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SECTION 2100

SITE FURNISHINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Benches
- B. Bicycle Racks

1.2 RELATED WORK

- A. None

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Provide products manufactured by:
 - 1. QCP Corp. (866) 703-3434
 - a) C2 Bench (Q2-C272B)
 - 2. Anova Site Furnishings (800) 325-3047
 - a) Tandem Bike Rack (#CIRCLEBR)

2.2 MATERIALS

- A. Wood: IPE
- B. Galvanized Steel: ASTM A53 or A120 pipe; ASTM A123 or A153 zinc coating on fabricated steel parts after fabrication (hot-dip galvanized).
- C. Concrete or Non-Shrink Grout: As recommended by site furnishings manufacturer or vendor.

2.3 RECYCLED CONTENT

- A. Recycled Material Content: Minimum 90%.

2.4 STEEL AND GALVANIZED-STEEL FINISHES

- A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.4 IRON FINISHES

- A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.5 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run directional finishes with long dimension of each piece.
 - 2. Directional Satin Finish: No. 4.
 - 3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

- B. Dimensions upon which Work of this Section may be contingent are to be verified at the project site to ensure proper placement and fit of equipment in the allotted areas.
- C. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- D. Set site furnishings plumb, level, and true to line with a neat and finished appearance. Include setting each item in its correct place, fastening it, connecting it, or incorporating it into other portions of the Work, as each item may require; testing and operating equipment to assure proper function.
- E. Include the providing of anchors and adhesives required for installing and attaching the items specified, in accordance with manufacturer's printed specifications.
- F. Keep the premises free from accumulation of waste materials and rubbish caused by this Work. Remove waste materials as specified in other Sections of these specifications.

END OF SECTION 02100

SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

- 1.01 DESCRIPTION: Division 1 applies to this Section. Provide and perform site preparation and earthwork as indicated, specified, and required.

A. Work In This Section: Principal items include:

1. Site clearing.
2. Excavation, filling, backfilling, and compaction.
3. Imported fill material as required.
4. Sand fill under floor slabs.
5. Control of surface and ground water.
6. Testing and inspection of work of this Section.
7. Clean up and disposal.

B. Related Work Not In This Section:

1. Vapor barrier under floor slabs.
2. Excavating and backfilling for underground utility systems.
3. Landscaping including planting fill and irrigation systems.

- 1.02 QUALITY ASSURANCE: The Soils Report shall control all aspects of this Work. If a discrepancy occurs between this specification and the Soils Report, the Soils Report shall take presidency.

A. Professional Observation: Perform Work of this Section under the inspection and approval of the Geotechnical Engineer. Give Geotechnical Engineer not less than 48 hours advance notice of readiness for inspection.

B. Source Quality Control: Obtain approval by Geotechnical Engineer of imported fill material before material is brought to site, and same approval of excavated material for use in fills or backfills prior to placing.

C. Requirements of Regulatory Agencies: Conform off-site excavation, backfill, and compaction to requirements of public authorities having jurisdiction. Obtain and pay for required permits and inspections.

- 1.03 JOB CONDITIONS:

A. Data: Maps, boring logs, geotechnical and foundation investigation reports, and similar reference data, not included in Contract Documents but made available to

Contractor by Architect or Owner, are for information only and the Architect and Owner assume no responsibility for any conclusions Contractor may draw from such information. Contractor shall determine all existing conditions under which he will operate in performing the Work. A copy of the Report of Geotechnical Study for the Proposed Anthony Munoz Community Center Gymnasium 1242 West 4th Street, Ontario, CA by Kleinfelder Project No. 20236170.006A dated June 24, 2024 and revised March 26, 2026 is provided as a part of the Bid Documents,

- B. Protection:** Provide and maintain protection to retain earth banks and protect adjoining grades and structures from caving, sliding, erosion, or other damage. Provide suitable protection against all bodily injury. Construct all bulkheads and shoring to requirements of State and Local codes and regulations. Shore vertical banks or slope banks back as required for stability and safety. Erect temporary barricades located at least 5-feet away from the top of slopes, and provide temporary berms as required to prevent slope erosion from water.
- C. Shoring:** Contractor shall employ and pay a California registered civil engineer to prepare and stamp drawings and calculations showing the shoring methods, soldier piles, tie back anchoring, wall support systems, and other systems used for protection of all adjacent existing structures and improvements and for all earth banks, shall submit shoring drawings and calculations to Geotechnical Engineer and Structural Engineer for discussions but not for approval, shall obtain Building Department approval prior to start of any construction involving shoring and pay fees and charges, and file three copies of the Building Department approved drawings and calculations with the Architect for record purposes only and not for review or approval. Frequently inspect all shoring for deflections during construction. Refer to the Geotechnical Investigation Report.
- D. Dewatering:** Keep the whole of the excavations continuously free from water and fluids of any kind. Shoring drawings and calculations shall be accompanied by detailed drawings, calculations, and written description of methods, materials, and procedures to be used in dewatering operations, prepared for record purposes only and not for review or approval.

PART 2 - PRODUCTS

2.01 MATERIALS: Provide approved imported material as required if the quantity of approved site and excavated material is insufficient to complete the Work.

- A. Earthwork Materials:** Approved excavated or imported granular earth material such as silty sand of the non-expansive type (that undergoes no undesirable volumetric change with changes in moisture content) and containing not more than 20% by weight of material passing the No. 200 sieve, free from trash, roots,

organic material, clay lumps, and rocks over 6" size.

B. Soil Materials:

1. General Materials: Any primarily non-expansive granular materials, imported or from cut areas, that are suitable for intended use in Geotechnical Engineer's opinion, free of rocks or hard lumps larger than 6" size, having at least 40% of material smaller than 1/4" size with a maximum 20% by weight of material passing a No. 200 sieve, free of trash, debris, roots, clay lumps, and organic material. Do not use materials of a perishable, spongy, or otherwise improper kind. Refer to the Geotechnical Investigation Report.
2. Select Material: As specified above for general materials, swell limited to less than 3% when the material is compacted as specified for compacted fills and soaked under an axial pressure of 160 pounds per square foot.
3. Trench Backfill Material: As specified above except materials in the pipe zone and to 12" above the pipe barrel shall contain no rocks or hard lumps over 1" size.

C. Gravel Fill Material: From an approved source, 90% to 100% passing the 3/4" sieve, 0% to 10% passing a No. 4 sieve, and 0% to 3% passing a No. 100 sieve. Crushed rock of same gradation may be used.

D. Pea Gravel Backfill Material: From an approved source, 100% passing 3/4" sieve, 95% to 100% passing 3/8" sieve, 0% to 5% passing the No. 4 sieve, and 0% to 5% passing the No. 8 sieve.

E. Sand Equivalent: ASTM D2419, California Sand Equivalent values not below 80 percent.

2.02 **ABANDONED UTILITIES:** Abandoned utilities within the proposed building areas should be removed in their entirety. Utilities within the proposed building areas would only be considered for in-place abandonment provided they do not conflict with new improvements, that the ends and all laterals are located and completely grouted, and the previous fills associated with the utility do not pose a risk to the structures.

Utilities outside the building areas should be removed or abandoned in-place by grouting or plugging the ends with concrete. Fills associated with utilities abandoned in-place could pose some risk of settlement; utilities that are plugged could also pose some risk of future collapse or erosion should the leak or become damaged.

2.03 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 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

3.01 **SITE CLEARING AND PREPARATION:** Before starting grading, remove all trash and strip all vegetation on the site, including roots. After stripping, excavate and remove all existing fill and disturbed natural soils. Excavate to allow for placing of fills and other materials. Remove remaining unsuitable deposits as directed by Geotechnical Engineer and backfill as specified herein for fills and backfills.

3.02 **DEWATERING REQUIREMENTS:** Contractor shall be experienced in the installation and operation of the types of dewatering system to be used and shall maintain on the job a superintendent of proven experience and capability throughout entire dewatering operation. Dewatering requirements herein apply to this Section and all other Sections which require the performance of earthwork or installation of Work at or below the ground water elevation.

A. Required: Provide necessary facilities and equipment to dewater excavations and to construct the below-grade work in the dry and on stable subgrades, including without limitation all necessary shoring, sheeting, sheet piling, lagging, well points, pumps and piping, recharging equipment if required, means to dispose of removed water without damage to existing grades and Work and without pollution of public or private property or receiving waters, and standby pumps and related equipment of adequate capacity to maintain dewatered conditions in case primary dewatering equipment fails. The method of water disposal shall conform to Code. Maintain dewatering systems in place and operable until below-grade construction in dewatered areas is completed, tested as required, and removal is approved.

B. Operation: Perform dewatering as a continuous uninterrupted operation until new Work in dewatered excavations is entirely constructed, waterproofing is tested, and backfill placed and compacted to an elevation at least 18" above the

highest existing ground water elevation.

- C. Recharging:** At any time during dewatering operations the ground water drawdown or water migration rate is sufficient to endanger the existing soils or Work in place, immediately install and operate a ground water pumping recharging system to maintain ground water elevation limits that eliminate the danger.
- D. Rock Blankets:** Provide crushed rock blankets as necessary to bring ground water to pumps or well points and provide a stable subgrade.
- E. Backfill In Dewatered Excavations:** Place and compact all backfill located below highest natural ground water elevation in dry dewatered excavation with shoring, sheeting, or sheet piling in place and with dewatering system in place and fully operable. Do not place rocks larger than 1-1/2" size within 6" of waterproofed surfaces. Place and compact the backfill as specified for general earthwork.
- F. Testing of Waterproofed Structures:** After backfilling is placed to above ground water elevation, allow the ground water to rise to natural elevation. Examine structure interior for leakage for at least 10 days. If leakage occurs, perform dewatering, excavation, repair, backfilling, and re-testing until all leakage is eliminated as approved.

3.03 EXCAVATION: Perform excavation to the dimensions and elevations indicated on Drawings, with additional space allowed as required for the installation and stripping of forms, and inspection of the various types of Work, except where authority may be given by Architect to deposit certain miscellaneous concrete directly against earth banks. Avoid loosening of soils in bottoms or sides of excavations.

