the Work of this Section.

3.17 OWNER'S REPRESENTATIVE'S RIGHT TO USE EQUIPMENT

A. Acceptance of the Work of this Section will be after completion of corrections and adjustments required by the "Punch List" which results from Acceptance Review and Testing of the completed installation. The Owner's Representative reserves the right to use equipment, material and services provided as part of the Work of this Section prior to Acceptance without incurring any obligation to Accept any equipment or completed systems until all Punch List work is complete and all systems comply with the Contract Documents; or accept any claim for additional cost or time.

END OF SECTION

SECTION 28 05 00- COMMON WORK RESULTS FOR ELECTRONIC SECURITY

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this Section shall consist of a design, furnishing of all material, labor, and installation for completion of an operable end to end structured cabling system. This includes - but is not limited to - furnishing and installing cable, cable supports, cable ties, inner duct, racks, cabinets, termination components, ancillary equipment, testing, and labeling and documentation of cables and connectors, for a complete end-to-end solution.

B. Section provides overarching coordination with various Electronic Security Systems sections, including Physical Access Control System, Video Assessment Surveillance System, and Security Intercommunication Systems.

C. The security system will be monitored from Zuckerberg San Francisco General Sheriff's Operations Center (SOC) and secondary locations that provide security assessment capabilities to security operators. Security Contractor to coordinate all work with facility personnel, including but not limited to HR, IT and Security Personnel.

1.2 DESCRIPTION OF WORK

A. The electronic security system (ESS) or security management system (consisting of all 28 series security sub-systems) shall be provided and installed in accordance with the drawings, specifications, and referenced publications.

B. The Contractor shall perform all work, provide products, systems integration, engineering, and design work required for the project to ensure complete and fully operational systems and proper installation of equipment. The Contractor shall provide calculations and analysis to support design and engineering decisions as specified in submittals. The Contractor shall provide and pay all labor, materials, and equipment, sales and gross receipts and other taxes. The Contractor shall secure and pay for plan check fees, permits, IP software license fees, other fees, and licenses necessary for the execution of work as applicable for the project. Give required notices; the Contractor will comply with codes, ordinances, regulations, and other legal requirements of public authorities, which bear on the performance of work.

C. The Contractor shall provide an ESS, installed, programmed, configured, documented, and tested. The security system shall include, but is not limited to: access control, intrusion detection, duress alarms, elevator control interface, video surveillance and assessment, video recording and storage, delayed egress, intercommunication system, fire alarm interface, equipment cabinetry, and uninterruptible power supplies (UPS) interface. Operator training shall be required as part of the Security Contractor's scope. The Security Contractor shall still be required to provide necessary maintenance and troubleshooting manuals as well as submittals as identified herein. The work shall include the procurement and installation of electrical wire and cables, the installation and testing of all system components. Inspection, testing, demonstration, and acceptance of equipment, software, materials, installation, documentation, and workmanship shall be as specified herein. The Contractor shall provide all associated installation support, including the provision of primary electrical input power circuits. All access control system will be compliant with Proximity and iClass® Smart Chip.

D. Repair Service Replacement Parts On-site service during the warranty period shall be provided as specified under “Emergency Service”. The Contractor shall guarantee all parts and labor for a term of one (1) year, unless dictated otherwise in this specification from the acceptance date of the system as described in Part 5 of this Specification. Vendor product warranties exceeding one (1) year shall be honored and extended to the Client. The Contractor shall be responsible for all equipment, software, shipping, transportation charges, and expenses associated with the service of the system for one (1) year. The Contractor shall provide 24-hour telephone support for the software program at no additional charge to the owner. Software support shall include all software updates that occur during the warranty period.

E. Where specific manufacturers are identified, approved equals will be considered.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section. Requirements of Section 5, Acceptance Testing shall take precedence over Division 01 System Acceptance requirements.

B. Safety Systems: This Division shall apply to Common Work Results for “Electronic Security” only. When applicable, Common Work Results for “Safety” shall precede this division.

C. Security Management System: This Division (280500 - Common Work Results for Electronic Security) shall be used as a base document for electronic security systems. The following sections shall be used in conjunction to provide a complete and fully integrated security management system.
1. 281300 – Access Control
2. 282300 – Video Surveillance
3. 283300 – Electronic Detection and Alarm

D. Related Sections include the following:
1. Division 01 Section “General Requirements”
2. Division 08 Section “Door Hardware”
3. Division 12 Section “Specialty Case Work”
4. Division 14 Section "Elevators" to add cameras, and access controls to elevator floor selection controls.
5. Division 23 Section "Sequence of Operations for HVAC Controls" to interface after-hours runtime accounting with security access-control reporting system.
6. Division 26 Supplement “Electrical Work for Electronic Security”
7. Division 27

1.4 RELATED DIVISION PROVISIONS

A. Division 1 Provisions: Comply with all applicable requirements including bonding, submittals, testing, and site safety.

B. Division 8 Provisions: The Division 8 Contractor at locations shown on the drawings shall provide all door hardware as shown in the door schedule. Door schedule shall detail all necessary components to interface with the security management system. The Security Contractor shall provide all connections between power supplies and the locking equipment.

C. Division 26 Provisions:

1. Dedicated Electrical Power (120 VAC) circuits shall be provided by the contractor as required to provide full system functionality. The Contractor shall provide, terminate, and test all system connections.
2. Contractor shall provide cable trays required by the security systems. Cable trays shall prevent water from contaminating the cables in the event of water leaking in the space (no ground level conduits should be used). Security conduits shall be labeled with blue marking band or blue paint every 9000mm. Security junction box covers shall be painted with paint manufactured by Benjamin Moore #791, Duron 5085A (Americana) or approved equal.
3. Contractor shall provide the uninterruptible power supplies (UPS) required for the security equipment at the Security Monitoring Console and the Equipment Room in the event of primary power loss. The UPS units shall support the listed security equipment as described in the Equipment Section of this specification.

1.5 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic design only. We intend all publications to be the most current editions except where otherwise noted.
   1. American National Standards Institute (ANSI)
      a. ANSI C2 (1990; TIA 90-2; Errata); National Electrical Safety Code
      b. ANSI C39.1 (1981; R 1992); Requirements for Electrical Analog Indicating Instruments
      c. ANSI C42.100 (2000); Standard Dictionary of Electrical and Electronics Terms
      d. ANSI INCITS 154 (1988; R 1999); Office Machines and Supplies - Alphanumeric Machines-Keyboard Arrangement
      e. ANSI INCITS 92 (1980; R 2003); Data Encryption Algorithm
      f. ANSI X3.154 (1988); Office Machines and Supplies = Alphanumeric Machine-Keyboard Arrangement
      g. ANSI X3.64 (1990); Additional Controls for Use by American National Standard Code for ANSI C2(1993); National Electrical Safety Code Information Exchange
      h. ANSI X3.92 (1988); Data Encryption Standard - Alphanumeric Machines-Keyboard Arrangement
      i. ANSI X9.52 (1998); Triple Data Encryption Algorithm Modes of Operation
      j. ANSI/TIA/EIA-568-A Commercial Building Telecommunications Cabling Standard (October l995 or newer).
      k. ANS1/TIA/EIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces (October 1990 or newer).
      l. ANSI/EIA/TIA-570 Residential and Light Commercial Telecommunications Wiring Standard (June 199l or newer).
      m. ANSI/TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings (February 1993 or newer).
      n. ANSI-J-STD-607-A (2002); Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
      o. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications (August 1994 or newer).
   2. ASTM International (ASTM)
      a. ASTM A 123/A 123M (2002) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
      b. ASTM B 3 (2001) Standard Specification for Soft or Annealed Copper Wire
      c. ASTM B 32 (2004) Solder Metal
      d. ASTM C 1107 (2007) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
      e. ASTM D 709 (2001) Laminated Thermosetting Materials

f. ASTM E 84 (2007) Standard Test Method for Surface Burning Characteristics of Building Materials

3. Consumer Electronics Association (CEA)
   a. CEA 170 (1957); Electrical Performance Standards - Monochrome Television Studio Facilities
   b. CEA-310-E (2005); Racks, Panels, and Associated Equipment
   c. CEA-330 (2004); Electrical Performance Standards for Closed Circuit Television Camera 525/60
   d. CEA-375-A (2004); Direct View Monochrome Closed Circuit Television Monitors 525/60 Interlaced 2:1
4. Electronic Industries Association (EIA)
   a. EIA 170 (1957); Electrical Performance Standards
   b. EIA 232-E (1991); Interface Between Data Terminal Equipment and Data Circuit - Terminating Equipment Employing Serial Binary data Exchange
   c. EIA 310-C (1982); Racks, Panels and Associated Equipment
   d. EIA 330 (1968); Electrical Performance Standards for Closed Circuit Television Camera 525/60 Interlaced 2:1
   e. EIA 445 (1980); Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices
   f. EIA/TIA-455-3A FOTP-3 Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components
   g. EIA/TIA-455-B Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components
5. Institute of Electrical and Electronics Engineers (IEEE)
   a. IEEE Std 81 (1983) Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
   b. IEEE Std 100 (2000) The Authoritave Dictionary of IEEE Standards Terms
   c. IEEE Std 142 (1991; Err 2006) Recommended Practice for Grounding of Industrial and Commercial Power Systems - IEEE Green Book (Color Book Series)
   d. IEEE Std. 503 (1978) Measurement and Characterization of Diode-Type Cameras.
   e. IEEE C2 (2005) National Electrical Safety Code
   f. IEEE C62.41 (1991; R 1995) Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits
6. International Organization for Standardization (ISO)
   a. ISO 7810 (2003) Identification Cards – Physical Characteristics
   b. ISO 7811-1 (2002) Identification Cards – Recording Technique - Part 1: Embossing
7. International Telecommunications Union (ITU)
   a. ITU V.34 (1998) Data Communication Over the Telephone Network: A Modem Operating at Data Signaling Rates of up to 33,600 bits for use on the General Switched Telephone Network and on Leased Point-to-Point Two-Wire Telephone Type Circuits
   b. ITU V.42 (CORR 1 2003) Data Communications Over the Telephone Network: Error-Correcting Procedures for DCEs Using Asynchronous-to-Synchronous Conversion
   c. ITU V.42 bis (1990) Data Communication over the Telephone Network: Data Compression Procedures for Data Circuit Terminating Equipment (DCE) Using Error Correction Procedures
   d. ITU V.92 (AMD 2001, AMD 2002 and CORR 2003) Enhancements to Recommendation V.90 Series: V, with Amendments 1 and 2
8. National Electrical Manufacturers Association (NEMA)
   a. NEMA 250 (2003) Enclosures for Electrical Equipment (1000 Volts Maximum)
   b. NEMA ICS 1 (2000; R 2005) Industrial Control and Systems: General Requirements

c. NEMA ICS 2 (2000; Errata 2002; R 2005; Errata 2006) Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment
d. NEMA ICS 6 (1993; R 2006) Industrial Control and Systems: Enclosures

9. National Fire Protection Association (NFPA)
   a. NFPA 70 (2019; TIA 2019); National Electrical Code
   b. NFPA 72 (2019; CBC 2019 CFC 2019); National Fire Alarm and Signaling Code.
   c. NFPA 101 Chapter 5 (2018 or newer; CBC 2019; CFC 2019); Life Safety Code
   d. NFPA 262 (2019; CBC 2019; CFC 2019); Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
   e. NFPA 730 (2019 or Newer; CBC 2019; CFC 2019); Guide for Premises Security
   f. NFPA 731 (2019 or Newer; CBC 2019; CFC 2019); Standard for the Installation of Premises Security Systems
10. Security Industry Association (SIA)
   a. SIA BIO-01(2000 or Newer); Biometric Standard, Vocabulary for Testing
   b. SIA CP-01 (2000 or Newer); Control Panel Standard
   c. SIA DC-01 (1988 or Newer); Digital Communications Technical Report - Receiver-to- Computer Interface Protocol
   d. SIA DC-03 (1990 or Newer); Digital Communications Standard - "SIA Format" Protocol - for Alarm System Communications
   e. SIA DC-07 (2001); SIA Digital Communications Standard - Receiver-to-Computer Interface Protocol (Type 2) - for Central Station Equipment Communications
11. Society of Motion Picture and Television Engineers (SMPTE)
   a. SMPTE 170M (2004) Television - Composite Analog Video Signal - NTSC for Studio Applications
12. Telecommunication Industry Association (TIA)
   a. TIA-232-F (1997; R 2002); Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange
   b. ANSI/TIA/EIA 492AAAA-A (2002); Detail Specification for 62.5µm Core Diameter / 125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
   c. ANSI/TIA/EIA-526-14-A – Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant OFSTP-14A
   d. ANSI/TIA/EIA-568-B.1 (2001 Addendums 2001, 2003, 2003, 2003, 2004, 2007) Commercial Building Telecommunications Cabling Standard – Part 1: General Requirements
   e. ANSI/TIA/EIA-568-B.2 (2002); Commercial Building Telecommunications Cabling Standard. Part 2: Balanced Twisted-Pair Cabling Components
   f. ANSI/TIA/EIA-568-B.3 (2002); Commercial Building Telecommunications Cabling Standard. Part 3: Optical Fiber Cabling Components Standard
   g. ANSI/TIA/EIA-569-B (2004); Commercial Building Standard for Telecommunications Pathways and Spaces
   h. ANSI/TIA/EIA-598-B (2001); Optical Fiber Cable Color Coding
   i. ANSI/TIA/EIA-604-2 (2002); Fiber Optic Connector Intermateability ST-Style Connectors
   j. ANSI/TIA/EIA-604-3-A (2002); Fiber Optic Connector Intermateability SC-Style Connectors
   k. ANSI/TIA/EIA-604-12(2002); FOCIS 3A Fiber Optic Connector Intermateability Standard
   l. ANSI/TIA/EIA-606-A (2002); Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   m. ANSI/TIA/EIA TSB-67 (1995 or Newer); Transmission Performance Specifications for Field Testing of Unshielded Twisted- Pair (UTP) Cabling Systems - Draft
   n. ANSI/T1A/E1A TSB-72 (1995 or Newer); Centralized Optical Fiber Cabling Guidelines - Draft.

13. Code of Federal Regulations
    a. 21 CFR 1020 (2006); Performance Standards for Ionizing Radiation Emitting Products
    b. 14 CFR 108.17 & 129.26 (2006); U.S. Federal Aviation Standards
    c. 29 CFR 1910.7 (2004); Definition and requirements for a nationally recognized testing
    d. 47 CFR 15 (2007); Radio Frequency Devices
    e. 47 CFR 68 (2006); Connection of Terminal Equipment to the Telephone Network
14. Underwriters Laboratories (UL) - The Contractor shall provide evidence of system compliance and shall clearly indicate any specific departures from the UL Listed configuration for the system provided.
    a. UL 6 (2004); Rigid Metal Conduit
    b. UL 50 (1995); Electrical Cabinets and Boxes
    c. UL 83 (2003); Thermoplastic-Insulated Wires and Cables
    d. UL 294 (1999; Rev thru Aug 2005) Access Control System Units
    e. UL 444 (2002); Communications Cables
    f. UL 464 (2003; Rev thru Oct 2003) Audible Signal Appliances
    g. UL 467 (2004); Standard for Grounding and Bonding Equipment
    h. UL 497B (2004); Protectors for Data Communication and Fire Alarm Circuits
    i. UL 609 (1996; Rev thru Mar 2005); Local Burglar Alarm Units and Systems
    j. UL 634 (2000); Connectors and Switches for Use with Burglar-Alarm Systems
    k. UL 636 (1996; Rev thru Mar 2001); Holdup Alarm Units and Systems
    l. UL 639 (1997; Rev thru Sep 2002); Intrusion Detection Units
    m. UL 681 (1999; Rev thru Jan 2001); Installation and Classification of Burglar and Holdup Alarm Systems
    n. UL 796 (2006); Printed-Wiring Boards
    o. UL 797 (2004); Electrical Metallic Tubing -- Steel
    p. UL 827 (1996; Rev thru Apr 1999); Central Station Alarm Services
    q. UL 910 (1998); UL 910 UL Standard for Safety Test for Flame-Propagation and Smoke-Density Values for Electrical and Optical-Fiber Cables Used in Spaces Transporting Environmental Air
    r. UL 969 (1995); Standard for Marking and Labeling Systems
    s. UL 972 (2006); Burglary Resisting Glazing Material
    t. UL 1037 (1999; Rev thru Nov 2004); Standard for Safety Antitheft Alarms and Devices
    u. UL 1076 (1995; Rev thru Mar 2005); Standard for Safety Proprietary Burglar Alarm Units and Systems
    v. UL 1410 (1991); Television Receivers and High Voltage Video Products
    w. UL 1424 (2005); Standard for Cables for Power-Limited Fire-Alarm Circuits
    x. UL 1492 (1996; R May 2004); Safety Audio-Video Products and Accessories
    y. UL 1581 (2001); Reference Standard for Electrical Wires, Cables, and Flexible Cords
    z. UL 1610 (1998; Rev thru Aug 2005); Central-Station Burglar-Alarm Units
    aa. UL 1635 (1996; Rev thru Aug 2005); Digital Alarm Communicator System Units
    bb. UL 1638 (2001; Rev thru Nov 2003); Visual Signaling Appliances - Private Mode Emergency and General Utility Signaling
    cc. UL 1655 (1997); Standard for Community-Antenna Television Cables
    dd. UL 1660 (2004); Liquid-Tight Flexible Nonmetallic Conduit
    ee. UL 1666 (2007); Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
    ff. UL 1981 (1994; Rev. 1999); Central Station Automation Systems
    gg. UL 2050 (2003; 4th Edition); National Industrial Security Systems
    hh. UL 2196 (2007); Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts
15. Federal Communication Commission (FCC)

a. FCC Part 15 (July 1986) rules and regulations; Radio Frequency Devices.

16. Federal Specifications (FS)
    a. WC-586 (Revised) conduit outlet boxes, bodies, and entrance caps electrical; cast metal.
17. Federal Information Processing Standards (FIPS)
    a. FIPS 201-2 (2013) Personal Identity Verification (PIV) of Federal Employees and Contractors

1.6 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

D. CPU: Central processing unit.

E. Credential: Data assigned to an entity and used to identify that entity.

F. DGP: Data Gathering Panel.

G. EMI: Electromagnetic interference.

H. EMT: Electric Metallic Tubing.

I. ESS: Electronic Security System.

J. File Server: A PC in a network that stores the programs and data files shared by users.

K. GFI: Ground fault interrupter.

L. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

M. I/O: Input/Output.

N. Intrusion Zone: A space or area for which an intrusion must be detected and uniquely identified, the sensor or group of sensors assigned to perform the detection, and any interface equipment between sensors and communication link to central-station control unit.

O. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

P. LAN: Local area network.

Q. LCD: Liquid-crystal display.

R. LED: Light-emitting diode.

S. Location: A Location on the network having a PC-to-Controller communications link, with additional Controllers at the Location connected to the PC-to-Controller link with RS-485 communications loop. Where this term is presented with an initial capital letter, this definition applies.

T. LOD: Level of Detail

U. LOE: Level of Effort

V. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

W. M-JPEG: Motion – Joint Photographic Experts Group.

X. MPEG: Moving Picture Experts Group.

Y. NEC: National Electric Code.

Z. NEMA: National Electrical Manufacturers Association.

AA. NFPA: National Fire Protection Association.

BB. NTSC: National Television System Committee.

CC. NRTL: Nationally Recognized Testing Laboratory.

DD. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).

EE. PC: Personal computer. This acronym applies to the Central Station, workstations, and file servers.

FF. PDF: (Portable Document Format.) The file format used by the Acrobat document exchange system software from Adobe.

GG. PIR: Passive infrared.

HH. RCDD: Registered Communications Distribution Designer.

II. RF: Radio frequency.

JJ. RFI: Radio-frequency interference.

KK. RIGID: Rigid conduit is galvanized steel tubing, with a tubing wall that is thick enough to allow it to be threaded.

LL. Solid-Bottom or Non-ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal side rails, and a bottom without ventilation openings.

MM. SMS: Security Management System – A SMS is a software that incorporates multiple security subsystems (e.g., access control, intrusion detection) into a single platform and graphical user interface.

NN. SOC: Security Operations Center.

OO. Standard Intruder: A person who weighs 45 kg (100 lb.) or less and whose height is 1525 mm (60 in) or less; dressed in a long-sleeved shirt, slacks, and shoes.

PP. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.

QQ. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

RR. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

SS. UPS: Uninterruptible Power Supply.

TT. UTP: Unshielded Twisted Pair.

UU. VPN: Virtual Private Network.

VV. VM: Virtual machine (VM) is an emulation of a particular computer system. Virtual machines operate based on the computer architecture and functions of a real or hypothetical computer, and their implementations may involve specialized hardware, software, or a combination of both.

WW. WAN: Wide Area Network.

XX. WAV: The digital audio format used in Microsoft Windows.

YY. Windows: Operating system by Microsoft Corporation.

ZZ. Workstation: A PC with software that is configured for specific limited security system functions.

1.7 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS

A. The Contract Documents supplement to this specification indicates approximate locations of equipment. The installation and/or locations of the equipment and devices shall be governed by the intent of the design; specification and Contract Documents, with due regard to actual site conditions, recommendations, ambient factors affecting the equipment and operations in the vicinity. The Contract Documents are diagrammatic and do not reveal all offsets, bends, elbows, components, materials, and other specific elements that may be required for proper installation. If any departure from the contract documents is deemed necessary, or in the event of conflicts, the Contractor shall submit details of such departures or conflicts in writing to the owner or owner’s representative for his or her comment and/or approval before initiating work.

B. Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called by all, except if a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Form of Agreement; the Supplemental General Conditions; the Special Conditions; the Specifications with attachments; and the drawings.

1.8 SUBMITTALS

A. General: Submittals shall be in full compliance of the Contract Documents. All submittals shall be provided in accordance with this section. Submittals lacking the breath or depth these

requirements will be considered incomplete and rejected. Submissions are considered multidisciplinary and shall require coordination with applicable divisions to provide a complete and comprehensive submission package. Additional general provisions are as follows:

1. The Contractor shall schedule submittals in order to maintain the project schedule. For coordination drawings refer to Specification Section 01331 - Design Submittal Procedures, which outline basic submittal requirements and coordination. Section 01331 shall be used in conjunction with this section.
2. The Contractor shall identify variations from requirements of Contract Documents and state product and system limitations, which may be detrimental to successful performance of the completed work or system.
3. Each package shall be submitted at one (1) time for each review and include components from applicable disciplines (e.g., electrical work, architectural finishes, door hardware, etc.) which are required to produce an accurate and detailed depiction of the project.
4. Manufacturer's information used for submittal shall have pages with items for approval tagged, items on pages shall be identified, and capacities and performance parameters for review shall be clearly marked through use of an arrow or highlighting. Provide space for Health Center Representative (HCR) and Contractor review stamps.
5. Technical Data Drawings shall be in the latest version of AutoCAD®, drawn accurately, and in accordance with owner's CAD Standards. FREEHAND SKETCHES OR COPIED VERSIONS OF THE CONSTRUCTION DOCUMENTS WILL NOT BE ACCEPTED. The Contractor shall not reproduce Contract Documents or copy standard information as the basis of the Technical Data Drawings. If departures from the technical data drawings are subsequently deemed necessary by the Contractor, details of such departures and the reasons thereof shall be submitted in writing to the UR for approval before the initiation of work.
6. Packaging: The Contractor shall organize the submissions according to the following packaging requirements.
    a. Binders: For each manual, provide heavy duty, commercial quality, durable three (3) ring vinyl covered loose leaf binders, sized to receive 8.5 x 11 in paper, and appropriate capacity to accommodate the contents. Provide a clear plastic sleeve on the spine to hold labels describing the contents. Provide pockets in the covers to receive folded sheets.
        1) Where two (2) or more binders are necessary to accommodate data; correlate data in each binder into related groupings according to the Project Manual table of contents. Cross-referencing other binders where necessary to provide essential information for communication of proper operation and/or maintenance of the component or system.
        2) Identify each binder on the front and spine with printed binder title, Project title or name, and subject matter covered. Indicate the volume number if applicable.
    b. Dividers: Provide heavy paper dividers with celluloid tabs for each Section. Mark each tab to indicate contents.
    c. Protective Plastic Jackets: Provide protective transparent plastic jackets designed to enclose diagnostic software for computerized electronic equipment.
    d. Text Material: Where written material is required as part of the manual use the manufacturer's standard printed material, or if not available, specially prepared data, neatly typewritten on 8.5 inches by 11 inches 20-pound white bond paper.
    e. Drawings: Where drawings and/or diagrams are required as part of the manual, provide reinforced punched binder tabs on the drawings and bind them with the text.
        1) Where oversized drawings are necessary, fold the drawings to the same size as the text pages and use as a foldout.
        2) If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of the binder. Insert a type

written page indicating the drawing title, description of contents and drawing location at the appropriate location of the manual.