- A. Adverse Subsurface Conditions:** Notify Architect should unsuitable bearing soil or other adverse subsurface conditions be encountered which are not indicated by the Drawings or Specifications.
- B. Unauthorized Excess Excavation:** If excavations are carried below elevations indicated without written authorization, provide satisfactory construction to correct the fault as approved by Soils Engineer, at no extra cost to Owner.

3.03 TRENCHING: Trenching and excavating for buried piping, conduits and related items is performed under other Sections. Trenching operations shall conform to the following requirements:

- A. Trenches:** Excavate trenches to widths required for proper laying of pipe, with banks as nearly vertical as practicable. Bring bottoms of trenches to required

depths, accurately graded to provide uniform bearing on undisturbed soil for entire length of each section of pipe, except where it is necessary to excavate for pipe bells.

- B. Machine Excavation** may be used to rough elevations. Perform fine grading and trimming by hand method.
- C. Trench Backfilling:** Unless Specified in the Geotechnical Report, conform to Paragraph "Compaction" except compact backfill to at least 85% of maximum dry density where trenches are located in paved areas or under building or structures. Precautions shall be taken in the placing and compaction of the backfill to avoid damage to the pipes.

3.04 FILLING AND BACKFILLING:

- A. Soil Materials Usage:** Use soil materials as directed by Geotechnical Engineer and according to the following:
 - 1. General material - for earthwork not otherwise specified or directed by the Geotechnical Engineer.
 - 2. Select material - for fill and backfill within the building prism and for the top 24" of rough grade for paved areas outside the building prism area.
- B. Equipment and Operations:** Perform compaction operations with equipment approved by Geotechnical Engineer, of types and design that uniformly compact material to required densities. Use pneumatic or barco-type hand held tampers in areas that are not accessible to wheeled equipment or machines.
- C. Moisture Content:** Before compacting, bring material to uniform moisture content per Soils Report. Obtain approval of moisture content before performing further grading operations.
- D. Preparation for Fills and Backfills:** After completion of clearing, preparation, and excavation, scarify top 8" of exposed material in both cut and fill areas, moisten or aerate to specified moisture content per Soils Report, and compact to the same density specified for fills.
- E. Compaction:** Moisten or aerate material to the specified moisture content, then uniformly compact fills and backfills in loose layers not over 8" in thickness to 90% of maximum dry density determined by ASTM D1557. This is the minimum compaction; average shall be at least 92%. Flooding or jetting is not allowed.
- F. Backfills:** Do not place backfills until after concrete forms have been removed and pointing and patching of concrete and waterproofing is done and approved.

- 3.05 SUBGRADE PREPARATION FOR CONCRETE: Prepare subgrade for concrete items placed directly on earth by cutting, filling, and grading as required and as specified herein, and bring to optimum moisture content. Finish the subgrade within 3/8" tolerance when measured along a 10-foot straightedge in any direction at any location. Compact to the density specified for fills, and maintain the moisture content until concrete is placed.
- 3.06 ASPHALTIC CONCRETE PAVING AREAS: Bring areas to required elevations and grades by clearing and preparation, cutting, filling, grading, and compacting as shown and as specified herein. Allow for thickness of subsequent materials. Rough grade to required elevations plus or minus 0.05 foot and proof-roll the areas with a 3-wheel 10-ton roller or approved equivalent. Excavate soft or moving areas revealed by proof-rolling and replace with compacted fill as specified under "Compaction" above. Final fine grading and compaction is specified as a part of the paving operations. Coordinate with Section 02513. requirements.
- 3.07 SUB SLAB PREPARATION: As per Civil and Structural Drawings (Sht. S2); 6" slab over 2" sand over 15 mil vapor barrier over 2" sand compacted over finish grade:
- 3.08 LANDSCAPE AREAS: Bring to nominal 0.10-foot below required grades except where topsoil fill occurs, and finish with smoothly curving contours at grade changes and slopes, as approved. Grade to allow for thickness of topsoil fill. Avoid excessive compaction in all areas.
- 3.09 SOIL FRACTURING: Landscape areas where compaction has occurred due to grading activities and where trees or storm water infiltration areas are located shall be loosened by soil fracturing. For trees a 12'x12'x18" deep area; for storm water infiltration, the entire area shall be loosened. The back-hoe method of soil fracturing shall be used to break up compaction. A 4" layer of compost is spread over the soil surface before fracturing is begun. The back-hoe shall dig into the soil lifting and then drop the soil immediately back into the hole. The bucket then moves to the adjacent soil and repeats. The compost falls into the spaces between the soil chunks created. Fracturing shall leave the soil surface quite rough with large soil clods. These must be broken by additional tilling. Tilling in more compost to the surface after fracturing per the soil report will help create an A horizon soil. Imported or reused topsoil can be added on top of the fractured soil as needed for grading. The Landscape Architect or representative shall be present during this process and provide certification of the soil fracturing.
- 3.10 DISPOSAL: Remove surplus and rejected earthwork materials from Owner's property to a legal disposal area. Perform trucking and material handling in a careful manner to prevent spillage and dusting or damage to surfaces and structures. Remove planks used to protect surfaces subject to public traffic at finish of each day's operations. Maintain public streets and sidewalks in broom clean condition.

3.11 FIELD QUALITY CONTROL: Refer to Section 01400.

- A. Testing:** Testing Laboratory will obtain the test samples and perform materials, moisture content, compaction densities, and other tests to the extent and by the methods ordered or directed by the Geotechnical Engineer.
- B. Professional Certificates:** Upon completion, Geotechnical Engineer shall certify in writing to the Architect, Owner, and public agencies having jurisdiction that earthwork and compaction densities conform to the project requirements.
- C. Certified Survey:** Upon completion, Contractor shall provide certified survey of site conditions with 1" contours, top of wall elevations, buildings, roads and utility line locations/depths on AutoCAD compatible CAD file.

END OF SECTION

SECTION 02240

EXCAVATING AND BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide excavating and backfilling for utilities complete as indicated, specified, and required.

A. Work in This Section: Principal items include:

1. Excavating and backfilling for utilities.

B. Related Work Not in This Section:

1. Section 02200 – Site Preparation and Earthwork.

1.02 QUALITY ASSURANCE:

A. Standard Specifications: Standard Specifications for Public Works Construction, Current Edition, herein referred to as "SSPWC".

1. Conform to latest Edition and supplements of the SSPWC.
2. In all referenced sections, the term "Engineer" means Architect. The term "Agency" means Owner.
3. All terms and definitions referred to shall not supersede such terms or definitions of General Conditions of these Specifications.
4. Reference paragraphs and sections concerning "Measurement" and "Payment" are deleted.

B. Qualifications of Workmen: Provide at least one person who shall be present at all times during execution of the work, who shall be thoroughly familiar with the design requirements, materials, and methods needed for their execution, and who shall direct all work performed under this Section. Provide adequate numbers of workmen skilled in the necessary crafts and properly informed in the methods to be used.

1.03 JOB CONDITIONS:

A. Protection of Utilities: Protect existing utilities indicated or made known of.

B. Protection of Trees: Protect existing landscaping as indicated on plans or otherwise instructed.

C. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights those excavations occurring on property adjacent to or with public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

D. Protection of Workers: All excavations shall conform to the requirements of the

rules, orders, and regulations of the Division of Industrial Safety of the State of California. Prior to commencing the excavation of a trench 5' in depth or greater and into which a person will be required to descend, the Contractor shall first obtain a permit to do so from the Division of Industrial Safety.

- E. Protection of Existing Improvements:** Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- F. Access:** Maintain vehicle and/or pedestrian access across or around excavation when within an existing area where vehicles and/or pedestrians normally use such area for access unless otherwise indicated or specified. Owner may allow closure of area to access when authorized prior to commencing construction operations.
- G. Regulations:** The Contractor shall conform to rules, orders, and regulations of the State of California Construction and General Industrial Safety Orders, the Occupational Safety and Health Act, the Construction Safety Act, and the requirements of all agencies having jurisdiction.
- H. Dust Control:** Use all means necessary to control dust on and near the Work and on and near all offsite borrow areas if such dust is caused by the Contractor's operations during performance of the work, or if resulting from the condition in which the Contractor leaves the site. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and to personnel performing work on the site.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS:

- A. Classification of Soils:** See Soils Report.
- B. Compaction:** Compaction shall be as specified hereinafter but in no case shall density be less than that of existing soil condition.
- C. Backfill and Fill Materials:** Provide acceptable soil materials for back-fill free from organic matter and other deleterious substances and containing no rocks or lumps over 3" in greatest dimension with not more than 20 percent of the rocks or lumps larger than 2" in greatest dimension. Materials shall also conform to Soils Report.
- D. Backfill Sand:** All material used for structural backfill shall be free from organic substance and other deleterious matter and subject to approval.
- E. Concrete:** Concrete shall be as specified for class use in Section 201 of the SSPWC unless otherwise indicated or specified.

- 2.02 OTHER MATERIALS: All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor, subject to approval.