3) Drawings shall be sized to ensure details and text is of legible size. Text shall be no less than 1/16" tall.

f. Manual Content: In each manual include information specified in the individual Specification section, and the following information for each major component of building equipment and controls:
   1) General system or equipment description.
   2) Design factors and assumptions.
   3) Copies of applicable Shop Drawings and Product Data.
   4) System or equipment identification including: manufacturer, model and serial numbers of each component, operating instructions, emergency instructions, wiring diagrams, inspection and test procedures, maintenance procedures and schedules, precautions against improper use and maintenance, repair instructions, sources of required maintenance materials and related services, and a manual index.

g. Binder Organization: Organize each manual into separate sections for each piece of related equipment. At a minimum, each manual shall contain a title page, table of contents, copies of Product Data supplemented by drawings and written text, and copies of each warranty, bond, certifications, and service Contract issued. Refer to Group I through V Technical Data Package Submittal requirements for required section content.

h. Title Page: Provide a title page as the first sheet of each manual to include the following information; project name and address, subject matter covered by the manual, name and address of the Project, date of the submittal, name, address, and telephone number of the Contractor, and cross references to related systems in other operating and/or maintenance manuals.

i. Table of Contents: After the title page, include a type written table of contents for each volume, arranged systematically according to the Project Manual format. Provide a list of each product included, identified by product name or other appropriate identifying symbols, and indexed to the content of the volume. Where more than one (1) volume is required to hold data for a particular system, provide a comprehensive table of contents for all volumes in each volume of the set.

j. General Information Section: Provide a general information section immediately following the table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the installer and maintenance Contractor. In addition, list a local source for replacement parts and equipment.

k. Drawings: Provide specially prepared drawings where necessary to supplement the manufacturers printed data to illustrate the relationship between components of equipment or systems, or provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation.

l. Manufacturer's Data: Where manufacturer's standard printed data is included in the manuals, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where more than one (1) item in tabular format is included, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation and delete references to information which is not applicable.

m. Where manufacturer's standard printed data is not available and the information is necessary for proper operation and maintenance of equipment or systems, or it is necessary to provide additional information to supplement the data included in the manual, prepare written text to provide the necessary information. Organize the text in a consistent format under a separate heading for different procedures.

Where necessary, provide a logical sequence of instruction for each operating or maintenance procedure. Where similar or more than one product is listed on the submittal the Contractor shall differentiate by highlighting the specific product to be utilized.

n. Calculations: Provide a section for circuit and panel calculations.
o. Loading Sheets: Provide a section for DGP Loading Sheets.
p. Certifications: Provide section for Contractor's manufacturer certifications.

7. Contractor Review: Review submittals prior to transmittal. Determine and verify field measurements and field construction criteria. Verify manufacturer's catalog numbers and conformance of submittal with requirements of contract documents. Return non-conforming or incomplete submittals with requirements of the work and contract documents. Apply Contractor's stamp with signature certifying the review and verification of products occurred, and the field dimensions, adjacent construction, and coordination of information is in accordance with the requirements of the contract documents.
8. Resubmission: Revise and resubmit submittals as required within 15 calendar days of return of submittal. Make resubmissions under procedures specified for initial submittals. Identify all changes made since previous submittal.
9. Product Data: Within 15 calendar days after execution of the contract, the Contractor shall submit for approval a complete list of all major products proposed for use. The data shall include name of manufacturer, trade name, model number, the associated contract document section number, paragraph number, and the referenced standards for each listed product.

B. Group 1 Technical Data Package: Group 1 Technical Data Package shall be one submittal consisting of the following content and organization. Consult the project Security Consultant for drawing format and content requirements. The data package shall include the following:
1. Section I - Drawings:
a. General – Drawings shall conform to facility conditions and CAD Standards Documents. All text associated with security details shall be 1/8" tall and meet owner text standard for AutoCAD® drawings.
b. Cover Sheet – Cover sheet shall consist of Project Title and Address, Project Number, Area and Vicinity Maps.
c. General Information Sheets – General Information Sheets shall consist of General Notes, Abbreviations, Symbols, Wire and Cable Schedule, Project Phasing, and Sheet Index.
d. Floor Plans – Floor plans shall be produced from the Architectural backgrounds issued in the Construction Documents. The contractor shall receive floor plans from the prime A/E to develop these drawing sets. Security devices shall be placed on drawings in scale. All text associated with security details shall be 1/8" tall and meet owner text standard for AutoCAD® drawings. Floor plans shall identify the following:
1) Security devices by symbol,
2) The associated device point number (derived from the loading sheets),
3) Wire & cable types and counts
4) Conduit sizing and routing
5) Conduit riser systems
6) Device and area detail call outs
e. Architectural details – Architectural details shall be produced for each device mounting type, camera, door details for EECS and IDS, IDS (motion detector glass break detector, duress button)
f. Riser Diagrams – Contractor shall provide a riser diagram indicating riser architecture and distribution of the SMS throughout the facility (or area in scope).
g. Block Diagrams – Contractor shall provide a block diagram for the entire system architecture and interconnections with SMS subsystems. Block diagram shall identify SMS subsystem (e.g. electronic entry control, intrusion detection, and

other associated subsystems) integration; and data transmission and media conversion methodologies.

h. Interconnection Diagrams – Contractor shall provide interconnection diagram for each sensor, and device component. Interconnection diagram shall identify termination locations, standard wire detail to include termination schedule. Diagram shall also identify interfaces to other systems such as elevator control, fire alarm systems, and security management systems.

i. Security Details –
   1) Panel Assembly Detail – For each panel assembly, a panel assembly details shall be provided identifying
   2) Panel Details – Use manufacturer recommended details for SMS power supplies, DGP, Field Panel configurations and layouts
   3) Device Mounting Details – Provide mounting detailed drawing for each security device (electronic entry control, intrusion detection, video surveillance and assessment) for each type of wall and ceiling configuration in project. Device details shall include device, mounting detail, wiring and conduit routing. Each detail shall incorporate project architectural details to provide
   4) Details of connections to power supplies and grounding
   5) Details of surge protection device installation
   6) Sensor detection patterns – Each system sensor shall have associated detection patterns.
   7) Equipment Room – Equipment room details shall provide architectural, electrical, mechanical, plumbing, IT/Data and associated equipment and device placements both vertical and horizontally.

j. Electrical Panel Schedule – Electrical Panel Details shall be provided for all SMS systems electrical power circuits. Panel details shall be provided identifying panel type (Standard, Emergency Power, Emergency/Uninterrupted Power Source, and Uninterrupted Power Source Only), panel location, circuit number, and circuit amperage rating.

k. Door Schedule – A door schedule shall be developed for each door equipped with electronic security components. At a minimum, the door schedule shall be coordinated with Division 08 work and include the following information:
   1) Item Number
   2) Door Number (Derived from A/E Drawings)
   3) Floor Plan Sheet Number
   4) Standard Detail Number
   5) Door Description (Derived from Loading Sheets)
   6) Data Gathering Panel Input Number
   7) Door Position or Monitoring Device Type & Model Number
   8) Lock Type, Model Number & Power Input/Draw (standby/active)
   9) Card Reader Type & Model Number
   10) Shunting Device Type & Model Number
   11) Sounder Type & Model Number
   12) Manufacturer
   13) Miscellaneous devices as required
      a) Delayed Egress Type & Model Number
      b) Intercom
      c) Camera
      d) Electric Transfer Hinge
      e) Electric Pass-through device
   14) Remarks column indicating special notes or door configurations

l. Camera Schedule - A camera schedule shall be developed for each camera. Contractors shall coordinate with the UR to determine camera starting numbers and naming conventions. All drawings shall identify wire and cable standardization

methodology. Color coding of all wiring conductors and jackets is required and shall be communicated consistently throughout the drawings package submittal. At a minimum, the camera schedule shall include the following information:

1) Item Number
2) Camera Number (Correspond with input into video switcher, and recorder)
3) Naming Conventions
4) Description of Camera Coverage
5) Camera Location
6) Floor Plan Sheet Number
7) Camera Type
8) Mounting Type
9) Standard Detail Reference
10) Power Input & Draw
11) Power Panel Location
12) Remarks Column for Camera

2. Section II – Data Gathering Panel Documentation Package: For the purpose of establishing project requirements, this section identifies manufacturer specific terms (I-8, R-8, iStar, etc.) for the purpose of communicating requirements; although specific products are outlined in the related section 281300.
   a. Contractor shall provide Data Gathering Panel (DGP) input and output documentation packages for review at the Shop Drawing submittal stage and also with the as-built documentation package. The documentation packages shall be provided in both printed and magnetic form at both review stages.
   b. The Contractor shall provide loading sheet documentation package for the associated DGP, including input and output boards for all field panels associated with the project. Documentation shall be provided in current version Microsoft Excel spreadsheets following the format currently utilized by owner. (See attached sample.) A separate spreadsheet file shall be generated for each DGP and associated field panels (I-8 input board and R-8 relay output board).
   c. The spreadsheet names shall follow a sequence that shall display the spreadsheets in numerical order according to the DGP system number. The spreadsheet shall include the prefix in the file name that uniquely identifies the project site. (Example: Site Name DGP-01.xls, Site Name DGP-01 I8-01)
   d. The spreadsheet shall detail all connected items such as card readers, alarm inputs, and relay output connections. The spreadsheet shall include an individual section (row) for each panel input, output and card reader. The spreadsheet shall automatically calculate the system numbers for card readers, inputs, and outputs based upon data entered in initialization fields.
   e. All entries must be verified against the field devices. Copies of the floor plans shall be forwarded under separate cover.
   f. The DGP spreadsheet shall include an entry section for the following information:
      1) DGP number
      2) First Reader Number (Except I-8 and R-8)
      3) First Monitor Point Number (Except R-8)
      4) First Relay Number (Except I-8)
      5) DGP, I-8 or R-8 Location
      6) DGP Chain Number
      7) DGP Cabinet Tamper Input Number (Except R-8 and R-8)
      8) DGP Power Fail Input Number (Except R-8 and R-8)
      9) Number of Monitor Points Reserved for Expansion Boards (Except R-8 and R-8)
      10) Number of Control Points (Relays) Reserved for Expansion Boards (Except R-8 and R-8)

g. The DGP, I-8 (input module) and R-8 (output module) spreadsheets shall automatically calculate the following information based upon the associated entries in the above fields:
   1) System Numbers for Card Readers (Except R-8)
   2) System Numbers for Monitor Point Inputs
   3) System Numbers for Control Points (Relays)
   4) Next DGP or I-8 First Monitor Point Number
   5) Next DGP or R-8 First Control Point Number

h. The DGP spreadsheet shall provide the following information for each card reader:
   1) DGP Reader Number
   2) System Reader Number
   3) Cable ID Number
   4) Description Field (Room Number)
   5) Description Field (Device Type i.e.: In Reader, Out Reader, etc.)
   6) Description Field (Area Description i.e.: Hall 21, Office, etc.)
   7) DGP Input Location
   8) Date Test
   9) Date Passed
   10) Cable Type
   11) Camera Numbers (of cameras viewing the reader location)

i. The DGP and I-8 spreadsheet shall provide the following information for each monitor point (alarm input). (Note: Communication for I/8 Boards in security closets are daisy chained. Communication for I/8 Boards in galleries, and display cases are home run back to the DGP.)
   1) DGP Monitor Point Input Number
   2) System Monitor Point Number
   3) Cable ID Number
   4) Description Field (Room Number)
   5) Description Field (Device Type i.e.: Door Contact, Motion Detector, etc.)
   6) Description Field (Area Description i.e.: Hall 21, Storage, Office, etc.)
   7) DGP or I-8 Input Location
   8) Date Test
   9) Date Passed
   10) Cable Type
   11) Camera Numbers (of associated alarm event preset call-ups)

j. The DGP and R-8 (output module) spreadsheet shall provide the following information for each control point (output relay). (Note: Communications for R/8 Boards in Security Closets are Daisy Chained. Communication lines for R/8 Boards in Galleries are home run back to the DGP.)
   1) DGP Control Point (Relay) Number
   2) System (Control Point) Number
   3) Cable ID Number
   4) Description Field (Room Number)
   5) Description Field (Device: Lock Control, Local Sounder, etc.)
   6) Description Field (Area Description i.e.: Hall 21, Storage, Office, etc.)
   7) DGP or R-8 Output Location
   8) Date Test
   9) Date Passed Cable Type
   10) Camera Number (of associated alarm event preset call-ups)

k. The DGP, I-8 and O-8 spreadsheet shall include the following information or directions in the header and footer:
   1) Header
      a) DGP Input and Output Worksheet
      b) Enter Beginning Reader, Input, and Output Starting Numbers and Sheet Will Automatically Calculate the Remaining System Numbers.

2) Footer
   a) File Name
   b) Date Printed
   c) Page Number

3. Section III - Construction Mock-up: In areas with exposed EMT/Conduit Raceways, contractor shall conceal raceway as much as practical and unobtrusively. In addition, historic significance must be considered to determine installation means and methods for approval by the owner.
4. Section IV - Manufacturers' Data: The data package shall include manufacturers' data for all materials and equipment, including sensors, local processors and console equipment provided under this specification.
5. Section V - System Description and Analysis: The data package shall include system descriptions, analysis, and calculations used in sizing equipment required by these specifications. Descriptions and calculations shall show how the equipment will operate as a system to meet the performance requirements of this specification. The data package shall include the following:
   a. Central processor memory size; communication speed and protocol description; rigid disk system size and configuration; flexible disk system size and configuration; back-up media size and configuration; alarm response time calculations; command response time calculations; start-up operations; expansion capability and method of implementation; sample copy of each report specified; and color photographs representative of typical graphics.
   b. Software Data: The data package shall consist of descriptions of the operation and capability of the system, and application software as specified.
   c. Overall System Reliability Calculations: The data package shall include all manufacturers' reliability data and calculations required to show compliance with the specified reliability.
6. Section VI – Certifications & References: All specified manufacturer's certifications shall be included with the data package. Contractor shall provide Project references as outlined in Paragraph 1.10 A "Contractor Qualifications".

C. Group II Technical Data Package
   1. The Contractor shall prepare a report of "Current Site Conditions" and submit a report to the UR documenting changes to the site, particularly those conditions that affect performance of the system to be installed. The Contractor shall provide specification sheets, or written functional requirements to support the findings, and a cost estimate to correct those site changes or conditions which affect the installation of the system or its performance. The Contractor shall not correct any deficiency without written permission from the UR.
   2. System Configuration and Functionality: The contractor shall provide the results of the meeting with OWNER to develop system requirements and functionality including but not limited to:
      a. Baseline configuration
      b. Access levels
      c. Schedules (intrusion detection, access control, holidays, etc.)
      d. Badge database
      e. System monitoring and reporting (unit level and central control)
      f. Naming conventions and descriptors
      g. Sequencing of PLC interfaces

D. Group III Technical Data Package
   1. Development of Test Procedures: The Contractor will prepare performance test procedures and reports for the pre-delivery test (PDT). The pre-delivery test procedures shall follow the format of the testing procedures and be customized to the contract

requirements. The Contractor will deliver the test procedures to the UR for approval at least 60 calendar days prior to the requested test date.

2. Perform Pre-delivery Testing: The Contractor will perform the pre-delivery test only after receiving written approval of the test procedures. The contractor shall deliver a final pre-delivery test report within 15 calendar days from completion of the pre-delivery test and request to initiate system installation process to continue. Refer to Part 5 of this section for system Testing and Acceptance requirements. No systems or devices shall be installed prior to successful completion of the PDT and written notice to proceed.

E. Group IV Technical Data Package
   1. Performance Verification Test
      a. Based on the successful completion of the pre-delivery test, the Contractor shall finalize the test procedures and report forms for the performance verification test (PVT) and the endurance test. The PVT shall follow the format, layout and content of the pre-delivery test. The Contractor shall deliver the PVT and endurance test procedures to the UR for approval. The Contractor may schedule the PVT after receiving written approval of the test procedures. The Contractor shall deliver the final PVT and endurance test reports within 14 calendar days from completion of the tests. Refer to Part 5 of this section for System Testing and Acceptance requirements.
   2. Training Documentation
      a. New Facilities: Familiarization training shall be provided for new equipment or systems. Training can include site familiarization training for owner technicians and administrative personnel. General information on new system layout including closet locations, turnover of the completed system including all documentation, including manuals, software, key systems, and full system administration rights. Lesson plans and training manuals training shall be oriented to type of training to be provided. See each section for specific training requirements.
   3. System Configuration and Data Entry:
      a. The contractor is responsible for providing all system configuration and data entry for the SMS and subsystems (e.g., video system, digital video servers, access control, intrusion detection). All data entry shall be performed Owner's standards & guidelines. The Contractor is responsible for participating in all meetings with the OWNER and the client to compile the information needed for data entry. These meetings shall be established at the beginning of the project and incorporated into the project schedule as a milestone task. The contractor shall be responsible for all data collection, data entry, and system configuration. The contractor shall collect, enter, & program and/or configure the following components:
         1) Access control system components
         2) All intrusion detection system components
         3) Video surveillance, control and recording systems
         4) Intercom systems components
         5) Programmable Logic Controllers
         6) All other security subsystems shown in the contract documents
      b. The Contractor is responsible for compiling the card access database for the UR's employees, including programming reader configurations, access shifts, schedules, exceptions, card classes and card enrollment databases.
      c. Refer to Part 4 for system programming requirements and planning guidelines.
   4. Graphics: Based on CAD as-built drawings developed for the construction project, create all map sets showing locations of all alarms and field devices. Graphical maps of all alarm points installed under this contract including perimeter and exterior alarm points shall be delivered with the system. The Contractor shall create and install all graphics needed to make the system operational. The Contractor shall utilize data from the contract documents, Contractor's field surveys, and all other pertinent information in the Contractor's possession to complete the graphics. The Contractor shall identify and

request from the UR, any additional data needed to provide a complete graphics package. Graphics shall have sufficient level of detail for the system operator to assess the alarm. The Contractor shall supply hard copy, color examples at least 203.2 x 254 mm (8 x 10 in) of each type of graphic to be used for the completed Security system. The graphics examples shall be delivered to the UR for review and approval at least 90 calendar days prior to the scheduled date the Contractor requires them. Confirm locations where graphic map displays will be loaded.

F. Group V Technical Data Package: Final copies of the manuals shall be delivered to the UR as part of the acceptance test. The draft copy used during site testing shall be updated with any changes required prior to final delivery of the manuals. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of each sub-contractor installing equipment or systems, as well as the nearest service representatives for each item of equipment for each system. The manuals shall include a table of contents and tab sheets. Tab sheets shall be placed at the beginning of each chapter or section and at the beginning of each appendix. The final copies delivered after completion of the endurance test shall include all modifications made during installation, checkout, and acceptance. Six (6) hard-copies and one (1) soft copy on CD of each item listed below shall be delivered as a part of final systems acceptance.

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the entire system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included for all system operating modes. Manufacturer developed literature may be used; however, shall be produced to match the project requirements.
2. Equipment Manual: A manual describing all equipment furnished including:
   a. General description and specifications; installation and checkout procedures; equipment electrical schematics and layout drawings; system schematics and layout drawings; alignment and calibration procedures; manufacturer's repair list indicating sources of supply; and interface definition.
3. Software Manual: The software manual shall describe the functions of all software and include all other information necessary to enable proper loading, testing, and operation. The manual shall include:
   a. Definition of terms and functions; use of system and applications software; procedures for system initialization, start-up, and shutdown; alarm reports; reports generation, database format and data entry requirements; directory of all disk files; and description of all communications protocols including data formats, command characters, and a sample of each type of data transfer.
4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system, including:
   a. Computers and peripherals; system start-up and shutdown procedures; use of system, command, and applications software; recovery and restart procedures; graphic alarm presentation; use of report generator and generation of reports; data entry; operator commands' alarm messages, and printing formats; and system access requirements.
5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, recommend schedules, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
6. Spare Parts & Components Data: At the conclusion of the Contractor's work, the Contractor shall submit to the UR a complete list of the manufacturer's recommended spare parts and components required to satisfactorily maintain and service the systems, as well as unit pricing for those parts and components.
7. Operation, Maintenance & Service Manuals: The Contractor shall provide two (2) complete sets of operating and maintenance manuals in the form of an instructional manual for use by the owner Security Guard Force personnel. The manuals shall be

organized into suitable sets of manageable size. Where possible, assemble instructions for similar equipment into a single binder. If multiple volumes are required, each volume shall be fully indexed and coordinated.

8. Equipment and Systems Maintenance Manual: The Contractor shall provide the following descriptive information for each piece of equipment, operating system, and electronic system:
   a. Equipment and/or system function.
   b. Operating characteristics.
   c. Limiting conditions.
   d. Performance curves.
   e. Engineering data and test.
   f. Complete nomenclature and number of replacement parts.
   g. Provide operating and maintenance instructions including assembly drawings and diagrams required for maintenance and a list of items recommended to stock as spare parts.
   h. Provide information detailing essential maintenance procedures including the following: routine operations, trouble shooting guide, disassembly, repair and re-assembly, alignment, adjusting, and checking.
   i. Provide information on equipment and system operating procedures, including the following; start-up procedures, routine and normal operating instructions, regulation and control procedures, instructions on stopping, shut-down and emergency instructions, required sequences for electric and electronic systems, and special operating instructions.
   j. Manufacturer equipment and systems maintenance manuals are permissible.
9. Project Redlines: During construction, the Contractor shall maintain an up-to-date set of construction redlines detailing current location and configuration of the project components. The redline documents shall be marked with the words 'Master Redlines' on the cover sheet and be maintained by the Contractor in the project office. The Contractor will provide access to redline documents anytime during the project for review and inspection by the UR or authorized owner representative. Master redlines shall be neatly maintained throughout the project and secured under lock and key in the contractor's onsite project office. Any project component or assembly that is not installed in strict accordance with the drawings shall be so noted on the drawings. Prior to producing Record Construction Documents, the contractor will submit the Master Redline document to the UR for review and approval of all changes or modifications to the documents. Each sheet shall have UR initials indicating authorization to produce "As Built" documents. Field drawings shall be used for data gathering & field changes. These changes shall be made to the master redline documents daily. Field drawings shall not be considered "master redlines".
10. Record Specifications: The Contractor shall maintain one (1) copy of the Project Specifications, including addenda and modifications issued, for Project Record Documents. The Contractor shall mark the Specifications to indicate the actual installation where the installation varies substantially from that indicated in the Contract Specifications and modifications issued. (Note related Project Record Drawing information where applicable). The Contractor shall pay particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later. Upon completion of the mark ups, the Contractor shall submit record Specifications to the UR. As with master relines, Contractor shall maintain record specifications for UR review and inspection at any time.
11. Record Product Data: The Contractor shall maintain one (1) copy of each Product Data submittal for Project Record Document purposes. The Data shall be marked to indicate the actual product installed where the installation varies substantially from that indicated in the Product Data submitted. Significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation shall be included. Particular attention will be given to information on concealed products and

installations that cannot be readily identified or recorded later. Note related Change Orders and mark up of Record Construction Documents, where applicable. Upon completion of mark up, submit a complete set of Record Product Data to the UR.

12. Miscellaneous Records: The Contractor shall maintain one (1) copy of miscellaneous records for Project Record Document purposes. Refer to other Specifications for miscellaneous record-keeping requirements and submittals concerning various construction activities. Before substantial completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Categories of requirements resulting in miscellaneous records include, a minimum of the following:
    a. Certificates received instead of labels on bulk products.
    b. Testing and qualification of tradesmen. (“Contractor’s Qualifications”)
    c. Documented qualification of installation firms.
    d. Load and performance testing.
    e. Inspections and certifications.
    f. Final inspection and correction procedures.
    g. Project schedule
13. Record Construction Documents (Record As-Built)
    a. Upon project completion, the contractor shall submit the project master redlines to the UR prior to development of Record construction documents. The UR shall be given a minimum of a thirty (30) day review period to determine the adequacy of the master redlines. If the master redlines are found suitable by the UR, the UR will initial and date each sheet and turn the redlines over to the contractor for as built development.
    b. The Contractor shall provide the UR a complete set of "as-built" drawings and original master redlined marked "as-built" blue-line in the latest version of AutoCAD® drawings unlocked on CD or DVD. The as-built drawing shall include security device number, security closet connection location, data gathering panel number, and input or output number as applicable. All corrective notations made by the Contractor shall be legible when submitted to the UR. If, in the opinion of the UR, any redlined notation is not legible, it shall be returned to the Contractor for re-submission at no extra cost to the Owner. The Contractor shall organize the Record Drawing sheets into manageable sets bound with durable paper cover sheets with suitable titles, dates, and other identifications printed on the cover. The submitted as built shall be in editable formats and the ownership of the drawings shall be fully relinquished to the owner.
    c. Where feasible, the individual or entity that obtained record data, whether the individual or entity is the installer, sub-contractor, or similar entity, is required to prepare the mark up on Record Drawings. Accurately record the information in a comprehensive drawing technique. Record the data when possible after it has been obtained. For concealed installations, record and check the mark up before concealment. At the time of substantial completion, submit the Record Construction Documents to the UR. The Contractor shall organize into bound and labeled sets for the UR's continued usage. Provide device, conduit, and cable lengths on the conduit drawings. Exact in-field conduit placement/routings shall be shown. All conduits shall be illustrated in their entire length from termination in security closets; no arrowed conduit runs shall be shown. Pull box and junction box sizes are to be shown if larger than 100mm.

1.9 PROJECT PROCESS DIAGRAM

A. Figure 1 - ESS Project Process Diagram (below) is provided to identify key consecutive or concurrent tasks and milestones required by the contractor to ensure the project is completed prior to owner occupancy. Substantial completion shall mean all systems have been fully tested and accepted in writing. Minor or non-life safety related punch list items may continue through

owner occupancy, but shall be resolved within 2 weeks of official date of occupancy. Administrative Group V Technical Data Package submission may be complete after substantial completion, but shall be completed within the specified time period (See Part 5 of this specification).

B. The contractor is encouraged to utilize the diagram for the development of project schedules, and coordinating submissions.

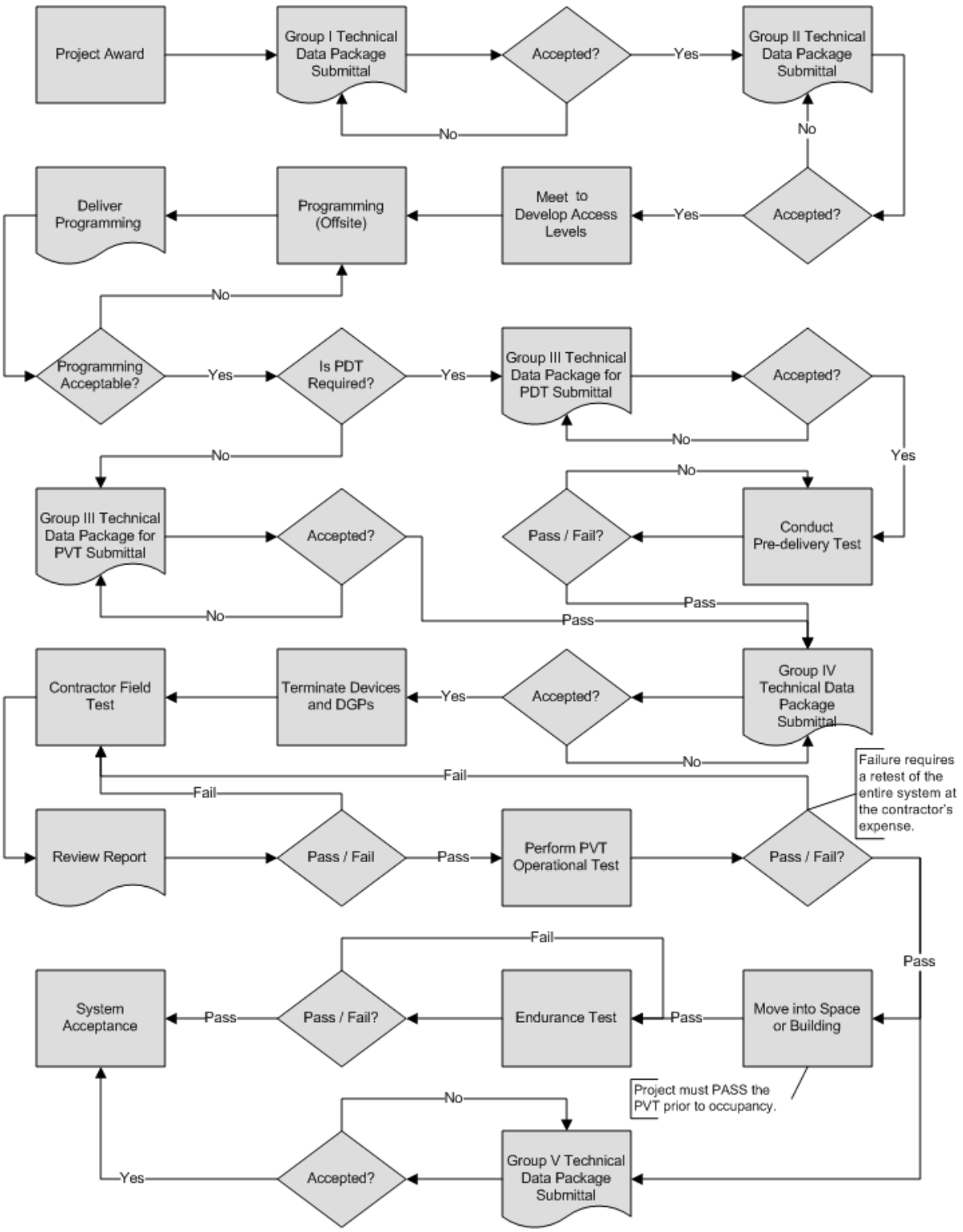

Figure 1 - ESS Project Process Diagram (Typical)

1.10 COORDINATION

A. Coordinate arrangement, mounting, and support of electronic security equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required heights.
   4. Ensure raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment. Meet seismic requirements as identified in this section.

B. Coordinate the installation of required supporting discipline devices placement and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate the locations of access panels and doors for electronic security items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

E. Contractor shall coordinate as needed with all related Divisions.

1.11 QUALITY ASSURANCE

A. Contractor Qualifications
   1. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years experience installing and servicing systems of similar scope and complexity. The Contractor shall be an authorized regional representative of the Security Management System's (SMS) manufacturer. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity which became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system. The references must include a current point of contact, company or agency name, address, telephone number, complete system description, date of completion, and approximate cost of the project. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the references' level of satisfaction with the system. The Contractor shall provide copies of system manufacturer certification for all technicians. The Contractor shall only utilize factory-trained technicians to install, program, and service the SMS. The Contractor shall only utilize factory-trained technicians to install, terminate and service controller/field panels and reader modules. The technicians shall have a minimum of five (5) continuous years of technical experience in electronic security systems. The Contractor shall have a local service facility. The facility shall be located within 60 miles of the project site. The local facility shall include sufficient spare parts inventory to support the service requirements associated with this contract. The facility shall also include appropriate diagnostic equipment to perform diagnostic procedures. The UR reserves the option of surveying the company's facility to verify the service inventory and presence of a local service organization.
   2. The Contractor shall provide proof project superintendent with BICSI Certified Commercial Installer Level 1, Level 2, or Technician to provide oversight of the project.
   3. Cable installer must have on staff a Registered Communication Distribution Designer (RCDD) certified by Building Industry Consulting Service International. The staff member

shall provide consistent oversight of the project cabling throughout design, layout, installation, termination, and testing.

B. Source Limitations: Obtain Central Station, workstations, Controllers, Identifier readers, and all software through one source from a single manufacturer.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Experience
1. The Contractor shall submit written proof that the following experience requirements are being met.
   a. Hardware Manufacturer's Experience: All system components shall be produced by manufacturers who have been regularly engaged in the production of electronic security system components of the types to be installed for at least five (5) years.

   b. Software Manufacturer's Experience: All system and application software shall be produced by manufacturers who have been regularly engaged in the production of electronic security system and application software of similar type and complexity as the specified system for at least five (5) years. Experience shall include similar experience in facilities law enforcement facilities.
   c. System Installer Experience: The system shall be installed by a Contractor who has been regularly engaged in the installation of electronic security system equipment of similar type and complexity.

E. Manufacturers' Representatives
1. The Contractor shall retain a manufacturers' technical representative or technician to consult on equipment selection, installation, testing, and training personnel. The manufacturers' technical representative or technician shall be thoroughly experienced in the installation and operation of the system being provided under this contract with no less than five (5) continuous years of technical experience.

F. Material & Workmanship
1. Unless otherwise specifically provided under this contract, all equipment, material and articles to be incorporated in the work shall be new and of the most suitable grade for the purposes intended. References to any equipment, material, article or patented process, by trade name, make or catalog number shall be regarded as establishing a standard of performance and quality, and shall not be construed as limiting competition. The Contractor may, at his or her option, use any equipment, material, article, or process which, in the judgment of the UR, is equivalent to or better than that specified. When required by this contract or when called for by the UR, the Contractor shall furnish the name of the manufacturer, model number, and other identifying data and information that reflects the performance, capacity, nature and rating of the electrical, mechanical, and other equipment that the Contractor contemplates incorporating in the work to the UR for approval. When so directed, the Contractor shall submit samples for approval at the Contractor's expense. Equipment, materials and articles installed or used without the required approval shall be at the Contractors risk of rejection. Warranties of all work and installed products shall be according to the Contract General Provisions. The Contractor shall be responsible for assuring the compatibility of new systems with Owners pre-existing card format and Security Management Systems.

1.12 MAINTENANCE & SERVICE

A. General Requirements: The Contractor shall provide all services required and equipment necessary to maintain the entire integrated electronic security system in an operational state as specified for a period of one (1) year after formal written acceptance of the system. The Contractor shall provide all necessary material required for performing scheduled adjustments or other non-scheduled work. Impacts on facility operations shall be minimized when performing scheduled adjustments or other non-scheduled work. See also General Project Requirements.

B. Description of Work: The adjustment and repair of the security system includes all software updates, panel firmware, and the following new items computers equipment, communications transmission equipment and data transmission media (DTM), local processors, security system sensors, access control equipment, facility interface, signal transmission equipment, and video equipment.

C. Personnel: Service personnel shall be certified in the maintenance and repair of the selected type of equipment and qualified to accomplish all work promptly and satisfactorily. The UR shall be advised in writing of the name of the designated service representative, and of any change in personnel. The UR shall be provided copies of system manufacturer certification for the designated service representative.

D. Schedule of Work: The work shall be performed during regular working ours, Monday through Friday, excluding federal holidays. These inspections shall include:
   1. The Contractor shall perform two (2) minor inspections at six (6) month intervals or more if required by the manufacturer, and two (2) major inspections offset equally between the minor inspections to effect quarterly inspection of alternating magnitude.
      a. Minor Inspections shall include visual checks and operational tests of all console equipment, peripheral equipment, local processors, sensors, electrical and mechanical controls, and adjustments on printers.
      b. Major Inspections shall include all work described for Minor Inspections and the following: clean all system equipment and local processors including interior and exterior surfaces; perform diagnostics on all equipment; operational tests of the CPU, switcher, peripheral equipment, recording devices, monitors, picture quality from each camera; check, walk test, and calibrate each sensor; run all system software diagnostics and correct all problems; and resolve any previous outstanding problems.

E. Emergency Service: The owner shall initiate service calls whenever the system is not functioning properly. The Contractor shall provide the owner with an emergency service center telephone number. The emergency service center shall be staffed 24 hours a day 365 days a year. The Owner shall have sole authority for determining catastrophic and non-catastrophic system failures within parameters stated in General Project Requirements.
   1. For catastrophic system failures, the Contractor shall provide same day four (4) hour service response with a defect correction time not to exceed eight (8) hours from [notification] [arrival on site]. Catastrophic system failures are defined as any system failure that the Owner determines will place the facility(s) at increased risk.
   2. For non-catastrophic failures, the Contractor within eight (8) hours with a defect correction time not to exceed 24 hours from notification.

F. Operation: Performance of scheduled adjustments and repair shall verify operation of the system as demonstrated by the applicable portions of the performance verification test.

G. Records & Logs: The Contractor shall maintain records and logs of each task and organize cumulative records for each component and for the complete system chronologically. A continuous log shall be submitted for all devices. The log shall contain all initial settings,

calibration, repair, and programming data. Complete logs shall be maintained and available for inspection on site, demonstrating planned and systematic adjustments and repairs have been accomplished for the system.

H. Work Request: The Contractor shall separately record each service call request, as received. The record shall include the serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing the action taken, the amount and nature of the materials used, and the date and time of commencement and completion. The Contractor shall deliver a record of the work performed within five (5) working days after the work was completed.

I. System Modifications: The Contractor shall make any recommendations for system modification in writing to the UR. No system modifications, including operating parameters and control settings, shall be made without prior written approval from the UR. Any modifications made to the system shall be incorporated into the operation and maintenance manuals and other documentation affected.

J. Software: The Contractor shall provide all software updates when approved by OWNER from the manufacturer during the installation and 12-month warranty period and verify operation of the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and incorporated into the operations and maintenance manuals and software documentation. There shall be at least one (1) scheduled update near the end of the first year's warranty period, at which time the Contractor shall install and validate the latest released version of the Manufacturer's software. All software changes shall be recorded in a log maintained in the unit control room. An electronic copy of the software update shall be maintained within the log. At a minimum, the contractor shall provide a description of the modification, when the modification occurred, and name and contact information of the individual performing the modification. The log shall be maintained in a white 3 ring binder and the cover marked "SOFTWARE CHANGE LOG".

1.13 SYSTEM DESCRIPTION

A. System consists of an existing PC-based central computer or more networked PC-based workstations, and new contractor field-installed Controllers, connected by a high-speed electronic data transmission network.

B. Network(s) Controllers shall consist of one or more of the following:
1. Local area, IEEE 802.3 Fast Ethernet 100 BASE-TX based on TCP/IP.

1.14 PERFORMANCE REQUIREMENTS

A. Distributed Processing: System shall be a fully distributed processing system so information, including time, date, valid codes, access levels, and similar data is downloaded to Controllers so each Controller makes access-control decisions for that Location. Do not use intermediate Controllers for access control. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

B. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as intrusion alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

C. System Response to Alarms: Field device network shall provide a system end-to-end response time of one (1) second or less for every device connected to the system. Alarms shall be annunciated at the Central Station within 1 second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Central Station. Alarm and status changes shall be displayed within 100 ms after receipt of data by the Central Station. All graphics shall be displayed, including graphics-generated map displays, on the console monitor within five (5) seconds of alarm receipt at the security console. This response time shall be maintained during system heavy load.

D. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

E. Error Detection: A cyclic code error detection method shall be used between Controllers and the Central Station, which shall detect single- and double-bit errors, burst errors of eight (8) bits or less, and at least 99 percent of all other multi-bit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message shall be in error if one bit is received incorrectly. System shall retransmit messages with detected errors. A two-digit decimal number shall be operator assignable to each communication link representing the number of retransmission attempts. When the number of consecutive retransmission attempts equals the assigned quantity, the Central Station shall print a communication failure alarm message. System shall monitor the frequency of data transmission failure for display and logging.

F. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

G. Door Hardware Interface: Coordinate with Division 08 Sections that specify door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics which match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Sections to function with the controls and PC-based software and hardware in this Section.

1.15 DELIVERY, STORAGE, & HANDLING

A. Controllers:
1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 10 to 30 deg C (50 to 85 deg F), and not more than 80 percent relative humidity, non-condensing.
2. Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.
3. Mark packing list with designations which have been assigned to materials and equipment for recording in the system labeling schedules generated by cable and asset management system specified in Part 2.
4. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.16 PROJECT CONDITIONS

A. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Control Station: Rated for continuous operation in ambient conditions of 16 to 30 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent, non-condensing.
2. Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for

continuous operation in ambient conditions of 2 to 50 deg C (36 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 1 enclosure.

3. Interior, Uncontrolled Environment: System components installed in non-temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of -18 to 50 deg C (0 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, non-condensing. NEMA 250, Type 4x enclosures.
4. Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of -34 to 50 deg C (-30 to 122 deg F) dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 137 km/h (85 mph) and snow cover up to 610 mm (24 in) thick. NEMA 250, Type 4X enclosures.
5. Hazardous Environment: System components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated, listed, and installed according to NFPA 70.
6. Corrosive Environment: For system components subjected to corrosive fumes, vapors, and wind-driven salt spray in coastal zones, provide NEMA 250, Type 4X enclosures.
7. Security Environment: Use vandal resistant enclosures in high-risk areas where equipment may be subject to damage.

1.17 EQUIPMENT AND MATERIALS

1. General Equipment Requirements: Equipment and materials furnished shall be new, first grade, standard, current products of the manufacturer, and be suitable for the systems being installed and the intent of the design.
2. Plastic laminated nameplates shall be installed on all components accessed by - Owner Security Maintenance Personnel. Each nameplate shall identify the component and its location within the security system. The laminated plastic shall be 1.6 mm thick, black with white lettering center core. Nameplates shall be a minimum of 19 mm (0.75 in) high, with a minimum of 3.3 mm (0.13 in) high-engraved block lettering. Nameplates are to be attached to the component with screws or located as required by security documentation plans and specifications. All console monitors shall be labeled with the monitor number and intended function. Contractor shall submit planned naming conventions for approval.
3. Where the words, "or shall be an approved equivalent" or like words are used, it shall mean that materials, devices, or equipment of equivalent or equal quality, function, operation, and appearance shall be furnished upon the approval of the UR. If the contractor recommends equipment substitution, the contractor is responsible for complete documentation of the reason for the change and is financially liable for the design time expended by the security consultant to research the substitution.
4. Any material, device, or equipment damages before or during installation and before acceptance of the completed system, shall be replaced unless repairs can be made that are acceptable to the UR. Any such replacement or repairs, including repairs to the finish, shall be made at no cost to the Owner.
5. Equipment and materials shall be properly stored, adequately protected, and carefully handled to prevent damage before and during installation. Equipment and materials shall be handled, stored, and protected according to the manufacturers' recommendations. Equipment provided with a factory finish shall be maintained free of dust, dirt, and foreign matter. Dents, marred finishes, and other damage shall be repaired to its original condition or replaced at no additional cost to the Owner.
6. Parts of the project site are finished spaces, including paint, trim, wall covering, floor treatments, lighting, and building mechanical systems. Therefore, the Contractor shall perform the work specified herein, such that, at the completion of his work, all finished space is restored to the original condition existing prior to the commencement of work. During the course of performing the work specified herein, if the Contractor should encounter any damaged finish in any area where the Contractor’s work is to be

performed, the Contractor shall notify the UR in writing prior to performing work in that area. Only after receiving written confirmation that the existing conditions have been documented and authorization has been given to proceed, shall the Contractor proceed with the work in these areas.

B. Extra Materials
1. Furnish extra materials described below which match products installed and are packaged with protective covering for storage and identified with labels describing contents.
a. Fuses, power supply, equal to 20 percent of amount installed for each size used, but no fewer than three (3) units.

1.18 ELECTRICAL POWER

A. Electrical power of 120 Volts Alternating Current (VAC) shall be indicated on the Division 16 drawings. Additional locations requiring primary power required by the security system shall be shown as part of these contract documents. Primary power for the security system shall be configured to switch to emergency backup sources automatically if interrupted without degradation of any critical system function. Alarms shall not be generated as a result of power switching, however, an indication of power switching on (on-line source) shall be provided to the alarm monitor. The Security Contractor shall provide an interface (dry contact closure) between the SMS and the UPS system so the UPS trouble signals and main power fail appear on the SMS operator terminal as alarms.

B. Failure of any on-line battery shall be detected and reported as a fault condition. Battery backed-up power supplies shall be provided sized for eight (8) hours of operation at actual connected load. Requirements for additional power or locations shall be included with the contract to support equipment and systems offered. The following minimum requirements shall be provided for power sources and equipment.
1. UNINTERRUPTIBLE POWER SUPPLY (UPS) ON EMERGENCY POWER
a. The following 120VAC circuits shall be provided by others. The Security Contractor shall coordinate exact locations with the Electrical Contractor:
1) Security System Monitors and Keyboards: Main Desk and Security Closet
2) CPU: Main Desk and Security Closet
3) Communications equipment: Server Room
4) Video Monitors: Main Desk and Security Closet
5) Intercom Stations
6) Radio System
7) Outlets: Security Outlets dedicated to security equipment racks or security enclosure assemblies.
8) Security Device Power Supplies (DGP, Card Access, Lock Power, etc.) powered from the security closets or remotely: various locations
9) All Server Room rack and wall mounted equipment.

1.19 ENVIRONMENTAL CONDITIONS

A. Interior, Controlled Environment: All system components except the console equipment installed in interior locations having controlled environments which shall be rated for continuous operation under ambient environmental condition of 0 to 48.9 deg C (32 to 120 deg F) dry bulb and 5 to 100 percent relative humidity, non-condensing.

B. Interior, Uncontrolled Environment: All system components installed in interior locations with uncontrolled environments shall be rated for continuous operation under ambient environmental condition of -17.8 to 48.9 deg C (0 to 120 deg F) dry bulb and 5 to 100 percent relative humidity, non-condensing.

C. Exterior Environment: All system components that are installed in locations exposed to weather shall be rated for continuous operation under ambient environmental conditions of -34 to 48.9 deg C (-30 to 120 deg F) dry bulb and 5 to 100 percent relative humidity, condensing. In addition, the system components shall be rated for continuous operation as specified in UL 294 for outdoor use equipment.

D. Hazardous Environment: All system components located in areas where fire or explosion hazards may exist because of flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers shall be rated and installed according to Chapter 5 of the NFPA 70.