PART 3 - EXECUTION

- 3.01 INSPECTION: Examine the areas and conditions under which excavating, backfilling for utilities are to be performed, and correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until unsuitable conditions have been corrected.
- 3.02 FINISH ELEVATIONS AND LINES: Finish elevations and lines shall meet and match the existing unless otherwise shown in the Drawings.
- 3.03 EXCAVATION:
- A. General:** Perform excavation of every description and of whatever substances encountered to the depths indicated or as otherwise specified. During excavation, store the material suitable for backfilling in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or caving in. Remove all excavated materials not required or suitable for backfill. Provide sheeting and shoring as may be necessary for protection of the work and for the safety of personnel. Sheeting used to support the excavated trench shall be removed by the Contractor, and no such sheeting will be permitted to remain in the trench except when, in the opinion of the Architect, field conditions, the type of sheeting, or methods of construction used by the Contractor, such as the use of concrete bedding, make the removal of sheeting impracticable. In such cases, the Architect may permit portions of the sheeting to be cut off and remain in the trench. All excavation or trenching shall be in accordance with Section 206.1 of the SSPWC.
 - B. Option:** Contractor may, at his option, subject to prior approval of the Architect, use the following methods in lieu of open excavations.
 - 1. Jacking operations in conformance with Section 306-2 of the SSPWC except the requirement of submitting drawings of jacking pit bracing, casing (or conduit), and jacking head proposed to be used will be the responsibility of the Contractor.
 - 2. Tunneling operations in conformance with Section 306-3 of the SSPWC.
 - C. Excavation for Appurtenances:** Excavation for structures shall be sufficient to leave at least 12" in the clear between the outer surfaces and the embankment or shoring that may be used to hold and protect the banks. Any overdepth excavation below such appurtenances that has not been directed will be considered unauthorized and shall be refilled with sand, gravel, or concrete, as directed by the Architect, at no additional cost to the owner.
 - D. Excavation shall be in accordance with the Project Geotechnical Report.**

3.04 TRENCHING:

- A. General:** Trench to the minimum necessary width as indicated for the proper installation of the utility, with sides as nearly vertical as possible. Accurately grade the bottom to provide uniform slopes as indicated for the utility being installed.
- B. Depressions:** Dig bell holes and depressions for joints after the trench has been graded in order that the pipe will rest uniformly within the prepared trench. Except where rock is encountered, take care not to excavate below the depth indicated or specified. Where rock is encountered, excavate it to a minimum overdepth of 4" below the trench depth indicated or specified. Backfill overdepths in rock and unauthorized overdepths with sand or approved loose granular earth, thoroughly tamped.
- C. Depth:** Where utility runs traverse public property or are subject to Municipal, County, or utility company jurisdiction, the depth, bedding, cover, and other requirements shall be as set forth by the legally constituted authority having jurisdiction but in no case shall be less than specified herein. Where rock is encountered, provide no less than a 4" sand bed beneath the pipe.
- D. Existing Landscaping** shall be protected from damage. Lawns or ground cover, prior to excavation or trenching operations, shall be removed in planks or rolls for easy handling. Store for replacement upon completion of work. The removed turf shall be kept moist and in good condition for replacement. Contractor shall replace ground cover and plantings to match the existing prior to removal.
- E. Covers:** Minimum depth shall be as shown on the approved plans or, otherwise, as indicated below to maintain a minimum cover over the top of the pipe, cable, duct, or concrete encasement of duct of pipe, below the finish grade or subgrade surfaces as follows:

 - 1. Water lines: 30"
 - 2. Concrete encased pipe for water lines: 24"
 - 3. Vehicular traffic area is any area a vehicle may use without obstructions, barriers, or obtain access without the use of a special or temporary ramp of any kind.
 - 4. Where utilities or conduits are on the Owner's property within an indicated or designated roadway or drive, the requirements for offsite roadways shall be the minimum cover. Where the work is under street, the requirements of the local agency having jurisdiction shall apply but shall not be less than specified above.
 - 5. Where casings or sleeves are indicated or specified and not concrete encased, the minimum cover shall be from the top of the casing or sleeve.
 - 6. Where utilities are under a concrete structural slab or pavement, the minimum depth need by only sufficient to completely encase the conduit or pipe sleeve, and electrical long-radius risers, provided it does not interfere with the structural integrity of the slab or pavement.
 - 7. Where the minimum cover is not practicable, encase the pipes in concrete no less than 4" all around pipe.

8. In the event water line passes under a gravity drainage line, support the drainage line to prevent sagging until work is completed. If the gravity line is a sanitary sewer line, encase sewer in no less than 4" of concrete for 10'-0" to both sides of crossing.

F. Location: Where utilities or conduit are parallel, pipes shall be arranged vertically in such an arrangement that branches or wye connections may pass over adjoining pipes without special fittings. Fire protection water lines shall be placed as specified in Mechanical Sections.

G. Trenching shall be in accordance with the Project Geotechnical Report.

- 3.05 **BEDDING:** Place the bedding material as required for the individual utility and in accordance with the Project Geotechnical Report.
- 3.06 **REMOVAL OF UTILITY LINES:** When utility lines, that are not made known or indicated, are encountered within the area of operations, notify the Architect in ample time for the necessary measures to be taken to prevent interruption of the service. Service is to be maintained. When it has been determined by the Contractor that the utility is inactive, remove the total line, or where impracticable or possible, remove that portion which interferes with the operation of work. Plug or cap the ends of the remaining portion of the utility in a manner which will make the utility inoperable for use. When all or a portion of the utility will remain indicate location on the record set of drawings (see Section 01700).
- 3.07 **BACKFILLING:**

A. General: All backfilling shall be in accordance with Section 306-1 of the SSPWC. Do not backfill trenches until all required inspections and tests have been performed and until the utilities systems, as installed, conform to the requirements specified in Sections covering the installation of the various utilities. Backfill trenches to the ground surface with sand or selected material that is suitable for the specified compaction. Trenches improperly backfilled shall be reopened to a depth required for proper compaction, then refilled and compacted as specified. Do not allow any of the work performed or installation to be covered up or enclosed by work of this Section prior to all required inspections, tests, and approvals, as specified in the individual Section for the utility to be installed. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at not additional cost to the Owner.

B. Compaction: Compaction shall be in accordance with Section 306-1.3 of the SSPWC with the following exceptions.

1. All relative compaction shall be a minimum of 95 percent of maximum dry density.
2. If any portion of the trench is within an area requiring special compaction, the special requirements shall control.
3. Take special care not to damage the coating or wrapping of pipes, and the insulation of distribution system conduits.

C. Adjacent to Buildings: All backfill shall be mechanically compacted with manual stampers or small vibrating compactors to within 10'-0" of buildings or structures.

D. Backfilling shall be in accordance with the requirements of the Project Geotechnical Report.

3.08 PLACING OF UTILITY: Pipe or conduit shall be placed as specified in the pertinent Section of these Specifications for the utility and in accordance with Section 306-1.2 of the SSPWC.

3.09 RESTORATION OF SURFACES: Saw-cut edges of existing paving which is to remain. Restore the surface as near as practicable to its original condition. Replace surface in areas of existing improvements as specified in Section 306-1.5 of the SSPWC and as specified in paragraph, "Existing Landscaping".

3.10 ABANDONMENT OF CONDUITS AND STRUCTURES: Abandonment shall be in accordance with Section 306-5 of the SSPWC unless otherwise specified or indicated.

3.11 FIELD QUALITY CONTROL:

A. Quality Control Testing During Construction: The Owner's representative will inspect and approve utilities before backfilling, and provide the following:

1. Ensure that trenches are not backfilled until all performance, pressure, and leak tests are performed and approved.
2. Check backfilling for proper layer thickness and compaction.
3. Verify that all test results of underground construction conform to requirements and that sufficient testing has been performed.
4. Ensure that defective work is removed and replaced properly.

B. Utilities subject to a local agency or company jurisdiction shall be tested and inspected in accordance with the requirements of the agency or company. Approval of the agency or company shall be in writing with copy submitted to the Architect.

C. After the Work has been completely tested, inspected, and approved, make repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, at no additional cost to the Owner.

D. Perform Compaction Tests on backfill for all utility lines including storm drains of 12" or greater diameter or width, unless otherwise specified or indicated.

END OF SECTION

SECTION 022509

TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

1.02 DEFINITIONS

- A. Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and defined by a circle concentric with each tree or shrub with a radius 1.25 times the diameter of the drip line unless otherwise indicated.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of organic mulch in sealed plastic bags labeled with composition of materials by percentage of weight, protection-zone fencing and protection-zone signage.
- C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
- D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- F. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1.04 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA, licensed arborist in jurisdiction where Project is located, current member of ASCA, or registered Consulting Arborist as designated by ASCA.
- B. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.
- B. Topsoil: Stockpiled topsoil from location shown on Drawings.
- C. Organic Mulch: Ground or shredded bark, free from deleterious materials.
- D. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements. Previously used materials may be used when approved by Architect.
 - 1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch- diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- OD line posts, and 2-7/8-inch- OD corner and pull posts; with 1-5/8-inch- OD top rails and 0.177-inch- diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - 2. Height of Fencing: 6 feet.

-
- 3. Gates: Swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones.
 - E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Protection Zones: Mulch areas inside protection zones and other areas indicated with 6 inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.02 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones in a manner that will prevent people from easily entering protected area except by entrance gates.
 - 1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install where indicated.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect.
- C. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3.03 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 2000 - Earth Moving.
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots for root pruning.
- C. Do not allow exposed roots to dry out before placing permanent backfill.

3.04 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Temporarily support and protect roots from damage until they are permanently covered with soil.
 - 3. Cover exposed roots with burlap and water regularly.
 - 4. Backfill as soon as possible according to requirements in Section 312000 - Earth Moving.
- B. Root Pruning at Edge of Protection Zone: Prune roots by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.05 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
 - 1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
 - 2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - 3. Cut branches with sharp pruning instruments; do not break or chop.
 - 4. Do not apply pruning paint to wounds.
- B. Chip removed branches and dispose of off-site.

3.06 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- C. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.07 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.08 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 - 2. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 - 3. Perform repairs within 24 hours.
 - 4. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 02250

SECTION 02751

CEMENT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes exterior cement concrete pavement for the following:

1. Driveways and roadways.
2. Parking lots.
3. Curbs and gutters.
4. Walkways.
5. Plazas and Patios

1.03 ALTERNATES

A. Refer to Division 1 Section Alternates for description of Work in this Section affected by alternates.

1.04 SUBMITTALS

- A. Product Data: Submit for each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples for Verification: Cast concrete samples, approximately 12 by 12 by 2 inches, of each color and finish indicated, showing full range of variations expected in these characteristics.
- D. Samples: 5-lb sample of exposed aggregate.

1.05 QUALITY ASSURANCE

- A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.
1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 2. ACI 318, "Building Code Requirements for Reinforced Concrete."
 3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

- C. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Concrete Testing Service: Engage a qualified independent testing agency to design concrete mixes.
- E. Field-Constructed Mockup: Cast 6 foot square mockup of each concrete type scheduled to demonstrate typical joints, surface finish, texture, color, and standard of workmanship. Provide control joint (C.J.) and expansion joint (E.J.) in each mockup.
 - 1. Building mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 - 3. Obtain Architect's approval of mockups before starting construction.
 - 4. If Architect determines that mockup does not meet requirements, demolish and remove it from the site and cast another until the mockup is accepted.
 - 5. Keep approved mockup undisturbed during construction as a standard for judging completed pavement.
 - 6. Demolish approved mockup and remove from site when directed by Architect.
 - 7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section Project Meetings.
 - 1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixes.
 - c. Ready-mix concrete producer.
 - d. Concrete subcontractor.

1.06 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 PRODUCTS

2.01 FORMS

- A. Forms: Metal, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal and to provide full-depth, continuous straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms to form radius bends as required.

- B. Form Release Agent: Provide commercial formulation form-release agent complying with local volatile organic compound (VOC) limitations, that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 40, deformed.
- B. Welded Wire Fabric: ASTM A 185. Furnish in flat sheets.
- C. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars to length with ends square and free of burrs.
- D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's Manual of Standard Practice from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.03 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement, ASTM C 150 Type I or II.
- C. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
 - 1. Class: 4S.
 - 2. Maximum Aggregate Size: +3/4 inch nominal.
 - 3. Do not use fine or coarse aggregates containing substances that cause spalling.
- D. Exposed Aggregate: Selected, hard, and durable; washed; free of material that reacts with cementitious material or causes staining; from a single source, with gap graded coarse aggregate as follows:
 - 1. Aggregate Size: 1/4 inch.
- E. Water: ASTM C94.

2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range Water-Reducing Admixture: ASTM C 494, Type F.
- E. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- F. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.05 CURING MATERIALS

- A. Moisture-Retaining Cover: ASTM C 171, non-staining, reinforced, waterproof sheet.
- B. Water: Potable.
- C. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-yellowing, wax free. Loss of water in the water retention test shall not exceed 0.040-gram per square centimeter of surface. Deliver curing compound in unopened labeled containers.
 - 1. Provide material with maximum volatile organic compound (VOC) rating of 120 g/L.
- D. For Integrally Colored Concrete: Compound recommended by manufacturer of color admixture.

2.06 RELATED MATERIALS

- A. Control Joint Material:
 - 1. Metal: "Keyed-Kold" with retained [removable] cap as manufactured by Burke Concrete Accessories, Inc. Phone (213) 7237286.
 - 2. Preformed Fiber Joint Filler: ASTM D1751 non-extruding preformed bituminous saturated fiberboard units. Plain or punched for dowels as required.
 - 3. Plastic: T-shaped plastic strip with removable top section, 1 inch minimum depth. W.R. Meadows, Speed-E-Joint or Superior Featherweight Zip-Strip.
 - 4. Sealant: Two-Component Polyurethane Sealant; Type M, Grade P, Class 25, Medium Grey Color, Use T. One of the following, or approved equal:
 - a. N.R.-200 Urexpan: Pecora, Corp.
 - b. Sonolastic Paving Joint Sealant: Sonneborn.
 - c. THC-900: Tremco, Inc.

- B. Coloring Agent: ASTM C 979, colored water-reduction set controlling admixtures; color stable, nonfading, and resistant to lime and other alkalis.
1. Color: Match Architect's sample.
 2. Color: As selected by Architect from manufacturer's full range.
 3. Products: Subject to compliance with requirements, provide the following, or approved equal:
 - a. Davis Standard Colors.
- C. Colored Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, nonfading mineral oxides interground with cement.
1. Color: Match Architect's sample.
 2. Color: As selected by Architect from manufacturer's full range.
 3. Products: Subject to compliance with requirements, provide the following, or approved equal:
 - a. Lithochrome Color Hardener; L.M. Scofield Co.
- D. Bonding Agent: ASTM C 1059, Type II, Acrylic emulsion or styrene butadiene.
- E. 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 25 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.
- F. Chemical Surface Retarder: Water-soluble, liquid set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
1. Products: Subject to compliance with requirements, provide one of the following, or approved equal:
 - a. True Etch Surface Retarder; Burke Group, LLC (The).
 - b. Concrete Surface Retarders; Euclid Chemical Co.
 - c. Lithotex; L.M. Scofield Co.
 - d. Rugasol-S; Sika Corporation.
- H. Precast Splash Blocks: 2500 psi concrete, 12 inch by 24 inch by 4 inch, with dense troweled sloping trough through center and raised edges on 3 sides. For all locations where downspouts discharge on earth.
- I. Concrete Wheel Stops: Precast concrete wheel stops, smooth finish, length as shown, minimum 3500 p.s.i. compressive strength, with continuous steel reinforcing. Secure to concrete slabs with epoxy adhesive.
1. Epoxy Adhesive: W.R. Meadows Sealtight Rezi-weld gel paste trowel grade epoxy

adhesive. Mix and apply per manufacturer's instructions.

- J. Tree Grates: Cast iron tree grates, "Century" model, manufactured by Canterbury International, Los Angeles, California 213/936-7111; distributed by David Silverman & Associates, 818/549-0984.
1. Provide tree grates with light ports and steel angle frame.

2.08 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.
1. Do not use the Owner's field quality-control testing agency as the independent testing agency.
 2. Limit use of fly ash to 15 percent of cement content by weight.
- B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:
1. Compressive Strength (28-day): 3000 psi.
 2. Slump Range: 3 inches to 4 inches.
- C. Add air-entraining admixture at manufacturer=s prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
- D. Coloring Agent: Add coloring agent to mix according to manufacturer=s written instructions.

2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.
- B. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and subbase is ready to receive paving.
- B. Remove loose material from compacted subbase surface immediately before placing

concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/8 inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
- C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.03 PLACING REINFORCEMENT

- A. General: Follow CRSI's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

- A. General: Construct control, construction, and expansion joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- B. Tooled Control Joints (CJ):
 - 1. Form tooled control joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of control joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
 - 2. Jointer Tool: 1/4 inch wide at surface, tapered, with top edges rounded to 1/4 inch radius.
 - 3. Location: As shown on drawings, but in any case not more than 15 feet o.c. both ways. Typical sidewalk joints shall be 5 feet o.c. or as directed by Architect.

- C. Plastic Control Joints: Immediately following preliminary troweling, part concrete to depth of 2 inches with #750 Lightweight Cutter Bar. Install plastic joint material so pull-top stiffener is flush with concrete surface. Immediately peel off pull top stiffener. After pull-top is removed, float concrete to fill all voids adjacent to strip. During final troweling, finish edge to a radius not to exceed 1/8 inch using a #335 or #350 slit jointer tool.
- D. Metal Joints: Install metal joint form. Set top of stakes 3/8 inch below slab surface elevation. Install with minimum of 5 stakes per 10 foot length. When concrete is not poured continuously over both sides of the joint, bend knock-out anchors at 45 degree angle into pour. Finish concrete to top of joint and burn in with hand trowel.
- E. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
 - 1. Prior approval of Architect is required.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
 - 1. Radius: 1/4 inch (6 mm).
- G. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
 - 1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.
 - 2. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- H. Expansion Joints (E.J.): Form expansion joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 30 feet, unless indicated otherwise.
 - 2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
 - 3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together. Do not leave gaps between ends of joint filler units.
 - 4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 - 5. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-

coat one half of dowel length to prevent concrete bonding to one side of joint.

- I. Installation of sealants is specified in Division 7 Section Joint Sealers.
- J. Installation of Sealants: Comply with sealant manufacturer=s instructions. Install sealant to depths recommended by sealant manufacturer but within the following general limitations, measured at center (thin) section of bead:
 - 1. For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 1/2 inch deep nor less than 3/8 inch deep.
 - 2. Tool joints to form smooth, uniform beads with slightly concave surfaces, with finished joints straight, uniform, smooth and neatly finished. Remove excess sealant from adjacent surfaces of joint, leaving the work in a neat, clean condition. Do not use tooling agents unless recommended by sealant manufacturer.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- C. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.
- D. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
 - 1. When concrete placing is interrupted for more than 1/2 hour, place a construction joint.
- E. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.
- F. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

- G. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
 2. Do not use frozen materials or materials containing ice or snow.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- H. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor=s option.
 2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
- C. Medium Textured Broom Finish: For slopes less than 6 percent, provide a medium texture by drawing a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.
- D. Heavy (Coarse) Textured Broom Finish: For slopes 6 percent and greater, provide a coarse finish by straiting surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- E. Smooth Finish: Steel trowel and burnish to a smooth, dense, hard finish.

- F. Textured Finish: Steel trowel with circular motion to produce non-slip surface.

3.07 SPECIAL FINISHES

- A. Monolithic Exposed Aggregate Finish: Expose course aggregate to pavement surfaces as follows:
1. Immediately after floating, spray-apply chemical surface retarder to pavement according to manufacturer=s written instructions.
 2. Cover with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- B. Seeded Exposed Aggregate Finish: Immediately after floating, broadcast a single layer of aggregate uniformly onto the pavement surface. Tamp seeded aggregate into plastic concrete, and float to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm).
1. Spray-apply chemical surface retarder to pavement according to manufacturer=s written instructions.
 2. Cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
 3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with sniff, nylon bristle broom.
 4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- C. Slip-Resistant Aggregate Finish: Before final floating, apply slip-resistant aggregate finish to pavement surfaces according to manufacturer=s written instructions and as follows:
1. Uniformly spread 25 lb./100 sq. ft. (12 kg/10 sq. m) of dampened nonslip aggregate over the surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
 2. After curing, lightly work surface with a steel wire brush or an abrasive stone, and water to expose nonslip aggregate.
- D. Colored Dry-Shake Hardener Finish: After initial floating, apply colored dry-shake materials to pavement surfaces according to manufacturer=s written instructions and as follows:
1. Uniformly apply colored dry-shake materials at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m), unless greater amount is recommended by manufacturer to match pavement color required.
 2. Uniformly distribute approximately two-thirds of colored dry-shake material over the

concrete surface with mechanical spreader, and embed by power floating. Follow power floating with a second shake application, uniformly distributing remainder of dry-shake material to ensure uniform color, and embed by power floating.

3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete. Cure concrete with curing compound recommended by dry-shake material manufacturer. Apply curing compound immediately after finish finishing.

3.08 CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer=s written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer=s written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Curing Compound for Colored Concrete: Apply an even coat of curing compound, following manufacturer's instructions. Do not use curing paper.

3.09 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

- B. Allow concrete pavement to cure for 28 days and be dry before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer=s recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).

3.10 WHEEL STOPS

- A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches (125 mm) into wheel stop and lower portion a minimum of 5 inches (125 mm) into pavement.