E. Console: All console equipment shall, unless noted otherwise, be rated for continuous operation under ambient environmental conditions of 15.6 to 29.4 deg C (60 to 85 deg F) and a relative humidity of 20 to 80 percent, non-condensing.

1.20 LIGHTNING, POWER SURGES, & GROUNDING

A. Transient Voltage Surge Suppression: All cables and conductors extending beyond building façade, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage Surge Suppression (TVSS) protection. The TVSS device shall be UL listed in accordance with Standard TIA 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 914.4 mm (3 ft) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode to verify there is no interference.
   1. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
   2. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
   3. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B.
   4. Operating Temperature and Humidity: -40 to 85 deg C (-40 to 185 deg F), 0 to 95 percent relative humidity, non-condensing.
   5. Grounding and Surge Suppression
      a. The Security Contractor shall provide grounding and surge suppression to stabilize the voltage under normal operating conditions. To ensure the operation of over current devices, such as fuses, circuit breakers, and relays, under ground-fault conditions.
      b. Security Contractor shall engineer and provide proper grounding and surge suppression as required by local jurisdiction and prevailing codes and standards referenced in this document.
      c. Principal grounding components and features. Include main grounding buses and grounding and bonding connections to service equipment.
      d. Details of interconnection with other grounding systems. The lightning protection system shall be provided by the Security Contractor.
      e. Locations and sizes of grounding conductors and grounding buses in electrical, data, and communication equipment rooms and closets.
      f. AC power receptacles are not to be used as a ground reference point.
      g. Any cable that is shielded shall require a ground in accordance with the best practices of the trade and manufactures installation instructions.
      h. Protection should be provided at both ends of cabling.
   6. See Part 2 for approved TVSS devices.

1.21 COMPONENT ENCLOSURES

A. Construction of Enclosures
1. Consoles, power supply enclosures, detector control and terminal cabinets, control units, wiring gutters, and other component housings, collectively referred to as enclosures, shall be so formed and assembled as to be sturdy and rigid.
2. Thickness of metal in-cast and sheet metal enclosures of all types shall not be less than those in Tables I and II, UL 611. Sheet steel used in fabrication of enclosures shall be not less than 14 gauge. Consoles shall be 16-gauge.
3. Doors and covers shall be flanged. Enclosures shall not have pre-punched knockouts. Where doors are mounted on hinges with exposed pins, the hinges shall be of the tight pin type or the ends of hinge pins shall be tack welded to prevent removal. Doors having a latch edge length of less than 609.6 mm (24 in) shall be provided with a single construction core. Where the latch edge of a hinged door is more than 609.6 mm (24 in) or more in length, the door shall be provided with a three-point latching device with construction core; or alternatively with two, one located near each end.
4. Any ventilator openings in enclosures and cabinets shall conform to the requirements of UL 611. Unless otherwise indicated, sheet metal enclosures shall be designed for wall mounting with tip holes slotted. Mounting holes shall be in positions that remain accessible when all major operating components are in place and the door is open, but shall be in accessible when the door is closed.
5. Covers of pull and junction boxes provided to facilitate initial installation of the system shall be held in place by tamper proof Torx Center post security screws. Stenciled or painted labels shall be affixed to such boxes indicating they contain no connections. These labels shall not indicate the box is part of the Electronic Security System (ESS).

B. Tamper Provisions and Tamper Switches:
1. Enclosures, cabinets, housings, boxes and fittings or every product description having hinged doors or removable covers and which contain circuits, or the integrated security system and its power supplies shall be provided with cover operated, corrosion-resistant tamper switches. In addition, Gallery I-8 junction boxes and enclosures in the security closets will be provided with tamper switches.
2. Tamper switches shall be arranged to initiate an alarm signal that will report to the monitoring station when the door or cover is moved. Tamper switches shall be mechanically mounted to maximize the defeat time when enclosure covers are opened or removed. It shall take longer than 1 second to depress or defeat the tamper switch after opening or removing the cover. The enclosure and tamper switch shall function together in such a manner as to prohibit direct line of sign to any internal component before the switch activates.
3. Tamper switches shall be inaccessible until the switch is activated. Have mounting hardware concealed so the location of the switch cannot be observed from the exterior of the enclosure. Be connected to circuits which are under electrical supervision at all times, irrespective of the protection mode in which the circuit is operating. Be spring-loaded and held in the closed position by the door or cover and be wired so they break the circuit when the door cover is disturbed. Tamper circuits shall be adjustable type screw sets and shall be adjusted by the contractor to eliminate nuisance alarms associated with incorrectly mounted tamper device shall annunciate prior to the enclosure door opening (within 1/4” tolerance.) The tamper device or its components shall not be visible or accessing with common tools to bypass when the enclosure is in the secured mode.
4. The single gang junction boxes for the portrait alarming and pull boxes with less than 102 square mm will not require tamper switches.
5. All enclosures over 305 square mm shall be hinged with an enclosure lock.

6. Control Enclosures: Maintenance/Safety switches on control enclosures, which must be opened to make routing maintenance adjustments to the system and to service the power supplies, shall be push/pull-set automatic reset type.
7. Provide one (1) enclosure tamper switch for each 609 linear mm of enclosure lock side opening evenly spaced.
8. All security screws shall be Torx-Post Security Screws.
9. The contractor shall provide the owner with two (2) Torx-Post screwdrivers.

1.22 ELECTRONIC COMPONENTS

A. All electronic components of the system shall be of the solid-state type, mounted on printed circuit boards conforming to UL 796. Boards shall be plug-in, quick-disconnect type. Circuitry shall not be so densely placed as to impede maintenance. All power-dissipating components shall incorporate safety margins of not less than 25 percent with respect to dissipation ratings, maximum voltages, and current-carrying capacity.

1.23 SUBSTITUTE MATERIALS & EQUIPMENT

A. In addition to this Section the Security Contractor shall also reference Section II, Products and associated divisions. Acceptable manufacturers of products included in this specification are indicated in Part 2.0 Products, Acceptable Manufacturers. Manufacturers not listed must be pre-qualified to bid as indicated herein. The Contractor shall list and identify those materials, devices, or equipment for which he intends a substitution. The UR shall have final authority on the authorization or refusal of substitutions. If there are no proposed substitutions, a statement in writing from the Contractor shall be submitted to the UR stating same. In the preparation of a list of substitutions, the following information shall be included, as a minimum:
   1. Identity of the material or devices specified for which there is a proposed substitution.
   2. Description of the segment of the specification where the material or devices are referenced.
   3. Identity of the proposed substitute by manufacturer, brand name, catalog or model number and the manufacturer's product name.
   4. A technical statement of all operational characteristic expressing equivalence to items to be substituted and comparison, feature-by-feature, between specification requirements and the material or devices called for in the specification; and
   5. Price differential.

B. Materials Not Listed: Furnish all necessary hardware, software, programming materials, and supporting equipment required to place the specified major subsystems in full operation. Note that some supporting equipment, materials, and hardware may not be described herein. Depending on the manufacturers selected by the UR, some equipment, materials and hardware may not be contained in either the Contract Documents or these written specifications, but are required by the manufacturer for complete operation according to the intent of the design and these specifications. In such cases, the UR shall be given the opportunity to approve the additional equipment, hardware and materials that shall be fully identified in the bid and in the equipment list submittal. The UR shall be consulted in the event there is any question about which supporting equipment, materials, or hardware is intended to be included.

C. Response to Specification: The Contractor shall submit a point-by-point statement of compliance with each paragraph of the security specification. The statement of compliance shall list each paragraph by number and indicate "COMPLY" opposite the number for each paragraph where the Contractor fully complies with the specification. Where the proposed system cannot meet the requirements of the paragraph, and does not offer an equivalent solution, the offers shall indicate "DOES NOT COMPLY" opposite the paragraph number. Where the proposed system does not comply with the paragraph as written, but the bidder feels it will accomplish the intent of the paragraph in a manner different from that described, the offers

shall indicate “COMPARABLE”. The offers shall include a statement fully describing the “comparable” method of satisfying the requirement. Where a full and concise description is not provided, the offered system shall be considered as not complying with the specification. Any submission that does not include a point-by-point statement of compliance, as described above, shall be disqualified. Submittals for products shall be in precise order with the product section of the specification. Submittals not in proper sequence will be rejected.

1.24 LIKE ITEMS

A. Where two or more items of equipment performing the same function are required, they shall be exact duplicates produced by one manufacturer. All equipment provided shall be complete, new, and free of any defects.

1.25 WARRANTY

A. The Contractor shall, as a condition precedent to the final payment, execute a written guarantee (warranty) to the UR certifying all contract requirements have been completed according to the final specifications. Contract drawings and the warranty of all materials and equipment furnished under this contract are to remain in satisfactory operating condition (ordinary wear and tear, abuse and causes beyond his control for this work accepted) for one (1) year from the date the Contactor received written notification of final acceptance from the UR. All defects or damages due to faulty materials or workmanship shall be repaired or replaced without delay, to the UR's satisfaction, and at the Contractor's expense. The Contractor shall provide quarterly inspections during the warranty period. The contractor shall provide written documentation to the UR on conditions and findings of the system and device(s). In addition, the contractor shall provide written documentation of test results and stating what was done to correct any deficiencies. The first inspection shall occur 90 calendar days after the acceptance date. The last inspection shall occur 30 calendar days prior to the end of the warranty. The warranty period shall be extended until the last inspection and associated corrective actions are complete. When equipment and labor covered by the Contractor's warranty, or by a manufacturer's warranty, have been replaced or restored because of it’s failure during the warranty period, the warranty period for the replaced or repaired equipment or restored work shall be reinstated for a period equal to the original warranty period, and commencing with the date of completion of the replacement or restoration work. In the event any manufacturer customarily provides a warranty period greater than one (1) year, the Contractor's warranty shall be for the same duration for that component.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Low-Voltage Control Cable
   1. Belden
   2. WestPenn
   3. Or approved equivalent

B. Wireline Transmission Media for Electronic Security
   1. Cisco Ethernet Level 3 Switches or approved equivalent
   2. DITEK for Transient Voltage Surge Suppression (TVSS)
   3. Or approved equivalent

C. Miscellaneous Equipment
   1. Dell CPU/Monitors or equivalent

2. Panasonic High Definition TV
3. Or approved equivalent

2.2 RS-232 CABLE

A. Standard Cable: NFPA 70, Type CM.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Polypropylene insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. PVC jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Plastic insulation.
3. Individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage.
4. Plastic jacket.
5. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
6. Flame Resistance: Comply with NFPA 262.

2.3 RS-485 CABLE

A. Standard Cable: NFPA 70, Type CM or CMG.
1. Paired, 2 pairs, twisted, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

B. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, 2 pairs, No. 22 AWG, stranded (7x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Fluorinated ethylene propylene jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.4 LOW-VOLTAGE CONTROL CABLE

A. Card Reader Cable: NFPA 70, CM (2 Cables).
1. RS485: 1 pair, twisted shielded, No. 22 AWG, Stranded tinned copper conductors.
2. 12VDC Power: 1 pair, twisted, No. 18 AWG, Stranded tinned copper conductors,
3. PVC Insulation.
4. Flame Resistance: Comply with UL 1581.

B. Paired Lock Power Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

C. Plenum-Rated, Paired Lock Power Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

D. Paired Lock Power Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1581.

E. Plenum-Rated, Paired Lock Power Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
2. Fluorinated ethylene propylene insulation.
3. Unshielded.
4. Plastic jacket.
5. Flame Resistance: NFPA 262, Flame Test.

2.5 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.

B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway or conduit complying with UL 83.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

2.6 CABLE IDENTIFICATION PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Brady Corporation
2. HellermannTyton.
3. Kroy LLC.
4. Panduit Corp.
5. EZ Label.
6. Or equivalent.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.7 POWER SURGES AND GROUNDING

A. Transient Voltage Surge Suppression
1. All cables and conductors extending beyond building perimeter, except fiber optic cables, which serve as communication, control, or signal lines shall be protected against Transient Voltage surges and have Transient Voltage surge suppression protection

(TVSS) UL listed in accordance with Standard 497B installed at each end. Lighting and surge suppression shall be a multi-strike variety and include a fault indicator. Protection shall be furnished at the equipment and additional triple solid state surge protectors rated for the application on each wire line circuit shall be installed within 915 mm (36 in) of the building cable entrance. Fuses shall not be used for surge protection. The inputs and outputs shall be tested in both normal mode and common mode using the following waveforms:

a. A 10-microsecond rise time by 1000 microsecond pulse width waveform with a peak voltage of 1500 volts and a peak current of 60 amperes.
b. An 8-microsecond rise time by 20-microsecond pulse width waveform with a peak voltage of 1000 volts and a peak current of 500 amperes.
c. Maximum series current: 2 AMPS. Provide units manufactured by Advanced Protection Technologies, model # TE/FA 10B or TE/FA 20B or approved equivalent.
d. Operating Temperature and Humidity: -40 to + 85 deg C (-40 to 185 deg F), and 0 to 95 percent relative humidity, non-condensing.

B. Access Control Systems

1. Suppressors shall be installed on AC power at the point of service and shall meet the following criteria:
   a. UL1449 2nd Edition, 2007, listed
   b. UL1449 S.V.R. of 400 Volts or lower
   c. Status Indicator Light(s)
   d. Minimum Surge Current Capacity: 40,000 Amps (8 x 20 µsec)
   e. Maximum Continuous Current: 15 Amps
   f. MCOV: 125 VAC
   g. Service Voltage: 110-120 VAC
   h. Ten Year Limited Warranty
   i. Acceptable Manufacturer: DITEK CORP. DTK-8FF, or approved equivalent.
2. Suppressors shall be installed on the Low Voltage circuit at both the point of entrance and exit of the building. Suppressors shall meet the following criteria:
   a. UL 497B
   b. Minimum Surge Current Capacity: 2,000 Amps per pair
   c. Maximum Continuous Current: 5 Amps
   d. MCOV: 33 Volts
   e. Service Voltage: 24 Volts
   f. Ten Year Limited Warranty
   g. Acceptable Manufacturer: DITEK CORP. DTK-2MHLP24BWB DTK-1LVLPLV, or approved equivalent.
3. Suppressors shall be installed on the communication circuit between the access controller and card reader at both the entrance and exit of the building. Suppressors shall meet the following criteria:
   a. Conforms with UL497B standards (where applicable)
   b. Clamp level for 12 and 24V power: 18VDC / 38VDC
   c. Clamp level for Data/LED: 6.8VDC
   d. Service Voltage for Power: 12VDC/24VDC
   e. Service Voltage for Data/LED: <5VDC
   f. Clamp level – PoE Access Power: 72V
   g. Clamp level – PoE Access Data: 7.9V
   h. Service Voltage – PoE Access: 48VAC – 54VAC
   i. Service Voltage – PoE Data: <5VDC
   j. Ten Year Limited Warranty
   k. Acceptable Manufacturer – DITEK CORP., or approved equivalents
      1) DTK-4LVLPCR (use DTK-3LVLP-X for “Wiegand” type readers)
      2) DTK-4LVTEP (commercial telephone entry)

3) DTK-4LVXR (residential telephone entry)
4) DTK-MRJPOE (Power over Ethernet access control)

C. Intrusion Detection Systems
1. Suppressors shall be installed on AC at the point of service and shall meet the following criteria:
a. UL 1449, 2nd Edition 2007, listed
b. UL 1449 S.V.R. of 400 Volts or lower
c. Status Indicator Lights
d. Center screw for terminating Class II transformers
e. Minimum Surge Current Capacity of 32,000 Amps (8 x 20 µSec)
f. Ten Year Limited Warranty
g. Acceptable Manufacturer: DITEK CORP. DTK-1F, or approved equivalent.
2. Suppressors shall be installed on all Telephone Communication Interface circuits and shall meet the following criteria:
a. UL 497A Listed
b. Multi Stage protection design
c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
d. Clamp Voltage: 130Vrms
e. Auto reset current protection not to exceed 150 milliAmps
f. Ten Year Limited Warranty
g. Acceptable Manufacturer: DITEK CORP. DTK-MRJ31XSCPWP, or approved equivalent.
3. Suppressors shall be installed on all burglar alarm initiating and signaling loops and addressable circuits which enter or leave separate buildings. The following criteria shall be met:
a. UL 497B for data communications or annunciation (powered loops)
b. Fail-short/fail-safe mode.
c. Surge Current Capacity: 9,000 Amps (8x20 µSec)
d. Clamp Voltage: 15 Vrms
e. Joule Rating: 76 Joules per pair (10x1000 µSec)
f. Auto-reset current protection not to exceed 150 milliAmps for UL 497A devices.
g. Ten Year Limited Warranty
h. Acceptable Manufacturer: DITEK CORP., or approved equivalent.

PART 3 - EXECUTION

3.1 ADJUSTING AND TESTING

A. System shall be complete and properly operating prior to calling for the test. Provide all necessary tools, ladders and equipment. Ensure appropriate subcontractors and manufacturer's representatives and security specialists are present for verification.

B. Client’s Representative and Contractor to tour areas to ensure that Systems and Subsystems are installed in place for proof of performance testing.

C. Take system inventory. Verify following items before beginning proof of performance test:
1. Electrical power circuits designated for system equipment are properly labelled, wired, phased, protected and grounded.
2. Conductor ends are protected by heat shrink wrap; audio spade lugs, barrier strips and punch blocks are used.
3. Dust, debris, solder splatter, etc. are cleaned and removed from site.
4. Equipment is properly labelled.
5. Equipment identified in system's equipment list are in-place and properly installed.

6. Each lightning and System ground method are installed in accordance with manufacturer's instructions and this specification

D. Perform operational test of each Subsystem to verify that all equipment is properly connected, interfaced and is functionally operational to meet requirements of this specification.

E. Device and cabling identification.

F. Application and location of UL approval decals.

G. Validate sensitivity of readers and applicability and application of cards.

H. Connecting joints and equipment fastening.

I. Compliance with manufacturer's specification, product literature and installation instructions.

J. Operation of each device in relation with programmable schedule and or/specific functions.

END OF SECTION

SECTION 28 13 00- ACCESS CONTROL

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Installer Qualifications: Must have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

1.2 RELATED SECTIONS

A. Division 01 Section – "Sustainable Design Requirements" for additional LEED documentation and requirements.

B. Division 08 Sections – “Doors” for hardware

C. Division 14 Section – "Elevators" for security access to elevator floor selection controls.

D. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.

E. Division 27 Section – "Communications" for connections to the LAN.

F. Division 28 Section – "Electronic Detection and Alarm" for detection devices installed at door openings and provided as part of an intrusion detection system.

G. Division 28 Section – "Video Surveillance" for motion detection and video camera devices and equipment installed at door openings and provided as part of a security and site management system.

H. Division 28 Section – "Fire Detection and Alarm" for connections to building fire alarm system.

I. Section 280500 – Common Work Results for Electronic Security

1.3 CODES AND REFERENCES

A. Comply with the current version year adopted by the Authority Having Jurisdiction.

B. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

C. ICC/IBC - International Building Code.

D. NFPA 70 - National Electrical Code.

E. NFPA 80 - Fire Doors and Windows.

F. NFPA 101 - Life Safety Code.

G. NFPA 105 - Installation of Smoke Door Assemblies.

H. State Building Codes, Local Amendments.

1.4 SUMMARY

A. The security system will be monitored from Zuckerberg San Francisco General Sheriff's Operations Center (SOC) and secondary locations that provide security assessment capabilities to security operators. Security Contractor to coordinate all work with facility personnel, including but not limited to HR, IT and Security Personnel.

B. The Electronic Access Control System is designed to monitor and restrict access to specified areas, and to report on the activity and violations of restricted access in those areas.

C. Included Areas:
1. All Exterior Entrance Doors
2. Utility Rooms (electrical, mechanical, MDF)
3. Staff Area Entry Doors
4. Offices (designated)
5. BOH Doors
6. Stairwell Doors
7. Elevator Cabs
8. Labs

D. The EACS shall be from the current Health Center standard utilizing the most current revisions.

E. This Section includes access control door hardware for the following:
1. Swinging doors.
2. Sliding doors
3. Other doors to the extent indicated.

F. Section includes, but is not necessarily limited to, the following for the integrated access control security and site management system:
1. Head-end Hardware and Software
2. Software Only (owner-provided head-end CPU hardware)
3. Field Panels
4. Cards & Readers
5. Electric Locks
6. Request-to-Exit Devices
7. Wiring
8. Access control system power supplies, back-ups, and surge protection.

1.5 DEFINITIONS

A. Industry standard words and phrases are used throughout the Drawings and Specifications, except:
1. Words which have well-known technical or trade meanings are used in accordance with such recognized meanings.
2. Whenever the following listed words and phrases are used, they shall be mutually understood to have the following respective meanings:
   a. The words "as indicated." means: as shown on the Drawings, and in accordance with the Specifications.
   b. The words "as required." means: as required to provide a complete and satisfactory Work in full conformance with the Drawings and Specifications.
   c. The word "New" means: new Work to be provided by Contractor.
   d. The word "Provide" means: furnish, install, connect, test and make ready for use.
   e. The words "Relocate existing" means: remove existing item from present location. Reinstall, re-connect, and test existing item and make ready for use at new location as shown on the Drawings.

f. The words “Remove existing “means: remove existing item and return item to Health Center.
g. The word “Replace” means: remove existing item and return item to Health Center. Provide new item as indicated.
h. The word “Work”: The Work is the completed construction required by the Drawings and Specifications, and includes all labor necessary to produce such construction, and all materials and equipment incorporated or to be incorporated in such construction.
i. The word “Furnish” means: supply item as specified. Item to be installed by others.

PART 2 - PROUDCTS

2.1 SYSTEM ARCHITECTURE - ACCESS CONTROL SITE MANAGEMENT SYSTEM (ACSMS)

A. General: The ACSMS is a modular and networked based system providing physical access control security to a Wide Area or enterprise. The system to be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACSMS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACSMS to include, but is not be limited to, the following features and functions:
1. An "Enterprise" class access control software application.
2. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multitasking environment.
   a. The ACSMS to permit multiple instances of client software applications to run simultaneously on the network. The base system to include Lenel software application licenses with an unlimited number of licenses available subject to connection fees.
3. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
   a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
4. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
   a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
   b. The ACSMS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
5. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
   a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail or affect more than two access points at perimeter points system wide.

6. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
7. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
8. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database, and import/export of employee data.
9. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
10. Alarm Monitoring: The system can monitor, report, and provide information about the time and location of alarms, along with their priority.
11. Event Monitoring: The system can monitor, report, and archive network access control activity.
12. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
13. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
14. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
15. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
16. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report features to allow exporting of generated reports over a network connection or by remote printing.
17. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of [ ] concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.
18. Systems Integration: The system to have the ability to be fully and seamlessly integrated with existing or specified intrusion detection alarm and video surveillance (CCTV) systems.

B. Open Architecture: The access control system infrastructure will be based on an open architecture design capable of supporting multiple access control hardware manufacturers and integrate with multiple non-proprietary network processors, controllers, interface modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

C. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:

1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
2. Direct-connected RS-232 and RS-485 communication cabling.
3. Dial-up modem connection using a standard dial-up telephone line.

2.2 MANUFACTURERS

A. General: Provide integrated access control door hardware and access control system equipment and accessories for each designated opening to comply with requirements in this Section and with the Access Control Hardware Sets listed at the end of Part 3.
   1. Access Control Hardware Sets: Requirements for quantity, item, model, design, grade, finish, size, and other distinctive qualities of each type of integrated door and access control hardware are indicated in the Access Control Hardware Sets at the end of Part 3.
   2. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. System Design: The equipment and materials supplied are to be standardized components regularly manufactured and utilized within the source manufacturer’s access control systems.
   1. System components to be non-proprietary in design and implementations, providing for an open protocol platform with multiple manufacturers having functional software capable of integrating with the hardware specified. The installed integrated product is to be part of a single, cohesive management and access control system.