3.11 FIELD QUALITY CONTROL

- A. Testing Services: Testing shall be performed according to the following requirements:
 - 1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
 - 2. Slump Tests: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 - 3. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 - 4. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day=s pour of each type of air-entrained concrete.
 - 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 - 6. Compressive-Strength Tests: ASTM C 39; one set for each day=s pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
 - 7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 8. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing if adequate evidence of satisfactory strength is provided.
 - 9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be

provided for protecting and curing in-place concrete.

10. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi (3.4 MPa).
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7 and 28 day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.
13. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.12 REPAIRS AND PROTECTIONS

- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet requirements of this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION

SECTION 02900

LANDSCAPE PLANTING

I. GENERAL

The provisions of the Standard Specifications for Public Works Construction (SSPWC), latest Edition, Sections 212 and 308 apply except as modified herein.

A. Work Included in this Section:

Finish grading (fine).
Weed abatement.
Soil preparation.
Tree supports, trunk protectors, and root barriers.
Furnishing plants and planting.
Fertilizer, soil amendment.
Watering.
Project maintenance period.
Soils analysis.

B. Work not Included in this Section:

Rough grading.
Finish grading.
Irrigation system.

C. Approvals:

All sprinkler work shall be inspected and approved before starting any work of this section, except that specimen trees shall be installed prior to beginning sprinkler work.

All turf areas shall be planted and all landscape planting shall be installed and approved prior to the commencement of the plant establishment period.

II. MATERIALS

A. Landscape Finish Grading:

Site topsoil material shall be used.

B. Tree Supports:

Stakes for trees shall be round, of Lodge Pole pine, made from the entire bole of the tree with bark removed and completely treated in a solution of pentachlorophenol. They shall be at least 2" or 2 2" in diameter, conically pointed at one end. 10" long tapered point and chamfered at the other end.

Ties shall be "Wonder Tree-Tie" or equal, black in color, install according to manufacturer's specifications.

C. Tree Trunk Protector:

Contractor shall supply and install an approved tree trunk protector device for trees in turf area only, equal to "Tree Boot".

D. Root Barrier:

Root barrier shall be installed on all planted trees within 5'-0" of concrete or asphalt paving. Contractor to supply and install "deep root" barrier by Deep Root Corp: (415) 437-9700 or Shawtown Root Barrier by NDS: (800) 726-1994 or approved equal. Where root barriers parallel curb face or concrete pavement, the barrier shall extend 5' on either side of the tree trunk 10' in length.

E. Landscape Edgings:

Wood Edging:

Provide 2-inch by 4-inch pressure treated Douglas Fir or Redwood construction grade headerboards. Make splices with 1-inch by 4-inch pieces no less than 12 inches long. Place 1-inch by 3-inch by 16-inch stakes at intervals of not more than 5 feet. Cut stakes level and set below top of headerboards.

On sharp turns and curves, four 1/2 inch by 4-inch laminated boards, or two 1-inch by 4-inch laminated boards may be permitted.

Nail stakes and splices with galvanized common nails. Nail as required for solid installation.

Provide header as shown on drawings, laid true to line and grade, protect in-place adjacent improvements, shrubbery and other properties. Place stakes on ground cover side of header.

Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

Aluminum Edging: Standard-profile extruded-aluminum edging, ASTM B221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.

Plastic Edging: Standard black polyethylene or vinyl edging, horizontally grooved, extruded in standard lengths, with 9-inch steel stakes.

Concrete Mowstrip: 6 inch wide by 6 inch thick concrete mowstrip with 1/2 inch tooled edging and #3 continuous rebar.

F. Plant Materials:

General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Legend shown on Drawings and complying with ANSI Z60.1. Provide plant materials in accordance with the State Department of Agriculture's regulation for nursery inspections, rules and ratings. Provide plants with a normal habit of growth, sound, healthy, vigorous and free from insect infestations, plant diseases, sunscalds, and other disfigurements. Ensure tree trunks are

sturdy and have well-hardened systems and vigorous and fibrous root systems which are not root or pot-bound. In the event of disagreement as to condition of root system, the root conditions of the furnished plants in containers will be determined by removal of earth from the roots of not less than two plants, or more than 2 percent of the total number of plants of each species or variety. Where container grown plants are from several sources, roots of not less than two plants of each species or variety from each source will be inspected. In the event that the sample plants inspected are found to be defective, the entire lot or lots of plants represented by the defective samples may be rejected. Plants rendered unsuitable for planting due to this inspection will be considered samples and will be provided at no cost to the Owner.

Size of plants will comply with ANSI Z60.1 and correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings. The minimum acceptable size of plants measured before pruning with the branches in normal position, must conform to the measurements specified in the plant list. If approved by the Owner, larger sized plants may be used. If larger plants are approved for use, the ball of earth or spread of roots for each plant will be increased proportionately.

Plants not meeting requirements of these specifications are considered to be defective whether in place or not. They must be immediately removed and replaced with new acceptable and approved plants of the required size, species and variety.

Pruning: Do not prune, trim, top or alter the shape of trees or plants except as approved.

Provide plant material true to botanical and common name and variety as specified in Annotated Checklist of Woody Ornamental Plants in California, Oregon and Washington, published by University of California School of Agriculture (latest edition).

Nursery Grown and Collected Stock: Grow under climatic conditions similar to those in locality of project; container-grown stock in vigorous, healthy condition, not root-bound or with root system hardened off. Use only liner stock plant material which is well established in removable containers or formed homogenous soil sections.

Select trees which are aesthetically desirable and are good examples of the species. Trees with gashes, misshapen trunks or branches, topped leaders, structural defects, badly crossed branches, or other visual defects will not be accepted. If formal arrangements or consecutive order of plants is shown on Drawings, select stock for uniform height and spread to assure symmetry in planting.

Seed: Label seed and provide in sealed containers with signed copies from vendor certifying that each container is fully labeled in compliance with State Agricultural Code and is in compliance with minimum requirements of these specifications. Wet, moldy or damaged seed will not be permitted. Provide seed mix per plan.

G. Soil Amendments and Fertilizer for Bid Purposes:

All turf and groundcover areas shall receive soil amendments per Agronomic Soils Testing. See specs. (Use the following quantity per 1,000 sq. ft. for bidding purposes).

1. 6 cubic yards nitrogen stabilized organic amendments.

2. 15 lbs. commercial fertilizer (6-20-20 either incorporated into the soil or incorporated into the hydromulch slurry as specified).
3. 20 lbs. of gypsum

H. Turfgrass Sod:

Turfgrass Sod: Certified, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

Turfgrass Species: Sod of grass species per plan.

I. Commercial Fertilizers:

Planting Tablets. Tightly compressed, long-lasting, slow-release fertilizer tablets weighing 21 grams, with a potential acidity of not more than 5% by weight and having an analysis of 20-10-5 derived from the sources listed in the following guaranteed analysis:

Guaranteed Analysis

Total Nitrogen.....	20.0%
Derived from urea-formaldehyde.	
7.0% water soluble Nitrogen, 13.0% water insoluble Nitrogen	
Available Phosphoric Acid	10.0%
Derived from calcium phosphate.	
Soluble Potash	5.0%
Combined Calcium	2.6%
Derived from calcium phosphates.	
Combined Sulfur	1.6%
Derived from ferrous and potassium sulfates.	
Iron (expressed as elemental Fe)	.35%
Derived from ferrous sulfate.	
Potential Acidity: 5% or 100 lbs. Calcium Equivalent per ton.	

Fertilizer 6-20-20 XB (for turf & groundcover areas): Premium high performance pre-plant fertilizer compound having an N-P-K ratio of 6-20-20, and shall be derived from the sources listed in the following analysis in a high quality homogeneous pellet.

Guaranteed Analysis

Total Nitrogen.....	6.0%
Ammoniacal Nitrogen	
Available Phosphoric Acid	20.0%
Soluble Potash	20.0%
Sulfur	5.5%
Iron (Fe) expressed as Elemental	1.5%
Potential Zinc	0.75%

Fertilizer 12-12-12 (for Plant Backfill): Fertilizer shall be rapidly soluble prills containing equal amounts of nitrogen, phosphorus, and potash plus sulfur and calcium and derived from the following sources:

<u>Guaranteed Analysis</u>	
Total Nitrogen.....	12.0%
As Ammoniacal derived	
Available Phosphoric Acid	12.0%
Soluble Potash	12.0%
Sulfur	15.0%

Fertilizer 16-6-8: (for Maintenance) Fertilizer shall be a fertilizer compound having an N-P-K ratio of 16-6-8, and shall be derived from the sources listed in the following analysis in a high quality homogeneous pellet.

<u>Guaranteed Analysis</u>	
Total Nitrogen.....	16.0%
Ammoniacal Nitrogen	
Available Phosphoric Acid	6.0%
Soluble Potash	8.0%
Sulfur	16.0%
Iron (Fe) expressed as Elemental.....	1.5%
Potential Zinc	0.1%
Ammonium Sulfate: Conforming to the requirements of the Agricultural Code of the State of California.	

Iron Sulfate: Ferric sulfate or ferrous sulfate in pelleted or granular form containing not less than 18.5% iron expressed as metallic iron, and shall be registered as an agricultural mineral with the State Department of Agriculture in compliance with Article 2, "Fertilizing Materials", Section 1030 of the Agricultural Code.

Soil Amendment: Standard Specifications Section 212-1.2.4 shall apply. Soil amendment shall be an organic wood base product, Type I, composted Redwood or Cedar only.

J. Shredded Wood Mulch:

Shredded Wood Mulch shall be a minimum of 1" thickness in all shrub and groundcover areas. Type: Forest Floor 0-2, Supplied by: Aguinaga Fertilization Products Phone 949-786-9558. or equal. Submit sample to landscape architect for approval prior to installation.

Organic Mulch: Provide medium grind bark, consisting of organic, fibrous, woody bark mixture of varied particle size such that 90 to 100 percent passes 1 inch sieve, 80 to 100 percent passes 1/2 inch sieve, and 20 to 60 percent passes 1/4 inch sieve, or approved equal. Mulch shall be free of contaminants and weed seed and shall have a pleasant musty or moldy soil-like odor. Putrid, ammonia and sour-smelling materials will be deemed unacceptable. Recycled construction materials will not be permitted.