C. Substitutions: Requests for substitution and product approval for inclusive integrated access control door and access control systems hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.
   1. The access control system described in this specification represents a complete engineered system. If alternate products are submitted, it is the responsibility of the Supplier/Dealer/Integrator to provide an acceptable complete and working system layout, including re-engineering of elevation and wiring diagrams, as applicable. Complete systems to include at a minimum required power supplies, power transfers, and integrated access control locking hardware and accessories.

D. Approved Access Control and Site Management System Manufacturers:
   1. Lenel (Software, Panels and Accessories)
   2. Corbin Russwin (Integrated Access Control Locking Devices and Accessories).
   3. HID Global (Access Cards and Credentials, Remote Readers).
   4. Sargent Manufacturing (Integrated Access Control Locking Devices and Accessories).
   5. Securitron Corporation (Power Supplies).

2.3 ACCESS CONTROL AND SITE MANAGEMENT SYSTEM HARDWARE

A. General: Provide all necessary access control field hardware devices required to receive alarms and administer all access granted/denied decisions. Field hardware devices must be designed and installed in accordance with applicable electrical codes.

B. Central Computer Host Server (Owner Provided): The central host server is interconnected to all system components, including client workstations and field installed controllers, providing operator interface, interaction, display, control, and real-time monitoring.

2.4 INTEGRATED ACCESS CONTROL MAGNETIC LOCKS

A. Acceptable Manufacturers:
1. Schlage (SC) – M400 Series, 320M, and required accessories.
2. Or Approved Equal

2.5 INTEGRATED ACCESS CONTROL PANIC BAR

A. Acceptable Manufacturers:
1. Von Duprin – 98/99 Series and required accessories.
2. Or Approved Equal

2.6 NON-ELECTRIC PANIC BAR

A. Acceptable Manufacturers:
1. Von Duprin – 98/99 Series and required accessories.
2. Or Approved Equal

2.7 CARD READERS

A. Networked Contactless Smart Card Readers: Contactless smart cards reader to securely read access control data from 13.56 MHz contactless smart cards. The contactless smart card reader is designed for use in access control applications by providing:
1. Secure access control data exchange between the smart card and the reader utilizing key diversification and mutual authentication routines.
2. Operating voltage: 5-16 VDC. Current requirements: 55 mA Avg, 116 mA Peak at 12 VDC.
3. Universal compatibility with most access control systems and backwards compatibility with legacy 125 KHz proximity access control formats.
4. Product construction suitable for both indoor and outdoor applications.
5. Customizable behavior for indicator lights and audible tones.
6. Acceptable Manufacturer:
   a. HID Global (HG) - iCLASS SE Series.
      1) CR1 - HID® iCLASS SE® R40

2.8 DOOR POSITION SWITCH

A. Acceptable Manufacturers:
1. GRI-180-12-G
2. Or approved equal.

2.9 REQUEST-TO-EXIT (REX)

A. Acceptable Manufacturers:
1. Bosch DS-150i or approved equal.
2. Or approved equal.

2.10 CABLES AND WIRING

A. Comply with Division 27 Section "Conductors and Cables for Electronic Safety and Security."

B. Data Line Supervision: System to include alarm initiation capability in response to opening, closing, shorting, or grounding of data transmission lines.

C. Install appropriate number of conductor pairs, in the wire gage (AWG) recommended by manufacturer, corresponding to the electronic locking functions specified, amperage drawn, and distances covered between the power supplies, power transfer devices, electrified hardware and access control equipment.

2.11 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.12 ACCESS CONTROL HARDWARE FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Protect mechanical finishes on exposed surfaces from damage by applying temporary protective coverings before shipping.

C. Where specified, finishes on integrated card key locksets or exit hardware to incorporate an FDA recognized antimicrobial coating (i.e. MicroShield™) listed for use on equipment as a suppressant to the growth and spread of a broad range of bacteria, algae, fungus, mold and mildew.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing:
1. Complete System Test: Test all access control equipment, control panels, and backup power systems under load conditions. Address any defects identified.
2. Compliance Review: Ensure all access control equipment meets the specifications and drawings. Correct any non-compliance issues.
3. Final Checkout Documentation: Provide a detailed report and test data for the final inspection of each component within the access control system.

B. Adjusting:
1. Operational Tuning: Adjust and service all operational components for smooth and quiet operation.
2. Calibration: Set and calibrate controls for optimal system performance.

C. Cleaning:
1. Surface Treatment: Clean all installed equipment, ensuring a pristine appearance without damage or marks.
2. Debris Removal: Eliminate dust and debris from all equipment surfaces, inside and out.

3.2 TESTS AND REPORTS

A. System testing and reporting will occur in two phases.

B. Security Contractor shall perform System Functionality Testing and correct all deficiencies prior to performing the Commissioning Testing.

C. Perform System Functionality Testing using manufacturer-certified personnel who have attended a manufacturer's training school for installation and testing of the systems. Perform testing with the test instruments and methodology as required by the manufacturer; testing by means other than the manufacturer's procedures will not be acceptable unless agreed to by the Owner and manufacturer.

D. Security Contractor shall perform System Functionality Testing and document these tests for review.

E. If testing will require monitors, mouse, and keyboards, contractor is to provide their own equipment at no extra cost to the client. Monitors, mouse, and keyboards are not provided at any of the IDF rooms or IDF closet locations.

F. At a minimum, perform System Functionality Testing to demonstrate and document:
1. Door Readers and Credentials: Test all card readers, keypads, or biometric scanners with various credentials to ensure they grant or deny access as appropriate.
2. Door Status Monitoring: Verify that door position switches accurately report door open, closed, and locked statuses.
3. Emergency Release: Test emergency release functions to ensure doors can be unlocked manually or through system overrides in case of an emergency.
4. Integration Testing: If the access control system is integrated with other building systems (like CCTV or alarm systems), verify that all integrations work as intended.
5. Software Configuration and Database Verification: Ensure the access control system software is correctly configured, including time schedules, access levels, and user database accuracy.
6. Throughput: Measure the time it takes for a door to unlock after a credential is presented.
7. Fail-Safe and Fail-Secure Operations: Test the system's ability to default to a secure state during power failure or communication loss.
8. Alarm Functions: Verify that all alarm notifications function correctly for events like forced entry or door left open.

G. Upon completion of the System Functionality Testing Security Contractor shall submit written reports including but not limited to the following information:
1. Certification that all devices and equipment meet or exceed the requirements of the System Functionality Testing.
2. Certification that all equipment is properly installed, programmed, fully functional and completely operational, and conforms to Specifications and Drawings.
3. Complete Bill of Materials of all equipment installed including quantity, make and model as well as serial numbers, MAC addresses, and IP addresses/host names of major components.
4. Technician’s field test reports of all cables, devices, and equipment.
5. Test technician's name, company and date(s) of test.
6. Exceptions shall be clearly noted in a Punch List.

H. Following review and acceptance of the System Functionality Testing report, the Security Contractor shall perform Commissioning Testing of all security system equipment and software.

I. Commissioning Testing shall include performance testing and functionality testing to demonstrate to the Owner that each system software and hardware component functions as required by the Specifications and Drawings. The Security Contractor shall be responsible for all additional costs to the Owner if retesting is required.

J. At a minimum, perform Commissioning Testing to demonstrate and document:
1. Each camera, cable, data network switch, VS, server, and client computer workstation functions as an integrated element of the Video Surveillance System.

2. Fully functional and completely operational condition of the cameras, client computer workstations, VS's, and Video Surveillance System server.
3. An abnormal condition of any signaling or communication circuit, device malfunction, or image loss required to be electrically supervised will result in activating the specified trouble or tamper alarm notification signal.
4. All Video Surveillance System software functions properly in accordance with manufacturer's written specifications and all equipment is fully programmed.

END OF SECTION

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SECTION 28 23 00- ELECTRONIC VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Section Includes:
1. Drawings and general provisions of the Contract, including Conditions of Contract, apply to this Section.
2. Division 26.
3. Division 27.
4. All other Division 28 Sections.

1.2 GENERAL WORK DESCRIPTION

A. The security system will be monitored from Zuckerberg San Francisco General Sheriff's Operations Center (SOC) and secondary locations that provide security assessment capabilities to security operators. Security Contractor to coordinate all work with facility personnel, including but not limited to HR, IT and Security Personnel.

1.3 SUMMARY

A. Section Includes: Description, architectural and functional requirements, data security requirements, operational capabilities, and computer equipment requirements for a single or multi-site on-premises Video Management System (VMS) supporting an unrestricted number of users, devices, servers and sites.

B. Compliance: System equipment and installation shall comply with all provisions and requirements of this specification as well as all applicable national, state and local codes and standards.

C. Video surveillance systems shall be integrated with monitoring and control system specified in Section 280500 "Common Work Results for Electronic Security", Section 281300 "Access Control", Section 283300 "Electronic Detection and Alarm" which specifies systems integration.

1.4 RELATED SECTIONS

A. Section 280500 "Common Work Results for Electronic Security"

B. Section 281300 "Access Control" that are used to control access to and throughout the facility and provide audit and reporting for all subsystems listed.

C. Section 283300 "Electronic Detection and Alarm" that provide sensor level intrusion for and throughout the facility and vehicle parking areas and utility areas

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Video surveillance system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 REFERENCES

A. Trademarks Used in This Document:
1. Apple: Safari®
2. Digital Living Network Alliance: DLNA®
3. Google: Google Chrome™
4. Intel: Intel®, Core™, Xeon®
5. Microsoft: Microsoft®, Outlook®, Windows®, Active Directory®, Hyper-V®, SQL Server®, Microsoft Internet Explorer®
6. Lenel: XProtect®, Scalable Video Quality Recording™
7. NVIDIA: NVIDIA®
8. Mozilla: Mozilla®, Firefox®
9. VMware: VMware®

B. Abbreviations and Acronyms:
1. ACC: Advanced Audio Coding.
2. AES: Advanced Encryption Standard.
3. API: Application Programming Interface.
4. CA: Certificate Authority.
5. DES: Data Encryption Standard.
6. DLNA: Digital Living Network Alliance.
7. EULA: End User License Agreement.
8. FPS: Frames per Second.
9. Full HD: High Definition video resolution of 1920 x 1080 pixels.
10. GB: Gigabyte.
11. GOP: Group of Pictures.
12. H.264/H.265: Video compression formats.
13. HD: High Definition video resolution of 1280 x 720 pixels.
14. HTML: Hyper Text Markup Language.
15. HTTPS: Hyper Text Transfer Protocol Secure.
16. I/O: Input/Output.
17. IP: Internet Protocol.
18. JPEG: Joint Photographic Experts Group (image format).
19. LAN: Local Area Network.
20. LPR: License Plate Recognition.
21. MPEG: Moving Picture Experts Group (video format).
22. NAS: Network Attached Storage.
23. NAT: Network Address Translation.
24. ONVIF: Open Network Video Interface Forum.
25. PTZ: Pan-Tilt-Zoom.
26. RTSP: Real Time Streaming Protocol.
27. SDK: Software Development Kit.
28. SVQR: Scalable Video Quality Recording.
29. UPnP: Universal Plug and Play.
30. UPS: Uninterruptible Power Supply.
31. VMS: Video Management System.
32. WAN: Wide Area Network.

C. Definitions:
1. AAC Audio Codec: Advanced Audio Coding is a proprietary audio coding standard for lossy digital audio compression.
2. Active Media Storage: High-performance media storage used for active video, audio and metadata recording.
3. Application Programming Interface (API): Set of clearly defined methods of communication between various software components.

4. Archived Media Storage: Secondary media storage used for storing video, audio and metadata beyond an initial retention period.
5. Authentication: Process that establishes the origin of information or determines an entity's identity.
6. Authorization: Process that associates permission to access a resource or asset with a person and the person's identifier(s) for the purpose of granting or denying access.
7. Bit Rate: Number of bits per time unit sent over a network.
8. Contractor: Firm selected by Owner and any of Contractor's subcontractors, vendors, suppliers or fabricators, to perform work specified in these contract documents and supporting documentation. Contractor shall supply all equipment, labor, material and services necessary to complete the project construction in accordance with Contract Documents.
9. Central Processing Unit (CPU): General purpose electronic circuitry within a computer that carries out the instructions of a computer program, typically contained in a single integrated circuit chip.
10. Digital Living Network Alliance: Standards-making group for consumer electronics manufacturers establishing interoperability among consumer devices for picture and video display.
11. Dwg-files: Proprietary binary file format used for storing two- and three- dimensional design data and metadata.
12. Dxf-files: CAD data file format developed by Autodesk for enabling data interoperability between AutoCAD and other programs.
13. G.711 Audio Codec: ITU-T standard audio codec that provides toll-quality audio.
14. G.726 Audio Codec: ITU-T ADPCM speech codec standard covering the transmission of voice.
15. Graphics Processing Unit (GPU): Specialized electronic circuit designed to rapidly decode video, manipulate images and accelerate the creation of video images in a video frame buffer intended for output to a display device, much more efficiently than can be done by general purpose computer CPUs. GPUs are used in mobile phones, personal computers, workstations and game consoles.
16. Group of Pictures (GOP): In video coding, a group of pictures, or GOP structure, specifies the order in which intra- and inter-frames are arranged. The GOP is a collection of successive pictures within a coded video stream. Each coded video stream consists of successive GOPs, from which the visible frames are generated. Encountering a new GOP in a compressed video stream means that the decoder doesn't need any previous frames to decode the next ones and allows fast seeking through the video.
17. Hardware Acceleration: Use of computer hardware (such as a GPU) to perform some functions more efficiently than is possible in software running on a more general-purpose CPU.
18. Kerberos: Ticket-based network authentication protocol designed to provide strong authentication for client/server or server/server applications.
19. Multi-site: Reference to a VMS that spans multiple physical site locations.
20. Open Network Video Interface Forum (ONVIF): Global and open industry forum for the creation of standards for how IP-networked products within video surveillance and other physical security areas can communicate with each other.
21. Pre-buffering: Temporary storage of video and audio for pre-recording.
22. Pre-recording: Automatically recording video and audio starting a specified number of seconds just before the event or time condition that initiated the recording.
23. Post-recording: Automatically continuing the recording of video and audio for a specified number of seconds after the end of the event or time condition that initiated the recording.
24. PTZ Patrolling or PTZ Tour: Automatically moving a camera through a specified series of preset PTZ positions, dwelling on those positions for a specified amount of time, and transitioning between the preset positions at a specified speed.

25. Reseller: Contractor authorized by manufacturer to furnish, install and maintain manufacturer's VMS, who may be the primary contractor or a subcontractor for the provision of this project's VMS.
26. Universal Plug and Play (UPnP): Set of networking protocols that permits networked devices, such as personal computers, printers, Internet gateways, Wi-Fi access points, IP video cameras and mobile devices to seamlessly discover each other's presence on the network and establish functional network services for data sharing and communications.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, material and services specified for this project for commercial, military or industrial use.
   2. Contractors / Installers:
      a. Licensure: Contractor or security sub-contractors shall be licensed to perform security installations in the state/region where the work is to be performed if so required.
      b. Experience: Contractor or security sub-contractor shall have a minimum of three years of experience installing and servicing systems of similar scope and complexity.
      c. References: Contractor shall provide four current project references from clients with systems of similar scope and complexity which became operational in the past three years.
         1) At least three references shall be utilizing the same system components, in a similar configuration as the proposed system.
         2) References shall include a current point of contact, company or agency name, business address, telephone number, and if the contact agrees, include a basic system description and date of project completion. The owner reserves the option to visit the reference sites, with the site owner's permission and representative, to verify the quality of installation and the reference's level of satisfaction with the system.
      d. Technician Certification: Utilize only manufacturer-trained technicians to install, program, and service VMS equipment.
         1) Ensure technicians have a minimum of five continuous years of technical experience in electronic security systems including IP networking and VMS solutions.
      e. Dealer Certification: Provide evidence that installing service company is an authorized dealer in good standing for the product's manufacturer, and that it meets the manufacturer's technical certification requirements.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver software installation packages via download directly from manufacturer's website

B. Software installation packages must be digitally signed by the manufacturer

1.9 WARRANTY AND SUPPORT

A. Manufacturer Warranty and Support:
   1. Software Warranty:
      a. Manufacturer's software warranty must be described in the manufacturer's EULA for the product.
   2. Software Support:

a. Provide free access to any software service updates or hot fixes released due to a material defect or error in the product.
b. Provide new device driver packs, multiple times per year, to extend support for additional devices without the need for a new version of the product.
c. Provide free access to self-paced interactive e-training.

3. Software Updates and Upgrades:
   a. Make software upgrades available for a period of one year from activation of the software license. Coverage options shall include:
      1) Free access to any new product versions for the purchased VMS software product.
      2) 100% credit on owners current VMS product when upgrading to a more advanced version of the same VMS product.
      3) Case Management online tool for submitting and tracking technical cases.
      4) Direct Access to technical support via e-mail and phone.
      5) Prioritized handling of support phone call response times based upon criticality of issue, for questions submitted by email or that cannot be answered in initial phone call.
      6) Additional years of software upgrades available for purchase separately.

B. Maintenance and Service:
1. General Requirements:
   a. Provide all services required and equipment necessary to maintain VMS in an operational state as specified for one year from formal written acceptance of system.
   b. Provide all necessary material required for performing scheduled adjustments or other non-scheduled work.
   c. Minimize impacts on facility operations when performing scheduled adjustments or other non-scheduled work.
2. Description of Work: Deployment of VMS includes installation and setup of new server hardware and software, plus any new and existing equipment specified in Article 2.1. OWNER-FURNISHED PRODUCTS.
3. Personnel: Service personnel shall be certified in the maintenance and repair of the selected type of equipment and integrations, and qualified to accomplish all work promptly and satisfactorily.
4. Schedule of Work: Work shall be performed during regular workweek working hours, as determined by the deployment facility's locale, excluding federal/public holidays.
5. Emergency Service:
   a. Provide Owner with an emergency service center telephone number. Emergency service center shall be staffed 24 hours a day, 365 days a year and be located within 60 miles/kilometers of the deployment facility.
   b. Be a stocking contractor of the manufacturer's equipment.
   c. Owner shall initiate service calls whenever system is not functioning properly.
   d. Service Response:
      1) Owner has sole authority for determining catastrophic and non-catastrophic system failures.
      2) Catastrophic system failure is defined as any system failure that Owner determines will place a facility at increased risk.
      3) For catastrophic system failures, provide same-day four-hour service response with continued status updates at least every four hours.
      4) For non-catastrophic failures, provide service response within eight hours with continued status updates at least twice a week.
6. Verification of Operation: As part of scheduled adjustments and repairs, verify operation of system as demonstrated by performance verification testing.

1.10 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For video surveillance. Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Functional Block Diagram: Show single-line interconnections between components for signal transmission and control. Show cable types and sizes.
   3. Dimensioned plan and elevations of equipment racks, control panels, and consoles. Show access and workspace requirements.
   4. UPS: Sizing calculations.
   5. Wiring Diagrams: For power, signal, and control wiring.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add pretesting record of each piece of equipment, listing name of person testing, date of test, set points of adjustments, name and description of the view of preset positions, description of alarms, and description of unit output responses to an alarm.

1.11 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For video surveillance, cameras, camera-supporting equipment, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   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.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.12 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For cameras, power supplies, infrared illuminators, monitors, videotape recorders, digital video recorders, video switches, and control-station components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three years from date of acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following are acceptable manufacturers of electronic security system products as specified in this specification section. Any proposed product from a different manufacturer is subject to the review and approval.
   1. Video Management System (VMS):
      a. Lenel
   2. Network Cameras
      a. AXIS or approved equal

2.2 VIDEO MANAGEMENT SYSTEM

A. Consult the manufacturer representative for complete specification of a complete turnkey solution. Shop drawing submission will include manufacturers certification.

B. Description: Video surveillance management system (referred to as “system” or “VMS”) supporting an unrestricted number of users, devices, servers and sites, with options for central surveillance operations and mobile devices.

C. System Architecture: The VMS shall consist of:
   1. Servers: One or more VMS servers.
      a. Physical Windows servers.
      b. UPS provided to physical servers, network infrastructure and devices such as cameras.
   2. Server Software Components: One or more software components by Manufacturer, or software components made by others as noted, per VMS server.
      a. Management Server: Central service component of the VMS responsible for handling system configuration, distributing the configuration to other system components, such as recording server services, and for facilitating user authentication.
      b. Recording Server: Service responsible for communications, recording and event handling for all devices (cameras, video and audio encoders, I/O modules, metadata sources, etc.), including:
         1) Retrieving video, audio, metadata and I/O event streams from devices.
         2) Recording video, audio and metadata.
         3) Providing access to live and recorded video, audio and metadata.
         4) Transmit live audio from operator’s microphone to one or more camera speakers or supported IP speakers.
         5) Providing access to device status.
         6) Triggering system and video events on device failures, events, etc.
         7) Writes video streams, audio streams and their metadata to a high-performance media database.
         8) Performing motion detection and generate smart search metadata.
      c. Event Server: Service that handles various tasks related to events, alarms, maps and third-party integrations via the Software Development Kit (SDK).
      d. Log Server: Service that writes all system, audit and rule-triggered log messages to database.
      e. Service Channel: Service responsible for communicating the following:
         1) Service and configuration messages to full viewing client.
      f. Mobile Server: Service responsible for hosting the web client and for providing access to the VMS for web client and mobile client users.
      g. ONVIF Out: Optional server, plus 64-bit plug-in for management client. This is to enable private-to-public video integration.

h. DLNA Out: Service to enable display of live video on any DLNA compliant TV or displays without the need for additional equipment.
i. Microsoft SQL Server: Microsoft database server service for the management server, event server and log server services.
j. Microsoft Active Directory: Active Directory is not required for single-site systems but is recommended for cyber security purposes.

3. PC or Laptop Workstations: One or more PCs or laptops for client software applications intended to run on Windows-based PCs and laptops.
   a. Management Client: The administration interface for all parts of the VMS, designed to be run remotely from, for example, an administrator's computer.
   b. Full Viewing Client: Designed for day-to-day use by dedicated operators, to be run remotely on the operator's computer. Full viewing client provides dedicated task-oriented tabs for Live Video, Video Playback, Search, plus dockable tabs for Alarm Monitor. Full viewing client supports definable keyboard and joystick button shortcuts for frequently-used actions, including window or camera selection.
   c. Web Client: Browser-based application for the occasional or remote user that needs easy access to live video monitoring and audio listening with PTZ control including use of presets, and video and audio playback and export, with defined exports available for later usage or download.
4. Tablets or Smartphones: One or more tablets or smartphones using web client (see above) or mobile client.
   a. Mobile Client: Native mobile app for smartphone or tablet users, for easy access to live and playback of cameras, and to activate system events and outputs. Additionally, for use as a remote recording device by using the mobile device's built-in camera, whereby video from the device's camera is streamed back to the VMS and recorded like a standard camera.
5. Networks:

D. Multiple Network Segments: The VMS must support network segmentation into separate device, server and internet-connected networks.
   a. Device Network: Local network whose capacity and configuration are suitable for the level of video, audio and metadata data transmission established by the system design and its intended usage.
   b. Server Network: Local network whose capacity and configuration are suitable for the level of video data transmission, systems integration, and user operations established by the system design and its intended usage.
   c. Internet-Connected Network: Internet-connected network providing connection to remote VMS sites and private-to-public connection via ONVIF Out. This network is also used for remote user access via the mobile server.
   d. Network Traversal: Enable software clients to access recording server services from outside a NAT firewall, by the use of public addresses and port forwarding.

E. Provide Remote Connect Services that enable secure remote connections to devices across different types of private and public networks.

F. The VMS shall be Lenel XProtect Corporate.

2.3 IP CAMERAS

A. CAM1 – 1920x1080p Resolution fixed dome camera for surface mount installations shall be model P3265-LV as manufactured by AXIS Communications, (www.axis.com), or approved equal.

B. CAM2 – Panoramic, fixed dome, 180° coverage camera shall be model P3827-PVE as manufactured by AXIS Communications, (www.axis.com), or approved equal.

C. CAM3 - 12 MP mini dome with 360° panoramic view camera. The cameras shall be model M4328-P as manufactured by AXIS Communications, (www.axis.com), or approved equal.

D. CAM4 - For general exterior area coverage, a Pan, Tilt & Zoom camera. This camera shall be a model Q6315-E as manufactured by AXIS Communications, (www.axis.com),or approved equal. Provide AXIS overhang or wall mounting accessories as required.

E. CAM5 – 4 MP, 2304x1728p fixed dome zoom camera for surface mount installations shall be model M4216-LV as manufactured by AXIS Communications, (www.axis.com), or approved equal.

2.4 NETWORK VIDEO RECORDER (NVR)

A. Seneca – Exact Build TBD

2.5 REQUIREMENTS

A. Video Surveillance System shall be fully functional and completely operational.

B. All wall, floor, and ceiling penetrations, regardless of the fire rating of the partition, must be properly sleeved with EZ-Path or conduit penetration assembly and properly sealed using approved fire stopping materials and sealants.

C. Exterior penetrations shall be properly sealed using approved weather-proof fire stopping materials and sealants.

D. Provide seismic restraint for all equipment, including equipment racks and consoles.

E. Security equipment, devices, brackets, mounting arms or pendants, junction boxes, cabinets, and enclosures shall be installed utilizing stainless steel tamper-resistant fasteners and mounting hardware.

F. Tamper-resistant fasteners shall be pin Torx.

G. Provide two (2) driver bits and hand tools to the Owner’s representative for each type and size of pin Torx security fastener provided.

H. Security Contractor shall provide the Owner with three (3) complete sets of keys for all keyed equipment or equipment enclosures installed in this Project prior to the close of the Project. All keys relating to the security systems shall be kept separate from the building systems and delivered to the Owner’s representative on transmittal.

I. Security equipment enclosures shall be locked at all times. Keys for security equipment enclosures shall be turned over to the Owner and shall not be left in the cam locks or on top of the enclosures.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing:
1. Test all security systems equipment, associated control panels and any back-up power equipment in their entirety under load conditions. Correct any defects found.

2. Review and check all systems equipment for compliance with the requirements of contract drawings and specifications. Correct any deficiencies discovered.
3. Provide detailed description and test data on the final checkout of each system specified herein.

B. Adjusting:
1. Adjust and service operating elements as necessary to operate smoothly and quietly.
2. Adjust systems to be operational, with controls set and calibrated.

C. Cleaning:
1. Clean all installed equipment, leaving exposed surfaces free from damage, dents, tool marks, stains, discoloration, and other defects and damage.
2. Remove dust and debris from interiors and exteriors of all installed equipment.

3.2 TESTS AND REPORTS

A. System testing and reporting will occur in two phases.

B. Security Contractor shall perform System Functionality Testing and correct all deficiencies prior to performing the Commissioning Testing.

C. Perform System Functionality Testing using manufacturer-certified personnel who have attended a manufacturer's training school for installation and testing of the systems. Perform testing with the test instruments and methodology as required by the manufacturer; testing by means other than the manufacturer's procedures will not be acceptable unless agreed to by the Owner and Security Consultant and manufacturer.

D. Security Contractor shall perform System Functionality Testing and document these tests for review.

E. If testing will require monitors, mouse, and keyboards, contractor is to provide their own equipment at no extra cost to the client. Monitors, mouse, and keyboards are not provided at any of the IDF rooms or IDF closet locations.

F. At a minimum, perform System Functionality Testing to demonstrate and document:
1. Video Server (VS)
   a. The VS is communicating over the Owner’s LAN/WAN data network.
   b. The VS operates correctly connected to 120VAC supply power.
   c. The VS records and displays all of the cameras connected to it.
   d. The VS stores recorded video and allows the retrieval of stored video when requested from a client workstation.
   e. The VS displays clear, bright, and focused images from all associated cameras.
   f. The VS produces a system notification alarm when any associated video image is lost. This notification alarm shall be produced whether the video loss is from loss of network communication or from vandalism or otherwise obscuring the camera’s view.
   g. The VS starts, operates, and records properly when the unit is restarted from a planned or unplanned shutdown.
2. Cameras
   a. The camera video feed displays on client workstations without flickering due to excessive latency greater than half of a second.
   b. The camera video feed displays on client workstations without pausing or freezing.
   c. The camera auto-focuses to display clear image acceptable by UCPD.
   d. The day/night interior and exterior cameras adjust properly between day and night lighting conditions.

e. The Wide Dynamic Range and auto-backlight compensation cameras adjust properly to challenging lighting conditions to produce clear, bright, and focused images.
f. The camera produces a stable picture with no roll, flutter or ghosting.
g. The camera resumes operation and produces clear, bright, and focused images when PoE power or network connectivity is restored from a failure.

G. Upon completion of the System Functionality Testing Security Contractor shall submit written reports including but not limited to the following information:
1. Certification that all devices and equipment meet or exceed the requirements of the System Functionality Testing.
2. Certification that all equipment is properly installed, programmed, fully functional and completely operational, and conforms to Specifications and Drawings.
3. Complete Bill of Materials of all equipment installed including quantity, make and model as well as serial numbers, MAC addresses, and IP addresses/host names of major components.
4. Technician's field test reports of all cameras, cables, devices, and equipment.
5. Test technician's name, company and date(s) of test.
6. Exceptions shall be clearly noted in a Punch List.

H. Following review and acceptance of the System Functionality Testing report by the Owner and Security Consultant, the Security Contractor shall perform Commissioning Testing of all security system equipment and software in the presence of the Owner and Security Consultant.

I. Commissioning Testing shall include performance testing and functionality testing to demonstrate to the Owner that each system software and hardware component functions as required by the Specifications and Drawings. The Security Contractor shall be responsible for all additional costs to the Owner and Security Consultant if retesting is required.

J. At a minimum, perform Commissioning Testing to demonstrate and document:
1. Each camera, cable, data network switch, VS, server, and client computer workstation functions as an integrated element of the Video Surveillance System.
2. Fully functional and completely operational condition of the cameras, client computer workstations, VS's, and Video Surveillance System server.
3. An abnormal condition of any signaling or communication circuit, device malfunction, or image loss required to be electrically supervised will result in activating the specified trouble or tamper alarm notification signal.
4. All Video Surveillance System software functions properly in accordance with manufacturer's written specifications and all equipment is fully programmed.

3.3 CATEGORY 6A CABLE TESTING

A. Ethernet Category 6A Cabling shall be field tested after installation.

B. Documentation shall be submitted to demonstrate that all cabling meets or exceeds ANSI/TIA/EIA 568-B.2-1 Commercial Building Telecommunications Cabling Standards and Transmission Performance Specifications for 4-Pair 100 Ohm Category 6 Cabling.

C. Deficiencies shall be corrected prior to utilizing the installed cabling as a component of the Video Surveillance System.

END OF SECTION

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SECTION 28 33 00- ELECTRONIC DETECTION AND ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including conditions of contract, apply to this section.

B. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.

C. Division 27 Section – "Communications" for connections to the LAN.

D. All other Division 28 Sections.

1.2 SUMMARY

A. The security system will be monitored from Zuckerberg San Francisco General Sheriff's Operations Center (SOC) and secondary locations that provide security assessment capabilities to security operators. Security Contractor to coordinate all work with facility personnel, including but not limited to HR, IT and Security Personnel.

1.3 SECTION INCLUDES

A. As shown on the plans
   1. Intrusion Detection Panels
   2. Passive infrared (PIR) motion detectors
   3. Panic or duress buttons

1.4 REFERENCE

A. Reference Standards: Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section:
   1. Underwriters Laboratories Inc. (UL):
      a. UL 365: Police Station Connected Burglar Alarm Units and Systems.
      b. UL 609: Local Burglar Alarm Units and Systems.
      c. UL 636: Holdup Alarm Units and Systems.
      d. UL 684: Local, Central Station, and Remote Station.
      e. UL 1037: Antitheft Alarms and Devices
      f. UL 1610: Central-Station Burglar-Alarm Units.
   2. Federal Communications Commission (FCC):
      a. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
      b. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.

1.5 INTRUSION DETECTION SYSTEM (IDS)

A. The Intrusion Detection System is designed to provide alarm monitoring of designated areas within the health center. The IDS is equipped with a keypad to allow arming/disarming of the system. The IDS shall be from the Health Center Standards list to include arming stations, motion detectors, and control panels.

B. System Integration: The access control software provides communication of alarm messages to the Video Surveillance System (VSS). This provides the capability of IDS alarms to automatically call-up cameras at the SOC workstation to allow visual assessments of alarms where cameras are positioned to view the alarm location.

C. This will report to the Health center's monitoring center via the existing Software House/C-Cure9000+ access control systems panels via the DSC intrusion detection panels.

D. Intrusion devices shall include motion detectors, glass break detectors, duress buttons and alarm contacts. Motion and glass break detectors shall be provided in areas located on the drawings.

E. All security cabling shall be installed in conduit. All enclosures shall be key accessed and equipped with tamper switches to alert security personnel. All accessible "boxes" shall be equipped with tamper resistant screws and fasteners.

1.6 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use, including instruction manuals.

C. Shop Drawings: Submit complete shop drawings including connection diagrams for interfacing equipment, list of connected equipment, and locations for major equipment components.

D. Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings not later than Substantial Completion of the project.

E. Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the system installed. Include system and operator manuals.

F. Field Tests: Submit results of field testing of every device including date, testing personnel, retesting date if applicable, and confirmation that every device passed field testing.

G. Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a one year period for Owner's review. Maintenance shall include, but not be limited to, labor and materials to repair the system, provide test and adjustments, and regular inspections.

1.7 QUALITY ASSURANCE

A. Manufacturer: Minimum ten years of experience in manufacturing and maintaining similar systems. Alarm manufacturer shall be certified compliant with ISO 9001.

B. Installer: Minimum two years of experience installing similar systems, and acceptable to the manufacturer.

C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's labeled packages. Store and handle in accordance with manufacturer's requirements, in a facility with environmental conditions within recommended limits.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 2 - PRODUCTS

2.1 INTRUSION DETECTION PANELS

A. The intrusion detection panels shall be compatible with the Electronic Access Control System.

B. Approved Manufacture
1. Bosch- G Series IP Control Panel and required accessories.

C. Keypads
1. Bosch D1255W and required accessories.
2. Or Approved Equal

2.2 PIR MOTION DETECTORS

A. Detectors shall be installed at locations shown on plans.

B. Approved Manufacture
1. Bosch ZX835 and required accessories.
2. Or Approved Equal

2.3 GLASS BREAK

A. Detectors shall be installed at locations shown on plans.

B. Approved Manufacture
1. Bosch DS1101i and required accessories.
2. Or Approved Equal

2.4 DURESS ALARM BUTTONS

A. Duress buttons shall be installed under the counters as locations shown on plans.

B. Approved Manufacture
1. Duress/Panic- Wall SS2029EM-EN STI and required accessories.
2. Duress/Holdup- Desk: UTC 3040-W and required accessories.
3. Or Approved Equal

2.5 ALARM SOUNDER

A. Alarm Sounder shall be installed at locations shown on plans.

B. Approved Manufacture
1. Bosch
2. Or Approved Equal

2.6 GSM CELL MODULE

A. GSM Cell Module shall be installed at Intrusion Detection Panel.

B. Approved Manufacture
1. B444-V Plug-in Cell Module
2. Or Approved Equal

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Testing:
1. Complete System Test: Test all access control equipment, control panels, and backup power systems under load conditions. Address any defects identified.
2. Compliance Review: Ensure all access control equipment meets the specifications and drawings. Correct any non-compliance issues.
3. Final Checkout Documentation: Provide a detailed report and test data for the final inspection of each component.

B. Adjusting:
1. Operational Tuning: Adjust and service all operational components for smooth and quiet operation.
2. Calibration: Set and calibrate controls for optimal system performance.

C. Cleaning:
1. Surface Treatment: Clean all installed equipment, ensuring a pristine appearance without damage or marks.
2. Debris Removal: Eliminate dust and debris from all equipment surfaces, inside and out.

3.2 TESTS AND REPORTS

A. System testing and reporting will occur in two phases.

B. Security Contractor shall perform System Functionality Testing and correct all deficiencies prior to performing the Commissioning Testing.

C. Perform System Functionality Testing using manufacturer-certified personnel who have attended a manufacturer's training school for installation and testing of the systems. Perform testing with the test instruments and methodology as required by the manufacturer; testing by means other than the manufacturer's procedures will not be acceptable unless agreed to by the Owner and manufacturer.

D. Security Contractor shall perform System Functionality Testing and document these tests for review.

E. If testing will require monitors, mouse, and keyboards, contractor is to provide their own equipment at no extra cost to the client. Monitors, mouse, and keyboards are not provided at any of the IDF rooms or IDF closet locations.

F. At a minimum, perform System Functionality Testing to demonstrate and document:
   1. Sensor Testing: Activate each sensor (motion detectors, door/window contacts, glass break detectors, etc.) to verify correct operation and communication with the control panel.
   2. Control Panel Functions: Test the control panel's ability to receive signals, arm/disarm the system, and log events.
   3. Alarm Activation: Confirm that alarms (audible/visual) activate correctly in response to detected intrusions and that they can be silenced or reset as appropriate.
   4. Communication Systems: Verify that the system successfully communicates with any off-site monitoring services and can transmit alarm signals under various conditions.
   5. Battery Backup: Test battery backup systems to ensure the system remains operational during a power outage.
   6. Detection Range and Sensitivity: Test sensors to confirm their detection range and sensitivity settings are appropriate for the covered areas.
   7. System Latency: Measure the time from sensor activation to alarm signal to ensure it falls within acceptable limits.
   8. False Alarm Prevention: Assess the system's ability to distinguish between legitimate threats and non-threatening movements or conditions to minimize false alarms.

G. Upon completion of the System Functionality Testing Security Contractor shall submit written reports including but not limited to the following information:
   1. Certification that all devices and equipment meet or exceed the requirements of the System Functionality Testing.
   2. Certification that all equipment is properly installed, programmed, fully functional and completely operational, and conforms to Specifications and Drawings.
   3. Complete Bill of Materials of all equipment installed including quantity, make and model as well as serial numbers, MAC addresses, and IP addresses/host names of major components.
   4. Technician’s field test reports of all cables, devices, and equipment.
   5. Test technician's name, company and date(s) of test.
   6. Exceptions shall be clearly noted in a Punch List.

H. Following review and acceptance of the System Functionality Testing report, the Security Contractor shall perform Commissioning Testing of all security system equipment and software.

I. Commissioning Testing shall include performance testing and functionality testing to demonstrate to the Owner that each system software and hardware component functions as required by the Specifications and Drawings. The Security Contractor shall be responsible for all additional costs to the Owner if retesting is required.

J. At a minimum, perform Commissioning Testing to demonstrate and document:
   1. Each camera, cable, data network switch, VS, server, and client computer workstation functions as an integrated element of the Video Surveillance System.
   2. Fully functional and completely operational condition of the cameras, client computer workstations, VS’s, and Video Surveillance System server.
   3. An abnormal condition of any signaling or communication circuit, device malfunction, or image loss required to be electrically supervised will result in activating the specified trouble or tamper alarm notification signal.
   4. All Video Surveillance System software functions properly in accordance with manufacturer’s written specifications and all equipment is fully programmed.

END OF SECTION

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Removing existing trees shrubs groundcovers plants and grass.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, and removing site utilities
6. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.3 PRO ECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

D. Do not commence site-clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION – NOT USED

END OF SECTION 31 10 00

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SECTION 31 20 00 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade walks pavements lawns and exterior plants
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs-on-grade.
4. Base course for concrete pavements.
5. Base course for asphalt paving.
6. Excavating and backfilling for utility trenches.

1.2 QUALITY ASSURANCE

A. Standard Specifications: Comply with the Standard Specifications for Public Works Construction (SSPWC), latest edition and supplements for rock materials. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 REFERENCES

A. This specification section has been prepared using the project soils report SUPPLEMENTAL GEOTECHNICAL STUDY REPORT - HEALTHY LIVING CAMPUS PRO ECT BEACH CITIES HEALTH DISTRICT by CONVERSE CONSULTANTS, May 27, 2022 as a reference.

1.4 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subgrade and hot-mix asphalt or concrete paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Classified Excavation: Removal and disposal of materials not defined as rock

F. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

H. Fill: Soil materials used to raise existing grades.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.

L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 PRO ECT CONDITIONS

A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from Owner. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

1.6 PROTECTION

A. Soils Consultant: A geotechnical consultant shall advise on Construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on Owner's property and adjoining properties.

B. Existing Utilities:

1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify utility Owner to ensure protective work will be coordinated and performed in accordance with utility Owner's requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.
2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.
3. Re-route existing subsoil drains which obstruct work around new constructions, or incorporate them into new drainage systems.
4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with Owner and public and private utility companies in keeping their respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of Architect and utility Owner.

C. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24 hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Sand, gravel, friable earth, or non-expansive clays, subject to Testing Laboratory's approval. Fill and backfill material shall be free of organic material, slag, cinders, expansive soils, trash or rubble and stones having maximum dimension greater than six inches .

C. Unsatisfactory Soils: Expansive and other soils as defined in the project's geotechnical investigation report.

1. Unsatisfactory soils also include satisfactory soils not maintained within two percent of optimum moisture content at time of compaction.

D. Base Course: Material conforming to SSPWC section 200-2.2, Crushed Aggregate Base or SSPWC section 200-2.4 Crushed Miscellaneous Base.

E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a one and one-half-inch sieve and not more than 12 percent passing a No. 200 sieve.

F. Bedding Course: Crushed rock conforming to SSPWC Section 200.1-2 and Table 306-1.2.1.3 (B).

G. Drainage Course: Narrowly graded mixture of washed, crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a one and one-half-inch sieve and zero to five percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, six inches wide and four mils thick, continuously inscribed with a description of the utility. Color coding shall be according to the American Public Works Association (APWA) standards:

1. Blue – Potable water and fire suppression lines.
2. Green – Sanitary sewer and storm drain lines
3. Orange – Communication, alarm or signal lines
4. Purple – Reclaimed water, irrigation, and slurry lines
5. Red – Electrical power lines, cables, conduit and lighting lines
6. Yellow – Gas, oil, steam, petroleum, or gaseous material lines.

PART 3 - EXECUTION – NOT USED

END OF SECTION 31 20 00

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated, including admixtures.

B. Design Mixtures: For each concrete pavement mixture.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. ACI Publications: Comply with ACI 301, Specification for Structural Concrete, unless modified by requirements in the Contract Documents.

C. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.

D. The Contractor shall have one copy of the Standard Specifications at the job site.

E. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT –

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's Manual of Standard Practice.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type II, low alkali. Supplement with the following:

a. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.

B. Combined Aggregates: Gradation “C” conforming to SSPWC Section 201-1.3.2.

C. Water: ASTM C 94/C 94M.

2.3 CURING MATERIALS

A. Liquid Curing Compound: ASTM C309, fugitive dye dissipating type, complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254.

B. Moisture-Retaining Cover (Curing Sheet): ASTM C 171, non-staining polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

2.4 RELATED MATERIALS

A. Expansion- and Isolation- oint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

C. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery with emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

D. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with Caltrans Standard Specifications - Section 84 (Federal Specification No. TT-P-1952 for Blue, Red and Green paint; and State of California Standard Specification No. PTWB-01 for White, Yellow and Black paint) with drying time of less than 45 minutes.

1. Color: As indicated

2.5 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete or Solid, integrally colored, 96 percent recycled HDPE or commingled postconsumer and postindustrial recycled plastic; UV stabilized.

1. Dowels: Galvanized steel, three-fourths-inch diameter, 24-inch minimum length.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:

1. Compressive Strength (28 Days): 3,000 pounds per square inch (psi).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.60.
3. Slump Limit: Four inches, plus or minus one inch.

B. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates to Architect for each batch discharged and used in the Work.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 13 13

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SECTION 32 13 16 - DECORATIVE CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Colored concrete paving with topcast surface retarder and/or exposed aggregate finish.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Approved by manufacturer of decorative concrete paving systems.

B. Mockups to demonstrate surface finish, texture, and color; curing; and standard of workmanship for review purposes only. Mockups must remain in place during installation of the decorative concrete. Mockups must be approved by the State before proceeding with the work.

1. Size : 4’ x 4’

1.3 MATERIALS

A. Concrete, General: ACI 301.

B. Reinforcement:
1. Steel : welded wire, reinforcing bars, bar mats, joint dowel bars.
2. Synthetic Fiber: Monofilament or Fibrillated.

C. Concrete:
1. Portland Cement Replacement: Use fly ash, slag cement, and silica fume to reduce portland cement by 40 percent.
2. Portland Cement: ASTM C 150, gray.
3. Fly ash.
4. Slag cement.
5. Blended cement.
6. Normal-weight aggregate.
7. Air-entraining admixture.
8. Color pigment.
9. Compressive Strength: Per section 321313

D. Surface Coloring: Integral Color concrete.

E. Concrete Finish: Seeded Aggregate, Acid wash

1.4 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency.

END OF SECTION 32 13 16

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SECTION 32 13 73 – CONCRETE PAVEMENT OINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and isolation joints within cement concrete pavement.

1.2 SUBMITTALS

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

B. Compatibility and Adhesion Test Reports: From sealant manufacturer.

1.3 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

1. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Colors of Exposed oint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED OINT SEALANTS

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Or any equivalent product.

B. Type SL Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:

a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Or any equivalent product.

2.4 HOT-APPLIED OINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly- et 3406.
c. Or any equivalent product.

2.5 OINT-SEALANT BAC ER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 13 73

SECTION 32 14 40 - UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

A. Product Data: For the following:

1. Pavers.
2. Edge restraints.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C 136.

C. Samples for Initial Selection: For each type of unit paver indicated.

D. Samples for Verification: For full-size units of each type of unit paver indicated.

E. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with requirements.

1.3 QUALITY ASSURANCE

A. Mockups for each form and pattern of unit paver. Mockups must remain in place during installation of the unit pavers. Mockups must be approved by the Owner and Architect before proceeding with the work.

1. Size : 4’ x 4’

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete pavers with joints filled with gravel for permeability.

B. Solid interlocking concrete pavers of shapes that provide openings between units.

C. Edge Restraints: Steel.

D. Curbs: Concrete.

E. Graded Aggregate for Subbase: Heavy duty.

F. Graded Aggregate for Base: Heavy duty.

G. Leveling Course: Sand or Crushed stone.

2.2 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.3 CONCRETE PAVERS (BASIS OF DESIGN)

A. Permeable Concrete Pavers: 'Aqualina Paving Stones' By Angelus Paving Stones or Approved Equal.
   1. 100mm Traffic Rated
   2. Size varies
   3. Colors: Blended Colors, Dark Grey – Pewter – Charcoal
   4. Pavers conform to ASTM C396
   5. Joint filling stone gradation: ASTM No. 8,89, or 9
   6. 100% permeable surface
   7. Bedding gradation: ASTM No. 8
   8. Base gradation: ASTM No. 57
   9. Subbase gradation: ASTM No 2, 3, or 4
   10. Soil subgrade: classified per ASTM D2487, tested for permeability per ASTM D3385

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 14 40

SECTION 32 14 43 - POROUS UNIT PAVING

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Mockups for each form and pattern of unit paver. Mockups must remain in place during installation of the porous unit pavers. Mockups must be approved by the State before proceeding with the work.
   1. Size : 4' x 4'

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete pavers with joints filled with gravel for permeability.