III. EXECUTION

A. Agronomic Soils Tests Prior to Amending Soil:

After completion of fine grading and prior to soil preparation, the Agency shall obtain agronomic soils tests for all planting and turf areas. A minimum of one sample per two acres of lawn shall be required. Tests shall be performed by an approved agronomic soils testing laboratory and shall include a fertility and suitability analysis with written recommendations for soil amendment, fertilizer, and chemical conditioner application rates for soil preparation, auger hole requirements, and maintenance and post-maintenance fertilization program for all areas.

The agronomic soils report recommendations shall take precedence over the minimum amendment and fertilizer application rates specified herein or on the plans only when they exceed the specified minimums. Additional materials required by the soils report shall be paid for by Change Order.

B. Agronomic Soil Test After Amending Soil:

After the soil amendment procedure has been completed and prior to commencement of planting the Agency Representative will take one sample per two acres of turf of amended soil.

The Agency Representative shall deliver the samples to an approved agronomic soils testing laboratory for analysis and report. Costs of analysis and report shall be borne by the Contractor.

If any deficiencies are found, the elements required to be added to the planting areas to comply with these specifications shall be borne by the Agency. The additional soil testing costs to insure conformance will be borne by the Contractor.

After certification by the laboratory that amendment procedures have been complied with, the Contractor may proceed with planting.

Permissible limits of analytical deviation are as follows:

<u>Items</u>	<u>Permissible Limits</u>
Percentage organic matter.....	Plus or minus 20%
Mineral nutrients:	
available nitrate plus ammoniac nitrogen	Plus or minus 20%
available phosphate phosphorus	Plus or minus 20%
available potassium	Plus or minus 20%

C. Finish Grading:

Before any planting operations start in any area, all trash and deleterious materials on the surface of the ground shall be removed and disposed of. After completion of fine grading and prior to soil preparation, the Contractor shall adhere to the Agronomic Soils Test and Report recommendations as required, except for the minimums specified herein.

All planting areas shall be finish graded per Standard Specifications, Section 308-2.4. Finish grades shall be so graded that required tolerances are met after settlement at the end of the project maintenance period.

D. Weed Abatement:

All weed growth in planting areas shall be removed. Common Bermuda grass found growing in areas not designated to be planted with Bermuda grass, shall be killed with an approved herbicide or fumigant with materials approved by the Agency.

Contractor shall irrigate for a minimum of twenty-one (21) days all banks and other areas that will be hydroseeded with plants other than turf to germinate existing weeds. Weeds shall be removed or killed by a contact herbicide to provide a complete kill. Soil surface shall be free of excessive vegetative material so that hydromulch is in contact with the soil surface.

E. Tree Supports:

Wood Tree Stakes: lodge pole pine, full treated with Coppernaphthanate Wood Preservative in strict accordance with FS TT-W-572 Type I, Composition B, 2-inch minimal normal size diameter by 10 feet long, minimum, with no split stakes.

Ties: Provide cinch ties, size corresponding to tree box size as manufactured by VIT Company or other approved.

F. Planting:

General:

The irrigation system shall be operational and approved prior to planting. Perform actual planting only during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice, as approved.

Distribute in planting areas only as many plants as can be planted and watered that same day.

Ensure that containers which are opened and plants removed are handled with care such that ball of earth surrounding roots is not broken and that plants are planted and watered immediately. Do not open containers prior to placing plants in planting areas.

Layout:

Mark locations for plants and outlines of areas to be planted before any plant pits are dug. Gain City approval. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting may be selected by Owner. Accomplish layout with flagged grade stakes indicating plant names and specified container size on each stake. Confirm location and depth of underground utilities and obstructions.

EXCAVATION FOR TREES AND SHRUB

Planting Pits and Trenches: Excavate circular planting pits with sides sloping inward at a 45-degree angle. Trim perimeter of bottom leaving center area of bottom raised slightly to support rootball and assist in drainage away from center. Do not further disturb base. Ensure that rootball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation

Excavate approximately two times as wide as rootball diameter.

Do not excavate deeper than depth of the rootball, measured from the root flare to the bottom of the rootball.

Subsoil and topsoil removed from excavations may be used in part for planting soil backfill. Backfill plants with: 6 parts by volume on-site soil, 4 parts by volume organic amendment, 1 pound 6-20-20 fertilizer mix per cubic yard of mix, 2 pounds iron sulfate per cubic yard of mix. Note: This is for bid purposes only. Specific backfill recommendations are made as a result of the Agronomic Soils Testing described above.

Strip and stack approved excavation for planting which is encountered within areas for trenches, tree holes, plant pits and planting beds.

Remove from site excess soil generated from planting holes and not used for backfilling.

Protect areas from excessive compaction when trucking plants or other materials to planting areas.

TREE, SHRUB, AND VINE PLANTING

Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

Set stock plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

Container Grown: Cut cans on two sides with acceptable can cutter only. Carefully remove rootball from container without damaging rootball or plant. Superficially loosen edge roots on three sides after removing from can.

Boxed Trees: Remove bottom of plant boxes before planting. Remove sides without damage to rootball after positioning plant and partially backfilling.

Face plants with fullest growth into prevailing wind.

Backfill plants with: 6 parts by volume on-site soil, 4 parts by volume organic amendment, 1 pound 6-20-20 fertilizer mix per cubic yard of mix, 2 pounds iron

sulfate per cubic yard of mix. Note: This is for bid purposes only. Specific backfill recommendations are made as a result of the Agronomic Soils Testing described above.

Backfill around rootball in layers, tamping to settle soil and eliminate voids and air pockets. Hold plant rigidly and plumb until soil has been firmed around ball or roots. Raise all plants which settle deeper than the surrounding grade. When planting pit is approximately one-half filled, add water to the top of the planting pit and thoroughly saturate rootball and adjacent soil.

Set planting tablets with each plant on top of rootball while plants are still in their containers so the required number of tablets can be verified. After water has completely drained, place planting tablets as follows or in amounts recommended in soil reports from soil-testing laboratory.

1 tablet per 1-gallon container
2 tablets per 5-gallon container
3 tablets per 15-gallon container
4 tablets per 24-inch box
6 tablets per 36-inch box
8 tablets per 48-inch box

Place tablets beside the rootball about 1-inch from root tips; do not place tablets in bottom of the hole.

Continue backfilling process. Construct an earthen basin around each plant after backfilling. Provide basin of depth sufficient to hold at least 2 inches of water. Construct basins with amended backfill. Remove basin in all turf areas after initial watering. Water again after placing and tamping final layer of soil.

Limit pruning to minimum necessary. Remove injured twigs and branches. Pruning may not be done prior to delivery of plants. Paint cuts over 3/4 inch in diameter with tree paint.

Stake or guy trees immediately after planting. Install stakes plumb. Locate stakes so that a straight line drawn between the stakes is perpendicular to the prevailing wind direction.

Do not bring iron sulfate into contact with concrete surfaces due to potential staining. Contractor is responsible for cleaning and replacing stained surfaces.

When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the rootball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the rootball.

All trees shall be planted, staked and tied as noted on drawings and in accord with U.C. Agricultural Extension Service Bulletin AXT-311. Plants shall be planted where shown on plans or as directed by Agency Representative.

Backfill material for plant pits shall be a mixture as noted below. The materials shall be thoroughly mixed to the bottom of the pit so that they are evenly distributed and

without clods or lumps. Backfill shall be so placed in the pits that the plant will be at its natural growing height and the backfill material will be level one inch below surrounding soil after settlement.

Amended backfill for plant holes shall be:

- A. 6 parts by volume on site soil.
- B. 4 parts by volume organic amendment.
- C. 2 lbs. iron sulfate per cubic yard.
- D. 1 lb. 12-12-12 commercial fertilizer per cubic yard or 17 lb. 5-3-1 Gro-Power).

Please note that this is for bid purposes only. Specific backfill recommendations are made as a result of the Agronomic Soils Testing described above.

GROUNDCOVER AND OTHER SMALL CONTAINER PLANTING

Set out and space ground cover and plants from flats or containers smaller than 1-gallon as indicated on planting plan in even rows with triangular spacing.

Ensure that groundcover remains in the flats until transplanting. Flats' soil must contain sufficient moisture so it will not fall apart when lifting plants.

Use planting soil for backfill. Plant each rooted plant with its proportionate amount of flat soil.

Dig holes large enough to allow spreading of roots.

Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

Protect plants for damage and trampling.

TREE, SHRUB, AND VINE PRUNING

Remove only dead, dying, or broken twigs or branches. Do not prune for shape. Pruning may not be done prior to delivery of plants.

Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

G. Watering:

Apply water to all planted areas during operations and thereafter, until acceptance of work.

Plants which cannot be watered efficiently with the existing water system shall be watered by means of a hose.

Immediately after planting, apply water to each tree and shrub. Apply water in a moderate stream in the planting hole until the material about the roots is completely saturated from the bottom of the hole to the top of the ground.

Apply water in sufficient quantities and as often as seasonal conditions require to keep the planted areas wet at all times, well below the root system of grass and plants.

All ground cover planting shall be immediately sprinkled to avoid drying out until the entire planted area is thoroughly watered and the soil soaked to the full depth of each plant hole.

All hydromulch and seeds should be kept damp at all times and irrigation should be adjusted accordingly. This normally would involve four to six watering periods daily; each watering period (ON) regulated to just dampen the mulch and seed, without creating runoff. Intervals between irrigations (OFF) should be judged by the length of the time mulch and seeds remain damp. Once mulch and seeds begin to dry out, the watering (ON) should be repeated.

H. Project Maintenance:

Project maintenance consists of a minimum 30 day plant establishment period and a subsequent 60 day maintenance period, constituting a total minimum 90 day maintenance period.

The plant establishment period commences when all plants and all turf (grass) has been planted. The establishment period will continue until all turf areas have been mowed to the specified height at least once, but not less than 30 days.

Water turf until acceptance of work. The areas shall be kept moist, but not glistening wet, until time for the first cutting of turf. After first cutting, water turf to maintain a thriving condition. Any areas where the seeds fail to germinate satisfactorily shall be immediately reseeded. The Contractor shall maintain the turf areas until an even, close stand of turf is obtained.

The establishment period shall be extended beyond the 30 day minimum at no cost to the City until all turf areas have been mowed to the specified height and a close stand of turf is attained to the satisfaction of the Agency Representative.

Project maintenance work shall commence after the Agency Representative has approved plant establishment and shall continue for 60 additional days.

Project maintenance work shall consist of applying water, fertilizing all areas, weeding, caring for plants, sweeping walks, litter pickup, and performing all general project maintenance.

The Contractor shall be responsible for detecting nutrient deficiencies and turf diseases and pests as soon as their presence is manifested. He shall take immediate action to identify the problem and shall immediately apply remedies. If the above and following conditions are not complied with, the Contractor shall re-plant the grass and maintain the turf until a healthy, mature turf is re-established, and shall maintain that area for an additional 60 days at no additional cost to the Owner.

During the project maintenance period, all plants and planted areas shall be kept well watered and kept weed free at all times. Weeds, Dallas and Johnson grass, and Bermuda grass shall be removed and disposed of (except Bermuda grass will be allowed to remain in turf areas). Provide special attention for watering slopes planted to lawn on the windward and/or sunny side so that turf will adequately be watered at all times.

Immediately after the second cutting of turf, where trees occur in turf areas, the turf shall be turned under and neatly edged 18" away from the plants. The turf edges shall be maintained in a neat condition until acceptance of the work.

Workmen shall not be allowed to walk on turf areas unnecessarily before, during or after seeding operations. Turf areas that have been damaged or compacted shall be recultivated and reseeded at the Contractor's expense.

The Contractor shall provide supplemental feedings of fertilizer as required by the agronomic soils test to maintain a healthy turf and all other plantings including slope areas. Minimum requirement: 16-6-8 at 6.2 lbs. per 1000 s.f. 35 days after initial planting, and just prior to final inspection.

In order to carry out the project maintenance work the Contractor shall maintain a sufficient number of personnel and adequate equipment to perform the work herein specified from the time any planting is done until the end of the project maintenance period or until the final approval.

The Contractor may be relieved from maintenance work required in these special provisions when the project maintenance work has been satisfactorily completed.

Damage to planting areas shall be repaired immediately.

Contractor shall continue to pick up rocks that surface and are 1" or greater in diameter.

I. Replacement of Plants:

All plants that show signs of failure to grow at any time during the life of the contract, or those plants so injured or damaged as to render them unsuitable for the purpose intended, shall be immediately replaced in kind at the expense of the Contractor.

J. Tree Guarantee:

The Contractor shall guarantee all trees from disease or death and injury resulting from improper planting for a period of one year after final acceptance of the project.

The Contractor shall replace at no expense to the Agency as soon as possible plants that are dead or not in a vigorous, healthy growing condition. Replacement shall be of the same

kind and size as originally specified and shall be planted as described on the drawings and in the specifications.

The Contractor shall not be held liable for loss of plant materials during the guarantee period due to lack of care, vandalism or accidental causes.

K. Inspections:

A written notice requesting an inspection should be submitted to the Agency Representative at least ten (10) days prior to the anticipated date. Prior to this inspection, the site must be thoroughly cleaned up and all excess material and debris removed.

The following inspections are required:

Prior to the start of the 90 calendar day plant establishment and project maintenance period,
the Contractor will be required to have a complete inspection and approval of all landscape construction items.

At 30th calendar day.

At 60th calendar day.

At completion of the maintenance period.

L. Certification:

Written certifications required which are to be submitted to the Agency Representative upon delivery to the job site include:

Quantity of commercial fertilizer used.
Quantity of soil amendments.
Quantity of seed.
Quantity of iron sulfate.
Quantity of soil sulfur.
Quantity of agricultural gypsum.
Quantity of hydromulch materials.
Quantity of shredded wood mulch.

END OF SECTION

SECTION 02916

PLANTING IRRIGATION (RECLAIMED WATER)

PART 1 - GENERAL

1.1 SECTION REQUIREMENTS

- 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 in these specifications, and as necessary to complete the contract.

1.2 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, site utilities and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Landscape Architect shall have final authority for clarification. When a conflict occurs between an item shown on the plan and as shown on the specifications, the Landscape Architect shall have final authority for clarification.
- C. The Contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in the design. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revisions necessary.

1.3 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.

- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnishes directions covering points now shown in the drawings and specifications.
- C. All local, municipal and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately.

1.4 SUBMITTALS

A. Materials List:

- 1. After award of contract and before any irrigation system materials are delivered to the job site, submit to the Landscape Architect a complete list of all irrigation systems, materials, or processes proposed to be furnished and installed as part of this contract.
- 2. Show manufacturer's name and catalog number for each item, furnish complete catalog cuts and technical data, and furnish the manufacturer's recommendations as to the method of installation.
- 3. No substitutions will be allowed without prior written acceptance by the Landscape Architect or Owner's authorized representative.
- 4. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

B. Substitutions:

If the Contractor wishes to substitute any equipment or materials for those listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect for approval:

- 1. A written statement indicating the reason for making the substitution and the difference in installed price if the item is accepted.
- 2. Catalog cut sheets, technical data and performance information for each substitute item.

1.5 EXISTING CONDITIONS

- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and telephone line connection to the irrigation system.
- B. Irrigation design is based on the available static pressure shown on the drawings. Contractor shall verify static water on the project prior to the start of construction.

Should a discrepancy exist, notify the Landscape Architect and Owner's authorized representative prior to beginning construction.

- C. Prior to cutting into the soil, the Contractor shall locate all cables, conduits, sewer lines, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect who will arrange for relocations. The Irrigation Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered.
- D. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost, all damage resulting from his operations or negligence.
- E. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeving as shown on the plans.

1.6 INSPECTIONS

- A. The Landscape Architect shall be permitted to visit and inspect at all times any part of the work and shall be provided safe access for such visits.
- B. Where the specifications require work to be tested by the Contractor, it shall not be covered over until accepted by the Landscape Architect, Owner's authorized representative, and/or governing agencies. The Irrigation Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing. Should any work be covered without testing or acceptance, it shall be, if so ordered, uncovered at the Irrigation Contractor's expense.
- C. Inspections will be required for the following at a minimum. Landscape Architect may opt to review photographs of pressure test (with image of pressure gauge and time stamps) and sample dripline layout.
 - 1. Pressure test of irrigation main line (Three hours at 150 PSI).
 - 2. Sample layout of dripline irrigation.
 - 3. Coverage test of irrigation sprinkler system.
 - 4. Final inspection prior to start of maintenance period.
 - 5. Final acceptance.
- D. Site observations and testing will not commence without the record drawings a prepared by the Irrigation Contractor. Record drawings must be complete and up to date for each site visit.
- E. Work which fails testing and is not accepted will be retested.

1.7 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the

event of damage, immediately make all repairs and replacements necessary to the acceptance of the Landscape Architect and Owner.

- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.8 CLEANUP AND DISPOSAL

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Owner's authorized representative.
- B. At the time of completion the entire site will be cleared of tools, equipment, rubbish and debris which shall be disposed of off-site in a legal disposal area.

1.9 TURNOVER ITEMS

- A. Record Drawings:
 - 1. Record accurately on one set of contract drawings all changes in the work constituting departures from the original contract drawings.
 - 2. The changes and dimensions shall be recorded in a legible and workmanlike manner to the satisfaction of the Landscape Architect. Prior to final inspection of work, submit record drawings to the Landscape Architect for review and approval.
 - 3. Dimensions from/to permanent points of reference such as buildings, sidewalks, curbs, etc. shall be shown. Data on record drawings shall be recorded on a day to day basis as the project is being installed. All lettering on drawings shall be minimum 1/8 inch in size.
 - 4. Show locations of the following items:
 - a. Point of connection (including water meters, backflow preventors, master control valves, etc.)
 - b. Routing of sprinkler pressure lines (dimensions shown at a maximum of 100 feet along routing and at all changes in direction)
 - c. Gate valves
 - d. Automatic remote control valves
 - e. Quick coupling valves
 - f. Routing of control wires
 - g. Irrigation controllers
 - h. Related equipment (as may be directed)
 - 5. Maintain record drawings on site at all times. Upon completion of work, transfer all as-built information and dimensions to a clean set of bond prints, using red, waterproof ink.

B. Controller Charts:

1. Record drawings must be approved by Landscape Architect before controller charts are prepared.
2. Provide one controller chart for each automatic controller. Chart shall show the area covered by the particular controller.
3. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible, when the drawing is reduced, it shall be enlarged to a readable size. Print shall be black and white, with a different color used to indicate the area of coverage for each station.
4. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 millimeters in thickness, with a matte finish.

C. Operation and Maintenance Manuals:

1. Two individually bound copies of operation and maintenance manuals shall be delivered to the Landscape Architect or Owner's authorized representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system.
2. Each complete, bound manual shall include the following information:
 - a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 - b. Operating and maintenance instructions for all equipment.
 - c. Spare parts list and related manufacturer information for all equipment.
 - d. Guarantee Statement.

D. Equipment:

1. Supply as a part of this contract the following items:
 - a. One (1) tool for disassembly and adjustment of each type of sprinkler head used in the irrigation system.
 - b. Padlock and two (2) keys for backflow enclosure (if used).
 - c. Two keys for each automatic controller.
 - d. Two quick coupler keys with a 3/4 inch bronze hose bib, bent nose type with hand wheel and two coupler lid keys.
 - e. One valve box cover key or wrench.
 - f. One 5-foot tee wrench for operating butterfly valves (if used).
 - g. Two (2) extra sprinkler heads of each size and type.
2. The above equipment shall be turned over to Owner's authorized representative at the final inspection.

1.10 COMPLETION

- A. At the time of the pre-maintenance period inspection, the Landscape Architect, Owner's authorized representative, and governing agencies will inspect the work, and if not accepted, will prepare a list of items to be completed by the Contractor. At the time

of the post-maintenance period or final inspection, the work will be reinspected and final acceptance will be in writing by the Landscape Architect, Owner's authorized representative, and governing agencies.

- B. The Owner's authorized representative shall have final authority on all portions of the work.
- C. After the system has been completed, the Contractor shall instruct Owner's authorized representative in the operation and maintenance of the irrigation system and shall furnish a complete set of operating and maintenance instructions.
- D. Any settling of trenches which may occur during the one-year period following acceptance shall be repaired. Repairs shall include the complete restoration of all damage to planting, paving or other improvements of any kind as a result of the work.