B. Solid interlocking concrete pavers of shapes that provide openings between units.

C. Edge Restraints: Steel.

D. Curbs: Precast concrete.

E. Graded Aggregate for Subbase: Heavy duty.

F. Graded Aggregate for Base: Heavy duty.

G. Leveling Course: Sand or Crushed stone.

H. Paver Fill: Soil mix.

PART 3 - EXEUCTION

3.1 INSTALLATION

A. Aggregate subbase over compacted subgrade and geotextile.

B. Aggregate base over compacted subbase and geotextile.

C. Leveling course of 2 to 2-1/2 inches over geotextile.

D. Pavers planted with ground cover and filled with crushed stone.

END OF SECTION 32 14 43

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SECTION 32 17 23 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Parking and roadway striping.
   2. Curb markings.
   3. Crosswalk striping.

B. Related Sections:
   1. Section 09 91 00 – Painting.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Special Requirements of Regulatory Agencies: Use materials for Work of the Section which comply with volatile organic compound limitations and other regulations of local Air Quality Management District and other local, state, and federal agencies having jurisdiction.

B. Single-Source Responsibility: Provide traffic paint products produced by one manufacturer.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide traffic paint materials that are compatible with the substrates indicated under conditions of service and application, as demonstrated by the manufacturer, based on testing and field experience.

B. Material Quality: Provide the manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

C. Parking and Traffic Line Paint: Acrylic traffic paint, FS TT-P-1952B.

D. Alternate Parking and Traffic Line Paint: Alkyd traffic paint, FS P-115F and FS TT-P-85E.

E. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish the manufacturer's material data and certificates of performance for proposed substitutions.

F. Colors: Match colors indicated by reference to the manufacturer's standard color designations.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 17 23

SECTION 32 17 26 – TACTILE WARNING SURFACING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Surface-applied, truncated dome, tactile warning surfacing.

1.2 SUSTAINABILITY REQUIREMENTS

A. This project is required to be Leadership in Energy and Environmental Design (LEED®) NC v4 certified Gold level. Certain designated credits will be pursued per the requirements of LEED-NC v4 and addenda current as of April 2021.
   1. In addition to LEED v4 Gold certification, the Project is required to also meet the following:
      a. WELL Building Standard v2 Certification.
      b. BLUE ZONES Certification.
   2. See Section 01 81 13 “Sustainable Design Requirements” for related product and procedure requirements, references, definitions, documentation requirements, action plans, meetings, and performance requirements of products and systems which relate to the scope of all designers, contractors, and suppliers.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain surface-applied tactile warning surfacing and accessories through one source from a single manufacturer.

B. Regulatory Requirements: Comply with requirements for detectable warning surfaces as mandated by the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and State of California Building Code, Title 24.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of tactile warning system that fail in materials, fabrication, or installation within specified warranty period. Failure includes defective work, breakage, deformation, delamination, separation and lifting from the floor substrate.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TILE PANEL MATERIALS

A. Material: Vitrified polymer composite (VPC), colorfast and ultraviolet stable, complying with the ANSI requirements for tactile warning surfacing.

B. Tactile Warning Surfacing Tiles:
   1. Size: Nominal 24" w by 48" l by 0.125" thick (0.325-inches thick at the truncated domes) with 1/2-inch flanges along the 48-inch length.

2. Form tiles with holes for anchors in the domes, 9 holes minimum per panel.
3. Dome Geometry: 0.9-inch diameter (nominal); 0.2-inch high, 1.6-inch center-to-center spacing.
4. Truncated Dome Surface Finish: ASTM C1028; textured and slip resistant.
5. Panel Edges: Manufacturer's standard edge joints from panel to panel along the 24-inch length.
6. Color: Yellow, conforming to Federal Color No. 33538, uniform throughout tile.
7. Finish: Non-skid in accordance with ADA requirements.

C. Physical Properties:
1. Water Absorption: ASTM C373; not greater than 0.35 percent.
2. Abrasion Resistance: ASTM C501; not less than 350.
3. Slip Resistance: ASTM C1028; meeting the requirements of the ADA Guidelines Appendix to Part 1192 Advisory Guidelines Section I, to provide a 0.6 coefficient of friction at all floors, steps, and lift platforms, and a 0.8 coefficient of friction at ramps. Surfaces shall maintain the required coefficient of friction under wet or dry conditions; not less than 0.80, wet or dry.
4. Compressive Strength: ASTM D695; not less than 6,500 psi.
5. Hardness: ASTM D785; not less than 70 Rockwell E.
6. Tensile Strength: ASTM D638; not less than 5,000 psi.
7. Impact Resistance: ASTM D5420 and ASTM D5628; withstand a 2 pound steel ball dropped from a height of 96 inches without cracking or chipping at 30 degrees F, 75 degrees F, and 120 degrees F.
8. Stain and Chemical Resistance: ASTM D2299; ASTM D1308; withstand bleach solution, soap solution, turpentine, iron oxide, ethane, hydraulic oil, motor oil, carbon black, calcium chloride, ethylene glycol, and salt without discoloration.
9. Accelerated Weathering: ASTM G155; Method A, no deterioration, fading, or chalking of tile surface after 200 hours of exposure.

2.2 FABRICATION TOLERANCES

A. Tile Length and Width: Plus or minus 0.6 percent.

B. Tile Thickness: Plus or minus 5 percent.

C. Edge Warping: Plus or minus 0.5 percent.

2.3 ACCESSORIES

A. Adhesive: One-part yellow urethane sealant as recommended by tactile warning strip manufacturer, non-toxic and non-flammable, with the following characteristics:
1. Manufacturer: BASF MasterSeal NP1, Sikaflex 1A, or approved equal.
2. Accelerated Aging and Freeze/Thaw: ASTM D1037; tile and adhesive system shall not show evidence of cracking, delamination, checking, blistering, or loosening.
3. Shear Strength: ASTM C666/C666M and ASTM D905; tile and adhesive system shall not show failure in adhesive bond or deterioration in shear strength after 50 cycles of freeze/thaw exposure.
4. Salt and Spray: ASTM B117; no deterioration or defects to tile and adhesive system after 100 hours of exposure.
5. Adhesive/setting materials shall be non-toxic and non-flammable.

B. Anchors: Flat-head drive, yellow anchors, 1/4-inch by 1-3/4-inch minimum, stainless steel with expansion sleeves as recommended by tactile warning strip manufacturer, with a minimum pullout capacity of 1,613 psi.

C. Joint Sealant: Premium-grade, self-leveling, black polyurethane, Chem Caulk 550, BASF MasterSeal, Sikaflex, or equal.

D. Cement Repair Mortar: Hilti RM 800PC, fast-setting cement repair mortar, or equal.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 17 26

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SECTION 323300 - SITE FURNISHINGS

1.1 BENCHES

A. Manufacturers: Landscape Forms, Forms and Surfaces, Victor Stanley or Approved Equal.

B. Frame: Cast aluminum, Powder coated Steel, or Stainless steel.

C. Seat and Back: Aluminum, Powder coated Steel, Stainless steel or Tropical Hardwood.

D. Arms: Two.

E. Installation Method: Attached at finish grade or Cast in concrete

1.2 TABLES AND CHAIRS

A. Manufacturers: Landscape Forms, Forms and Surfaces, Victor Stanley or Approved Equal.

B. Material: Cast aluminum, Powder coated Steel or Teak.

C. Installation Method: Freestanding

1.3 BICYCLE RAC S

A. Manufacturers: Landscape Forms, Dero or Approved Equal.
   1. Standard Bike Racks
   2. Bike Racks with Electric charging capacity.

B. Frame: Stainless steel

C. Installation Method: Attached below finished grade, Cast in concrete or Cast-in anchor bolts.

1.4 BICYCLE LOC ERS

A. Manufacturers: Landscape Forms, Dero or Approved Equal.

B. Material: Steel sheet with perforated metal sides.

C. Lock: Manufacturer's standard.

D. Capacity: Two bicycle.

E. Installation Method: Attached at finish grade

1.5 TRASH RECEPTACLES

A. Manufacturers: Landscape Forms, Forms and Surfaces, Victor Stanley or Approved Equal.

B. Facing Surrounds: Aluminum or Powder coated Steel

C. Support Frames: Galvanized steel.

D. Capacity: 30 gal.

E. Installation Method: Anchored to substrate.

END OF SECTION 323300

SECTION 32 84 00 - IRRIGATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.

B. The work shall include all materials, labor, services, transportation, and equipment necessary to perform the work as indicated on the drawings, in these specifications, and as necessary to complete the contract.

1.3 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Provide dedicated water meter for irrigation water supply.

C. State of California MWELO regulations for landscapes larger than 2,500sf

D. Commissioning to meet CAL Green requirements.

E. If recycled / reclaimed water is to be used, irrigation system shall be designed in accordance with all local and state health department requirements for recycled water.

1.4 SUBMITTALS

A. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, submit to the Owner a complete list of all irrigation system materials, or processes proposed to be furnished and installed as part of this contract.

B. A water pressure test shall be performed to measure the dynamic water pressure at the point of connection at the maximum flow rate of the proposed irrigation system as shown on the point of connection note. Dynamic water pressure is when water is flowing through the point of connection. Static water pressure readings when water is not flowing, are not acceptable.

C. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required component. The record drawings shall be prepared to the satisfaction of the Owner. Prior to final inspection of work, submit record drawings to the Landscape Architect or Owner's authorized representative.

1.5 GUARANTEE

A. The entire sprinkler system, including all work done under this contract, shall be unconditionally guaranteed against all defects and fault of material and workmanship, including settling of backfilled areas below grade, for a period of one (1) year following the filing of the Notice of Completion.

PART 2 - PRODUCTS

2.1 IRRIGATION PIPING

A. Pressure supply line between the water meter and the backflow prevention device shall be type K copper, one size larger than backflow device.

B. Backflow prevention assemblies, and all other above grade assemblies, shall be constructed of threaded brass pipe and threaded brass fittings the same size as the backflow device.

C. Pressure supply lines 2 inches in diameter and up to 3 inches in diameter downstream of backflow prevention unit shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D2241.

D. Non-pressure lines 3/4 inch in diameter and larger downstream of the remote control valve shall be SCH 40 solvent weld PVC conforming to ASTM D1785.

2.2 METAL PIPE AND FITTINGS

A. Brass pipe shall be 85 percent red brass, ANSI, IPS Standard 125 pounds, Schedule 40 screwed pipe.

B. Fittings shall be medium brass, screwed 125-pound class.

C. Copper pipe and fittings shall be Type "K" sweat soldered or brazed.

2.3 PLASTIC PIPE AND FITTINGS

A. Pipe shall be marked continuously with manufacturer's name, nominal pipe size, schedule or class, PVC type and grade, National Sanitation Foundation approval, Commercial Standards designation, and date of extrusion.

B. All plastic pipe shall be extruded of an improved PVC virgin pipe compound in accordance with ASTM D2672, ASTM D2241 or ASTM D1785.

C. All solvent weld PVC fittings shall be standard weight Schedule 40, all mainline fittings shall be Schedule 80 PVC and shall be injection molded of an improved virgin PVC fitting compound. Slip PVC fittings shall be the "deep socket" bracketed type. Threaded plastic fittings shall be injection molded. All tees and ells shall be side gated. All fittings shall conform to ASTM D2464 and ASTM D2466.

D. All threaded nipples shall be standard weight Schedule 80 with molded threads and shall conform to ASTM D1785.

E. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.

F. When connection is plastic to metal, female adapters shall be hand tightened, plus one turn with a strap wrench. Joint compound shall be non-lead base Teflon paste, tape, or equal.

G. All pressure mainlines installed with solvent weld PVC fittings shall be installed with concrete thrust blocking at all directional changes in the mainline routing. Concrete thrust blocking shall not be required when ductile iron fittings and mechanical restraints are specified.

2.4 BACKFLOW PREVENTION UNITS

A. The backflow prevention unit shall be installed in accordance with the requirements set forth by local codes

B. Install with brass nipples, unions and fittings.

C. Provide bronze Wye strainer and brass ball valves

D. Provide manual shut-off valve upstream of backflow device.

2.5 VALVES

A. Ball Valves:
1. All ball valves shall have a minimum working pressure of not less than 150 PSI and shall conform to AWWA standards.

B. Quick Coupler Valves:
1. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage.

C. Automatic Control Valves:
1. Automatic control valves shall be electrically operated.
2. Provide valve ID tags for each remote control valve with valve number.

D. Master Control Valve:
1. Shall be normally closed, Brass

E. Flow Sensor:
1. Shall be Brass

2.6 VALVE BOXES

A. Valve boxes shall be fabricated from a durable, weather-resistant plastic material resistant to sunlight and chemical action of soils.

B. The valve box cover shall be secured with a hidden latch mechanism or bolts.

C. The cover and box shall be capable of sustaining a load of 1,500 pounds.

D. Valve box extensions shall be by the same manufacturer as the valve box.

E. The plastic irrigation valve box cover shall be an overlapping type.

F. Automatic control valve, master valve, and flow sensor boxes shall be marked "RCV" with the valve identification number, or “MV”, “FS” "heat branded" onto the cover in 1-1/4 inch high letters / numbers.

G. Drip air relief valve boxes shall be marked with “ARV” "heat branded" onto the cover in 1-1/4 inch high letters.

H. Quick coupler, ball valve, and drip flush valve boxes shall be marked with "QCV", “BV”, or “FV” "heat branded" onto the cover in 1-1/4 inch high letters.

2.7 AUTOMATIC CONTROLLER

A. Automatic irrigation controllers shall utilize either evapotranspiration or soil moisture sensor data utilizing non-volatile memory shall be required for all irrigation scheduling.

B. Controller shall be grounded according to local codes using equipment of the manufacturer, size, and type indicated on the drawings; or as required by local codes and ordinances.

2.8 ELECTRICAL

A. All electrical equipment shall be NEMA Type 3, waterproofed for exterior installations.

B. All electrical work shall conform to local codes and ordinances.

2.9 LOW VOLTAGE CONTROL WIRING

A. Remote control wire shall be direct-burial AWG-UF type and in no case smaller than 14 gauge.

B. Remote control wire shall be 14 AWG solid core twisted pair.

C. Common wires shall be white in color. Control wires shall be red. Where two or more controllers are used, the control wires shall be a different color for each controller.

D. Ground wires shall be green in color or bare copper and in no case smaller than 6 gauge.

2.10 IRRIGATION INLINE DRIP TUBING AND DRIP EMITTERS

A. All inline drip tubing and drip emitters shall be pressure compensating emitters and shall be continuous flushing type and equipped with a check valve and anti-siphon feature.

B. Minimum irrigation efficiency required 0.81 for drip.

2.11 IRRIGATION SPRAY HEADS

A. All spray heads shall include both drain check valve and pressure regulator built into the body.

B. Minimum irrigation efficiency required 0.75 for spray head.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 84 00

SECTION 32 93 00 – PLANTS AND PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 QUALITY ASSURANCE

A. Installer's Personnel Certifications: Landscape Industry Certified Technician – Exterior, Landscape Industry Certified Horticultural Technician.

1.3 SUBMITTALS

A. Certificates of Inspection: Conform to requirements of federal, state and county laws requiring inspection for plant diseases and infestations of insects or their eggs. Accompany each shipment, invoice or order with inspection certificates required by law.

B. Fertilizer analysis. Also provide labels of each fertilizer used and the quantities used at each application.

C. Herbicides, Pesticides, Fungicides: Furnish manufacturer’s certification by the EPA, description of ingredients, and recommendations for usage and application rates for each material to be used and dates of application.

D. Product data and testing agency analysis of imported topsoil, structural soil, lightweight soil and bioswale filter media.

E. Product data and samples of bark mulch and soil conditioner.

F. Nursery information and photographs of trees, shrubs and groundcovers

1.4 PRECONSTRUCTION TESTING

A. Preconstruction testing of existing, on-site soil, imported soil by certified Agronomic Soils Testing Laboratory.

1. Include Soil Management Report in compliance with AB 1881 Section 432.5 Soil Management Report

1.5 WARRANTY

A. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

B. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All required materials shall be of standard, approved, first grade quality, in first class condition and in ample quantities. The following products comprise the principal materials but do not set the limitation for materials required to complete the intended development.

1. Plants: Plants shall be in conformance with the California State Department of Agriculture's regulation for nursery inspections, rules, and ratings. Plants shall be healthy, vigorous, and free of insect infestations, plant diseases, sunscalds, frost burns, abrasions, or other disfigurement. Plants shall be grown in climatic conditions similar to that of the planting site, and well hardened off. Plants shall have vigorous fibrous root systems which are not rootbound or pot bound. The Landscape Architect is the sole judge as to acceptability of plant material.

2. Mulches: Shredded hardwood, Rounded riverbed gravel or smooth-faced stone, Crushed stone or gravel.

3. Tree Stabilization: Upright staking and tying for establishment.

4. Landscape Edgings: Steel

5. Root barrier for trees within 5’-0” of hardscape areas.

6. Planter drainage gravel and filter fabric.

7. Soil preparation: Amendments to be determined after proper soils analysis and testing have been done.

8. Mycorrhizal fungi shall be added in all planting, regardless of Soils Report

2.2 MAINTENANCE SERVICE

A. Trees, Shrubs, Groundcovers and Other Plants: 90 days.

PART 3 - EXECUTION – NOT USED

END OF SECTION 32 93 00

SECTION 33 11 00 – WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements: Provide water distribution system, complete, as indicated on the Drawings or inferable therefrom and/or as specified in accordance with the Contract Documents.

1.2 SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications and installation instructions for each material. Include certification or other data verifying compliance with required characteristics. Indicate by transmittal form that copy of each has been distributed to the Installer.

B. Shop Drawings: Submit layout and shop drawings as required under Section Submittals. Include details of reinforced concrete structures.

C. Test Reports: Submit certified Test Reports showing compliance of the following items in accordance with Section General Conditions.

1. Laboratory test for bedding and trench stabilization materials.
2. Concrete design mix.
3. Compression tests.
4. Water Test Reports: Submit results of water sample tests by State or local health authorities

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.
3. The Contractor shall have one copy of the Standard Specifications at the job site.
4. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and pavement sections do not apply to this document.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Comply with FM's Approval Guide or UL's Fire Protection Equipment Directory for fire-service-main products.

D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

E. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.4 PRO ECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify **a ER'S REPRESENTATIVE** not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without **a OWNER'S** written permission.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prevent damage to materials during loading, transportation, and unloading. Store equipment with moving parts off ground on platforms or skids.

1.6 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPE AND FITTINGS

A. **c e le o** ASTM D 1785. Suitable for potable water distribution and manufactured in compliance with NSF Standards.

1. Fittings: PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. **e o** : AWWA C900, Class 200 DR 14, with bell-and-spigot or double-bell ends.

1. PVC to PVC Fittings: Push-on- oint, PVC Fittings, ASTM 3139, with elastomeric gasket bell ends, conforming to ASTM D2122 for bell measurements.
2. PVC to Metal Fittings, Valves, and Accessories: Mechanical- oint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

    a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts. Use corrosion resistant, high strength, low alloy steel, bolts and nuts where in contact with corrosive soil ASTM A 325.

2.3 VALVES

A. AWWA, UL/FM Cast-Iron, Gate Valves:

1. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509 and UL/F.M. approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

    a. Minimum Working Pressure: 200 pounds per square inch gauge (psig).
    b. End Connections: Flanged, push-on rubber gasketed, or mechanical joint, as required.
    c. Interior Coating: Complying with AWWA C550.

2.4 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering WATER, bottom section with base of size to fit over valve, and approximately five-inch diameter barrel. Fabricate valve box cover to fit snugly to prevent displacement by traffic.

1. Operating Wrenches: Steel tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

B. Vertical-Type Indicator Posts: UL 789, FM-approved, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve with tamperproof electrical supervisory switch for connection to the fire alarm control panel system.

2.5 VALVE APPLICATION

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FM, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

1. Where specific valve types are not indicated, the following requirements apply:

    a. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated, gate valves with valve box.
    b. Underground Valves, NPS 4 and Larger, for Vertical-Type Indicator Posts: UL/FM, Cast-iron, nonrising-stem gate valves with indicator post.

2.6 WATER METERS

A. Water meter(s) indicated on drawings shall be installed by the local water purveyor for the area, unless noted otherwise.

2.7 BAC FLOW-PREVENTION DEVICES

A. General: FM Approved, AWWA, UL Classified, Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California.

1. Working Pressure: 175 pounds per square inch (psi) minimum, unless otherwise indicated.
2. Interior Components: Corrosion-resistant materials.
3. Exterior Components: Assembly shall be provided with flanged connections, galvanized cast-iron or epoxy coated construction.

B. Reduced-Pressure-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2, air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

C. Double-Check-Detector Assembly Backflow Preventers: Suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer. Include tamperproof electrical supervisory switch for connection to tie the fire alarm control panel system.

2.8 FIRE HYDRANTS

A. Before procurement, verify approval has been issued by the Fire Department having jurisdiction.

B. Wet-Barrel Fire Hydrants: AWWA C503 or UL 312, one NPS 4 and two NPS 2-1/2 outlets, NPS 6 threaded or flanged inlet, and base section with NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have 150 pounds per square inch gauge (psig) minimum working-pressure design.

1. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
2. Operating and Cap Nuts: Pentagon, one-and-one-half inches point to flat.
3. Direction of Opening: Open hydrant valves by turning operating nut to left or counterclockwise.

C. Combined length of bury and extension shall be as indicated. Where not indicated, install top of hydrant flange three inches above finished surface.

D. Exterior Finish: “O.S.H.A. safety yellow” Ameritone 719 or approved equal after receiving a prime coat.

2.9 FIRE DEPARTMENT CONNECTIONS

A. Connections: UL 405, cast-bronze body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch high brass sleeve; and round escutcheon plate, and all appropriate check valves per NFPA 24.

1. Escutcheon Plate Marking: .

PART 3 - EXECUTION – NOT USED

END OF SECTION 33 11 00

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SECTION 33 31 00 – SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure sanitary sewerage outside the building, with the following components:

1. Cleanouts.
2. Precast concrete manholes.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

A. Manufacturer's product data for pipe and fittings.

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.4 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded, Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.5 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: Forty-eight inches, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: Six-inch minimum thickness for floor slab and four-inch (100-mm) minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.
5. Top Section: Eccentric-cone type, unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. oint Sealant: ASTM C 990, bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.

10. Grade Rings: Reinforced concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording SANITARY SEWER.

    a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48/A 48M, Class 35 gray iron, unless otherwise indicated.

2.6 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification: Light, Medium, Heavy, and Extra-heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.

1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.

    a. Invert Slope: Two percent through manhole unless otherwise noted.

2. Benches: Concrete, sloped to drain into channel.

    a. Slope: Four percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3,250 pounds per square inch (psi) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

PART 3 - EXECUTION – NOT USED

END OF SECTION 33 31 00

SECTION 33 41 00 – STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage pipe and drainage structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.3 SUBMITTALS

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

B. Field quality-control test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

2.3 CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) HDPE PIPE AND FITTINGS

A. HDPE Drainage Pipe and Fittings, NPS 4 to NPS 10: AASHTO M252, Type S, with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seals.

B. HDPE Drainage Pipe and Fittings, NPS 12 to NPS 60: AASHTO M294, Type S, or ASTM F2306 with bell-and-spigot ends. Gasketed joints shall be soil-tight with ASTM F 477, elastometric seal.

2.4 PVC PIPE AND FITTINGS

A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

B. PVC Sewer Pipe and Fittings, NPS 18 and Larger: ASTM F 679, T-2 wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.5 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Shielded Flexible Couplings: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.6 CLEANOUTS

A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.7 MANHOLES

A. Standard Precast Concrete Manholes: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Diameter: Forty-eight inches minimum, unless otherwise indicated.
2. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
3. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
4. Riser Sections: Four-inch minimum thickness, and of length to provide depth indicated.

5. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
6. oint Sealant: ASTM C 990 bitumen or butyl rubber.
7. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
8. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, one-half-inch steel reinforcing rods encased in ASTM D 4101, PP wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
9. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and diameter matching manhole frame and cover. Include sealant recommended by ring manufacturer.
10. Grade Rings: Reinforced-concrete rings, six- to nine-inch total thickness, to match diameter of manhole frame and cover.
11. Manhole Frames and Covers: Ferrous; 24-inch ID by seven- to nine-inch riser with four-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording STORM DRAIN.

    a. Material: ASTM A 536, Grade 60-40-18 ductile iron or ASTM A 48, Class 35 gray iron, unless otherwise indicated.

2.8 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.
5. Ballast and Pipe Supports: Portland cement design mix, 3,000 pounds per square inch (psi) minimum, with 0.58 maximum water-cementitious materials ratio.

    a. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
    b. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.9 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: Six-inch minimum thickness for floor slab and four-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Top Section: Eccentric-cone type unless flat-slab-top type is indicated.
3. oint Sealant: ASTM C 990, bitumen or butyl rubber.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16 (heavy traffic) structural loading unless otherwise indicated. Include 24-inch ID by seven- to nine-inch riser with four-inch minimum width flange, and 26-inch-diameter flat grate with small square or short-slotted drainage openings.

1. Grate Free Area: Approximately 50 percent, unless otherwise indicated.

PART 3 - EXECUTION – NOT USED

END OF SECTION 33 41 00

SECTION 33 46 00 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes subdrainage systems for retaining walls.

1.2 SUBMITTALS

A. Product Data: For perforated pipe, fitting and drainage panel.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated plastic pipe shall be either smooth-wall polyvinyl chloride plastic pipe, corrugated polyvinyl chloride plastic pipe with a smooth interior surface, or corrugated polyethylene plastic tubing.

1. Smooth-wall polyvinyl chloride plastic pipe shall conform to the requirements in AASHTO Designation: M 278.
2. Corrugated polyvinyl chloride plastic pipe with a smooth interior surface shall conform to the material and structural requirements in AASHTO Designation: M 278. The pipe shall have perforations located in the bottom half of the pipe, and the perforations shall consist of slots meeting the size and opening area requirements in AASHTO Designation: M 252. The inside diameter and diameter tolerances shall conform to the requirements of either AASHTO Designation: M 252 or M 278.
3. Corrugated polyethylene plastic tubing shall conform to the requirements in AASHTO Designation: M 252 or M 294.

2.2 PERFORATIONS

A. Perforations per ASTM F 758, section 7.2.4., and Table 5.

1. NPS 4: two rows of perforations.
2. NPS 6 and 8: Four rows of perforations
3. NPS 10 and larger: Six rows of perforations.

2.3 FITTINGS

A. Polyvinyl chloride pipe shall be connected with belled ends, or with sleeve-type or stop-type couplings conforming to the requirements in AASHTO Designation: M 278. Polyethylene tubing shall be connected with snap-on, screw-on, or wrap-around fittings and couplings conforming to the requirements of AASHTO Designation: M 252 or M 294. Solvent cementing of joints will not be required.

2.4 SPECIAL PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant metal tension band and tightening mechanism on each end.

1. Unshielded Flexible Couplings: Elastomeric sleeve with corrosion-resistant metal tension band and tightening mechanism on each end.

2.5 DRAINAGE PANELS

A. Molded-Sheet Drainage Panels: Prefabricated geocomposite, 36 to 60 inches wide with drainage core faced with geotextile filter fabric.

1. Manufacturers:

a. American Wick Drain Corporation – Amerdrain.
b. Cosella-Dorken.
c. CCW – MiraDrain.
d. Eljen Corp.
e. Greenstreak, Inc.
f. DR Enterprises, Inc.
g. LINQ Industrial Fabrics, Inc.
h. Midwest Diversified Technologies Incorporated.
i. TC Mirafi.
j. Any equivalent manufacturer.

2. Prefabricated Drainage Core: Three-dimensional, nonbiodegradable, molded PP or PS. Select prefabricated drainage core recommended by the manufacturer for the type of application specified elsewhere in the contract documents.

a. Minimum Compressive Strength: 10,000 pound force (lbf)/square foot according to ASTM D 1621.
b. Minimum In-Plane Flow Rate: Ten gallons per minute (gpm)/foot according to ASTM D-4716.

3. Filter Fabric: Nonwoven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties:

a. Grab Elongation: 60 percent maximum according to ASTM D-4632.
b. Apparent Opening Size: No. 70 sieve, minimum according to ASTM D-4751.
c. Water Flow Rate: 165 gpm/square foot according to ASTM D-4491.

2.6 SOIL MATERIALS

A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 2 Section Earthwork.

2.7 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gallons per minute (gpm)/square foot when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament.
2. Style(s): Flat and sock.

PART 3 - EXECUTION – NOT USED

END OF SECTION 33 46 00

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SECTION 48 14 00
SOLAR ENERGY ELECTRICAL POWER GENERATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, testing, and commissioning of solar energy electrical power generation systems.

B. The requirements of this Section apply to all sections of Division 26 related to solar energy electrical power generation systems.

1.2 RELATED WOR

A. Section 26 0000, Requirements that apply to all sections of Division 26.

B. Section 26 0170, DISCONNECTS: Requirements for enclosed disconnect switches.

1.3 DEFINITIONS

A. Unless otherwise specified or indicated, solar energy conversion and solar photovoltaic energy system terminology used in these specifications, and on the drawings, shall be as defined in ASTM E772.

1.4 QUALITY ASSURANCE

A. Products and Services pertaining to this specification shall comply with Section 26 0000, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Solar Energy Electrical Power Generation System installer(s) shall demonstrate that they have successfully installed at least four projects within the past five years that, in aggregate, equal or exceed the size of the proposed project. The installer(s) shall provide written references for each of the referenced qualified projects to EOR.

C. Supports and racking for solar photovoltaic system installations shall be prepared by a licensed Structural Engineer whose structural engineering license is current and valid. For roof top installations on an existing structure, the engineer shall provide review and structural analysis of the existing structure to ensure that the existing structure shall safely support the proposed installations. The engineer shall submit to relevant Building Departments the required design documents such as engineering calculations, drawings, the environmental loading analyses (including wind, snow, hail, and where applicable, seismic), and the rack and substrate's ability to withstand these environmental forces.

D. If paralleling arrangement is desired, the system shall have anti-islanding capability such that it is incapable of exporting power to the utility distribution system in the absence of utility power. Paralleling must be approved by serving electric utility. Provide written correspondence from the utility confirming its requirements.

F. Investigate whether the Owner's environmental entities require environmental impact studies which may include, but are not limited to, effects upon wildlife. The Contractor shall determine which entity has jurisdiction over environmental matters and shall make appropriate inquiry and comply with all applicable regulations.

G. Investigate any other local ordinances that may apply to installation of a solar energy electrical generating system in the proposed location. Bring any conflicts with the drawings and specifications to the attention of the Owner's Representative.

H. Warranties: The solar energy electrical generating system warranty period shall be as noted for the items below:

1. Solar photovoltaic modules and inverter: 10 year manufacturer's warranty against defects in materials and workmanship.
2. Power output: 25 year manufacturer's power output warranty, with the first 10 years at 90% minimum rated power output and the balance of the 25 years at 80% minimum rated power output.

1.5 SUBMITTALS

A. Where proposed system shall be a Net Meter project, prepare appropriate applications and submittals to the Owner Representative and local utility. In all cases, the serving electric utility may have a requirement for further electrical studies, which may include or not be limited to power factor analysis, short circuit protection studies, grid wiring adequacy, or capacities of upstream equipment. If such requirements exist and are required by the serving electric utility, these requirements shall be fulfilled by the Contractor. Provide written documentation confirming the utility's approval of the interconnection of the solar energy electrical power generation system with the utility system to the Owner's Representative.

B. Submittals shall comply with paragraph, SUBMITTALS, in Section 26 0000, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
    a. Submit sufficient information to demonstrate compliance with drawings and specifications.
    b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, wiring and connection diagrams, accessories, and nameplate data.
    c. Include shop drawings for foundations and other support structures.
2. Product Data:
    a. Include detailed information for components of the solar energy electrical generation system.
        1. Wiring.

2. Inverter.
3. Photovoltaic modules.
4. Rack and support assemblies.
5. Instrumentation.
6. Switchgear.
7. DC and AC disconnects.
8. Combiner boxes.
9. Monitoring systems // including appropriate interfacing with existing facility data collection systems//.

b. Certification from the manufacturer that the system has been seismically tested to International Building Code requirements. Certification shall be based upon simulated seismic forces on a shake table or by analytical methods, but not by experience data or other methods.

3. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering replacement parts.
      1. Safety precautions.
      2. Operator restart.
      3. Startup, shutdown, and post-shutdown procedures.
      4. Normal operations.
      5. Emergency operations.
      6. Environmental conditions.
      7. Preventive maintenance plan and schedule.
      8. Troubleshooting guides and diagnostic techniques.
      9. Wiring and control diagrams.
      10. Maintenance and repair procedures.
      11. Removal and replacement instructions.
      12. Tracking systems (where applicable).
      13. Spare parts and supply list.
      14. Parts identification.
      15. Testing equipment and special tool information.
      16. Warranty information.
      17. Testing and performance data.
      18. Contractor information.

b. If changes have been made to the maintenance and operating manuals originally submitted, then submit updated maintenance and operating manuals two weeks prior to the final inspection.

4. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturers of all major items of the solar energy electric generation system that the system conforms to the requirements of the drawings and specifications, and that they have jointly coordinated and properly integrated their equipment and controls to provide a complete and functional installation.
   b. Certification by the Contractor that the solar energy electric generation system has been properly installed, adjusted, tested, commissioned, and warrantied. Contractor shall make all necessary field measurements and investigations to ensure that the equipment and assemblies meet contract requirements.
5. Estimated Annual Power Output: Submit calculated annual power output for each of the proposed solar photovoltaic systems. Provide independent calculations for each fixed, single-axis tracking, or double-axis tracking system.

C. If equipment submitted differs in arrangement from that shown on the drawings, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract and acceptable to the Owner's Representative.

D. Submittals and shop drawings for independent but related items shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group. Final review and approval will be made only by groups.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Society for Testing and Materials (ASTM):
E772-15 (R2021)..... Standard Terminology of Solar Energy Conversion
E1038-10 (R2019)..... Standard Test Method for Determining Resistance of Photovoltaic Modules to Hail by Impact with Propelled Ice Balls

C. Institute of Electrical and Electronics Engineers (IEEE):
519-22 ..... Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
937-19 ..... Recommended Practice for Installation and Maintenance of Lead-Acid Batteries for Photovoltaic (PV) Systems

1013-19 ..... Recommended Practice for Sizing Lead-Acid Batteries for Stand-Alone Photovoltaic (PV) Systems
1361-14 ..... Guide for Selection, Charging, Test and Evaluation of Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems
1526-20 ..... Recommended Practice for Testing the Performance of Stand-Alone Photovoltaic Systems
1547-18 ..... Standard for Interconnecting Distributed Resources with Electric Power Systems
1561-19 ..... Guide for Optimizing the Performance and Life of Lead-Acid Batteries in Remote Hybrid Systems
1562-21 ..... Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV) Systems
1661-19 ..... Guide for Test and Evaluation of Lead-Acid Batteries Used in Photovoltaic (PV) Hybrid Power Systems

D. International Code Council (ICC):
IBC-21 ..... International Building Code
E. National Electrical Manufacturer's Association (NEMA):
250-20 ..... Enclosures for Electrical Equipment (1,000 Volts Maximum)
F. National Fire Protection Association (NFPA):
70-23 ..... National Electrical Code (NEC)
70E-21 ..... Electrical Safety in the Workplace
G. Underwriters Laboratories (UL):
6-22 ..... Electrical Rigid Metal Conduit – Steel
94-23 ..... Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Ed 6
797-07 ..... Electrical Metallic Tubing – Steel
969-17 ..... Standard for Marking and Labeling Systems
1242-06 ..... Standard for Electrical Intermediate Metal Conduit – Steel
1703-02 ..... Standard for Flat-Plate Photovoltaic Modules and Panels
1741-21 ..... Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide materials to fabricate functioning photovoltaic system in accordance with ASTM, IEEE, NEMA, NFPA, and UL, as specified in this section, and as shown on the drawings.

B. Factory-prefabricated solar equipment packages which include photovoltaic modules, batteries or other energy storage, inverters, and controls and which meet the requirements of this section are acceptable.

2.2 GROUNDING

A. All applicable components of the solar energy electrical power generating system must be grounded per latest NEC requirements.

B. DC Ground-Fault Protector:

1. Shall be listed per UL 1703.
2. Shall comply with requirements of the NEC.

2.3 PHOTOVOLTAIC ARRAY CIRCUIT COMBINER BOX

A. Shall be listed to UL 1741.

B. Shall include internal overcurrent protection devices with dead front.

C. Shall be contained in non-conductive NEMA Type 4X enclosure.

D. Up to 48 volts DC: Shall use UL-listed DC breakers that meet NEC requirements for overcurrent protection.

E. Up to 600 volts DC, paralleling system: Shall use fuses instead of breakers.

F. Ground and pole-mounted arrays shall have a separate combiner box mounted to the pole itself.

G. Where applicable, combiner box shall be a disconnecting combiner box.

2.4 SWITCH/DISCONNECTING MEANS

A. Shall be UL-listed, in accordance with the NEC, as shown on the drawings, and as specified.

B. Utility External Disconnect Switch (UEDS): Coordinate requirements with serving electric utility.

2.5 WIRING SPECIALTIES

A. Direct Current Conductors:

1. If Exposed: Shall be USE-2, UF (inadequate at 60□C 140□F), or SE, 90□C 194□F wet-location rated and sunlight-resistant (usually for tracking modules).
2. If in Conduit: Shall be RHW-2, THWN-2, or XHHW-2 90□C 194□F , wet-location rated.

B. Conduits and Raceways:

1. Shall use steel conduit listed per UL 6, UL 1242, UL 797 (as appropriate), except for tracking modules. Weathertight EMT installations shall be allowed for DC wiring in weather-protected areas.
2. Shall use expansion joints on long conduit runs and seismic joints.

3. Shall not be installed on photovoltaic modules.

C. Enclosures subject to weather shall be rated NEMA 3R or better.

D. Cable Assemblies and unction Boxes:

1. Shall be UL-listed.
2. Shall be rated to 5VA flammability per UL 94.

E. Prohibited Wiring Materials: Those which are not UL-listed, or listed materials used in environments outside those covered in their listing.

2.6 DC-AC INVERTER

A. Shall be listed to UL 1741.

B. Shall comply with IEEE 519 and IEEE 1547.

C. Shall be listed per FCC Part 15 Class A.1.

D. Shall have stand-alone, utility-interactive, or combined capabilities.

E. Shall include maximum power point tracking (MPPT) features.

F. Shall include anti-islanding protection if paralleling arrangement is required.

2.7 SOLAR PHOTOVOLTAIC (PV) MODULES

A. Minimum Performance Parameters as per UL 1703.

B. Photovoltaic Panel Types:

1. Monocrystalline: Listed to UL 1703.
2. Polycrystalline: Listed to UL 1703.
3. Thin-Film/Flexible: Listed to UL 1703.
4. Building-Integrated Solar Shingles: Listed to UL 1703.

C. Module and System Identification

1. Module or Panel:
   a. Listed to UL 969 for weather resistance.
   b. Listed to UL 1703 for marking contents and format.
2. Main Service Disconnect: per NEC.
3. Identification Content and Format: per NEC.
4. Identification for Inverter: per NEC.

D. Bypass diodes shall be built into each PV module either between each cell or each string of cells.

E. Other Components: per UL 1703.

F. Hail Protection: Compliant with testing procedure per ASTM E-1038.

G. Lightning Protection: Shall ground according to manufacturer instructions per UL 1703.

H. Access, Pathways, and Smoke Ventilation: Per IFC 605.3, access and spacing requirements must be observed in order to: ensure access to the roof, provide pathways to specific areas of the

roof, provide for smoke ventilation opportunities area, and, where applicable, provide emergency access egress from the roof.

I. Fire Classification:
   1. IBC 1505.8 for building-integrated photovoltaic and solar shingles.
   2. IBC 1509.7.2: Although not technically enforceable, every effort shall be made to ensure the solar photovoltaic module is not combustible.

2.8 BATTERY CHARGE CONTROLLER

A. Listed per UL 1741.
B. Charge controller or self-regulating system shall be required for a stand-alone system with battery storage. Charge controller's adjusting mechanism shall be accessible only to qualified persons.
C. Shall be capable of withstanding 25% over-amperage while charging for limited time per the NEC.
D. Charge controller shall include maximum power point tracking (MPPT) and temperature compensation.

2.9 BATTERY

A. General: Comply with NEC. Flooded lead-acid, captive electrolyte lead acid and nickel-cadmium are acceptable. Consider climate when selecting battery type.
B. Off-Grid: Always use high-quality, industrial-grade, deep-cycle batteries.
C. Grid-Interactive with Battery Backup: Best to use sealed-absorbed glass mat (AGM) batteries specifically designed for emergency standby or float service.
D. Sizing: For stand-alone systems, size per IEEE 1013, or 1562.
E. Installation and Maintenance: Follow practices per IEEE 937.
F. Test and Evaluation:
   1. Stand-Alone System: Follow procedures per IEEE 1361.
   2. Hybrid System: Follow procedures per IEEE 1661.
G. Optimize Performance and Life: Follow practices per IEEE 1561.
H. Safety and Ventilation:
   1. Use protective enclosure and proper ventilation per the NEC.
   2. Exposed battery terminals and cable connections shall be protected, and live parts of batteries shall be guarded. Batteries should be accessible only to a qualified person via locked room, battery box, or other container.
   3. Spacing around battery enclosures and boxes and other equipment shall be at least 915 mm 36 inches ; batteries shall not be installed in living areas, or below enclosures, panelboards, or load centers.

4. Prohibited are conductive cases for flooded, lead-acid batteries operating above 48-volt nominal. Battery racks shall have no conductive parts within 155 mm 6 inches of the tops of cases.
5. To reduce risk of electric shock, storage batteries in dwellings shall operate at less than 50 volts (48-volt nominal battery bank). Live parts of any battery bank shall be guarded.

I. Interconnection:
1. Per NEC, battery cables shall be a standard building wire type conductor. Welding and automobile “battery” cables (listed and non-listed) are prohibited.
2. Flexible cables, listed for hard service use and moisture resistance, are permitted (not required) from battery terminals to nearby junction box and between battery cells. Flexible, highly-stranded building-wire type cables (USE/RHW and THW) are available. Battery terminals shall be compatible with flexible cables.//

2.10 COLLECTOR SUPPORTS

A. Wind Resistance Requirement:
1. For rack-mounted: per IBC 1509.7.1.
2. For building-integrated photovoltaic and solar shingles: IBC 1507.17.3.

B. Mechanical Load Requirement: per UL 1703.

C. Ground and Pole Mount:
1. Foundations shall be designed by a licensed Professional Structural Engineer (PE).
2. Where possible, combiner boxes shall be mounted directly to the pole itself.

2.11 INSTRUMENTATION

A. Meters: If applicable and system is grid-connected, use net smart meter provided by the serving electric utility.

B. Sensors:
1. Temperature sensor shall be a component in the MPPT control system.
2. May install additional data acquisition sensors to measure irradiance, wind speed, and ambient and PV module temperatures. Any additional sensors shall require a conduit separate from the current conductor conduit.

C. Data logger/Monitoring System: Shall be a packaged system capable of string-level monitoring or in the case of micro-inverters, capable of monitoring and logging an individual module’s information.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install the solar photovoltaic system in accordance with the NEC, this section, and the instructions of the manufacturer.

B. Prior to system start-up, ensure no copper wire remains exposed with the exception of ground wire as allowed in certain circumstances per manufacturer's instructions.

C. Seismic areas, systems shall be adequately anchored and braced per details per structural engineer to withstand seismic forces at the locations where installed.

D. Wiring Installation: Workers shall be made aware that photovoltaic modules are energized electrically when there is any ambient light source; therefore, workers shall take appropriate safety precautions to prevent accidents. Utilize on-site measurements in conjunction with the design drawings to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. All cabling shall be mechanically fastened. If the system is roof-mounted, it shall have direct current ground fault protection according to NEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.

E. Instrumentation: Install instruments as recommended by the manufacturer. Locate control panels inside a room accessible only to qualified persons.

F. Rack-Mounted Photovoltaic Installations: Rack-mounted photovoltaic modules shall be installed in accordance with the manufacturer's installation instructions.

H. Provide safety signage.

3.2 FIELD QUALITY CONTROL

A. Field Inspection: Perform in accordance with manufacturer's recommendations. Prior to initial operation, inspect the solar energy electrical power generation system for conformance to drawings, specifications, and NEC. In addition, include the following:

1. Visual Inspection and Tests:
    a. Compare equipment nameplate data with specifications and approved shop drawings.
    b. Inspect physical, electrical, and mechanical condition.
    c. Verify required area clearances.
    d. Verifying tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
    e. Verify the correct operation of all sensing devices, alarms, and indicating devices.
    f. Verify that all cable entries from top of junction boxes are sealed per junction box rating.
    g. Verify all connections and integrity of printed circuit boards in all applicable junction boxes.

B. Tests: Provide equipment and apparatus required for performing tests. Correct defects disclosed by the tests and repeat tests. Conduct tests in the presence of the EOR and Project Manager.

1. Module String Voltage Test: Prior to connecting wiring to the combiner box, use a digital multi-meter to ensure each series string's polarity is correct.
2. Operational Tests: Perform tests in accordance with the manufacturer's written recommendations. Tests for stand-alone systems shall be performed per IEEE 1526.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall show by demonstration in service that the solar photovoltaic electrical power generation system is in good operating condition and properly performing the intended function.

3.4 COMMISSIONING

A. Comply with the requirements of Section 260000 for commissioning.
B. Only qualified personnel shall connect the solar photovoltaic electrical power generation system to the serving electric utility grid.
C. If the system is grid-tied, the Contractor shall coordinate with the serving electric utility to establish an interconnection agreement.
D. Connect the solar photovoltaic electrical power generation system to the serving electric utility grid only after receiving prior approval from the utility company.

3.5 INSTRUCTION

A. A complete set of operating instructions for the solar photovoltaic electrical power generation system shall be laminated or mounted under acrylic glass and installed in a frame near the equipment.
B. Furnish the services of a factory-trained technician for one, 4-hour training period for instructing personnel in the maintenance and operation of the solar photovoltaic electrical power generation system, on the date requested by the Project Manager.

---END---