1.11 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.

Should any problem with the irrigation system be discovered within the guarantee period, it shall be corrected by the Contractor at no additional expense to Owner within ten (10) calendar days of receipt of written notice from Owner. When the nature of the repairs, as determined by the Owner, constitutes an emergency (i.e. broken pressure line) the Owner may proceed to make repairs at the Contractor's expense. Any and all damages to existing improvements, resulting either from faulty materials or workmanship, shall be repaired at the Contractor's expense.

- B. Guarantee shall be submitted on Contractor's own letterhead as follows:

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear and unusual abuse, or neglect excepted. We agree to repair or replace any defective material during the period of one year from date of filing of the Notice of Completion and also to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within 10 calendar days following written notification by the Owner. In the event of failure to make such repairs or replacements within the time specified after receipt of written notice from Owner, we authorize the Owner to proceed to have said repairs or replacements made at our expense and we will pay the costs and charges therefore upon demand.

PROJECT NAME:

PROJECT LOCATION:

CONTRACTOR NAME:

ADDRESS:

TELEPHONE:

SIGNED:

DATE:

PART 2 - PRODUCTS

2.1 SUMMARY

Use only new materials of the manufacturer, size and type shown on the drawings and specifications. Materials or equipment installed or furnished that do not meet Landscape Architect's, Owner's, or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

2.2 PIPING

- A. Pressure supply line from point of connection through basket strainer unit shall be Type "K" copper or brass pipe.
- B. Pressure supply lines 2 inches in diameter and larger shall be Class 315 solvent weld PVC. Piping shall conform to ASTM D1784.
- C. Pressure supply lines 1-1/2 inches and smaller in diameter shall be Schedule 40 solvent weld PVC. Piping shall conform to ASTM D1784.
- D. Non-pressure lines 3/4 inches in diameter and larger downstream of the remote control valve shall be Sch. 40 PVC or as stated on Irrigation Materials Legend on plans. Non-pressure lines 1 inch and larger to conform to ASTM D1784.
- E. Reclaimed water PVC pipe to be color coded "purple" in color and marked on two sides with reclaimed water warning statements "CAUTION – RECLAIMED WATER". Reclaimed water piping must be accepted by the local reclaimed water governing agencies.

2.3 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.

2.4 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 ASATM D2241 or ASTM D1784.
- C. All PVC fittings shall be standard weight Schedule 80 for constant-pressure mainline fittings and screwed fittings, and Schedule 40 for non-pressure lateral fittings 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 D2466 and D2467.
- 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 applied per the manufacturer's recommendations. Cement shall be of a fluid consistency, not gel-like or ropy. 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.

2.5 BASKET STRAINER

- A. The basket strainer unit shall be of the manufacturer, size, and type indicated on the drawings.
- B. The basket strainer unit shall be installed in accordance with the requirements set forth by local codes.

2.6 VALVES

- A. Gate Valves:
 - 1. Gate valves shall be of the manufacturer, size, and type indicated on the drawings.
 - 2. Gate valves shall have threaded ASTM B-62 bronze body, bonnet and wedge, silicon bronze stem, and malleable iron handwheel.
 - 3. All Gate 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 of the manufacturer, size, and type indicated on the drawings.

2. Quick coupler valves shall be brass with a wall thickness guaranteed to withstand normal working pressure of 150 psi without leakage. Valves shall have $\frac{3}{4}$ female threads opening at base, with two-piece body. Valves to be operated only with a coupler key, designed for that purpose. Coupler key is inserted into valve and a positive, watertight connection shall be made between the coupler key and valve. Hinge cover shall be the locking type in color constructed of brass with a rubber-like vinyl cover. Vinyl quick coupler cover to be purple with the words "WARNING – RECLAIMED WATER – DO NOT DRINK" permanently marked on the lid.

C. Automatic Control Valves:

1. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
2. Automatic control valves shall be electrically operated.
3. Automatic control valves shall include manual flow adjustment.

D. Anti-drain Valves:

1. Anti-drain valves shall be of the manufacturer, size and type indicated on the drawings.
2. Anti-drain valves shall have 18-8 stainless steel springs and valve stems with Buna-N seals.
3. Anti-drain valves will have threaded connections the size of the riser or pipe they are to be installed onto, or the next available size. No slip connection anti-drain valves are allowed.

2.7 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 purple in color and permanently marked with words "WARNING – RECLAIMED WATER – DO NOT DRINK". 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. Automatic control valve boxes shall be 16 inch x11 inch x12 inch rectangular size. Valve box covers shall be marked "RCV" with the valve identification number "heat branded" onto the cover in 2-inch high letters/numbers.
- F. Ball valve and quick coupler valve boxes shall be 10-inch diameter circular size. Valve box covers shall be marked with either "BV" or "QCV" with the valve identification "heat branded" onto the cover in 2-inch high letters.

2.8 AUTOMATIC CONTROLLER

- A. Automatic controller shall be of the manufacturer, size, and type indicated on the drawings.
- B. Automatic controller enclosures shall be of the manufacturer, size, and type indicated on the drawings. Enclosure shall be vandal-resistant, ventilated and waterproof.

2.9 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.

2.10 LOW VOLTAGE CONTROL WIRING

- A. Remote control wire shall be direct-burial AWG-UF type, size in no case smaller than 14 gauge.
- B. Connections shall be either epoxy-sealed packet type or Penn-Tite connectors.
- C. Ground 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. These colors shall be noted on the "Record Drawings" plans located on controller door).

2.11 IRRIGATION HEADS

- A. Sprinkler heads shall be of the manufacturer, size, type, with radius of throw, operating pressure and discharge rate indicated on the drawings.
- B. Pop-up heads and riser heads shall be used.
- C. Pop-up heads and gear driven rotors used on reclaimed water systems shall have a color coded purple cap with reclaimed water warnings embossed on the top surface. Riser heads shall have a self-adhesive reclaimed water sticker placed on the riser directly below the sprinkler body. All reclaimed water warnings shall be in English and Spanish and have the international symbol for "Do Not Drink". All reclaimed water warnings shall be as required by the local water utility.

2.12 DRIP IRRIGATION COMPONENTS

- A. Dripline tubing shall be of the manufacturer, model number and distribution (emitter flow and spacing) indicated on the drawings.
- B. Drip emitters, bubblers and micro-sprays shall be of the manufacturer and model number indicated on the drawings.

- C. Distribution tubing, connectors and insert or compression fittings shall be of the manufacturer and type indicated on the drawings.

2.13 RAIN SENSOR

Rain sensor shall be of the manufacturer, size, and type indicated on the drawings.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Inspections:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that irrigation system may be installed in accordance with all pertinent codes and regulations, the original design, the referenced standards, and the manufacturer's recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Landscape Architect or Owner's authorized representative.
2. Do not proceed with installation in areas of discrepancy until all discrepancies have been resolved.

C. Grades:

1. Before starting work, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths with respect to finish grade.
2. Final grades shall be accepted by the Engineer before work on this section will be allowed to begin.

D. Field Measurements:

1. Make all necessary measurements in the field to ensure precise fit of items in accordance with the original design. Contractor shall coordinate the installation of all irrigation materials with all other work.
2. All scaled dimensions are approximate. The Contractor shall check and verify all size dimensions prior to proceeding with work under this section.
3. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by his operations or neglect.

E. Diagrammatic Intent:

The drawings are essentially diagrammatic. The size and location of equipment and fixtures are drawn to scale where possible. Provide offsets in piping and changes in

equipment locations as necessary to conform to structures and to avoid obstructions or conflicts with other work.

F. Layout:

1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads, valves, backflow preventor, and automatic controller.
2. Layout irrigation system and make minor adjustments required due to differences between site and drawings. Where piping is shown on drawings under paved areas, but running parallel and adjacent to planted areas, install the piping in the planted areas.

G. Water Supply

Connections to, or the installation of, the water supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made.

H. Electrical Service:

1. Connections to the electrical supply shall be at the locations shown on the drawings. Minor changes caused by actual site conditions shall be made.
2. Contractor shall make 120 volt connection to the irrigation controllers. Electrical power source to controller locations shall be provided by others.

3.2 TRENCHING

- A. Excavations shall be straight with vertical sides, even grade, and support pipe continuously on bottom of trench. Trenching excavation shall follow layout indicated on drawings to the depths below finished grade and as noted. Where lines occur under paved area, these dimensions shall be considered below subgrade.
- B. Provide minimum cover of 24 inches on pressure supply lines 4 inches and larger. Provide minimum cover of 18 inches on pressure supply lines 3 inches and smaller.
- C. Provide minimum cover of 18 inches for control wires.
- D. Provide minimum cover of 12 inches for non-pressure lines.
- E. Pipes installed in a common trench shall have a 6-inch minimum space between pipes.

3.3 BACKFILLING

- A. Provide 3" sand bedding under mainline. Backfill material on all lines shall be the same as adjacent soil free of debris, litter, and rocks over 1/2 -inch in diameter
- B. Backfill shall be tamped in 4-inch layers under the pipe and uniformly on both sides for the full width of the trench and the full length of the pipe. Backfill materials shall be sufficiently damp to permit thorough compaction, free of voids. Backfill shall be compacted to dry density equal to adjacent undisturbed soil and shall conform to adjacent grades.

- C. Flooding in lieu of tamping is not allowed.
- D. Under no circumstances shall truck wheels be used to compact backfill.
- E. Provide sand backfill a minimum of 6 inches over and under all piping under paved areas.

3.4 PIPING

- A. Piping under existing pavement may be installed by jacking, boring, or hydraulic driving. No hydraulic driving is permitted under asphalt pavement.
- B. Cutting or breaking of existing pavement is not permitted unless specifically indicated on the drawings.
- C. Carefully inspect all pipe and fittings before installation, removing dirt, scale, burrs and reaming. Install pipe with all markings up for visual inspection and verification.
- D. Remove all dented and damaged pipe sections.
- E. All lines shall have a minimum clearance of 6 inches from each other and 12 inches from lines of other trades.
- F. Parallel lines shall not be installed directly over each other.
- G. In solvent welding, use only the specified primer and solvent cement and make all joints in accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.
- H. PVC pipe shall be installed in a manner which will provide for expansion and contraction as recommended by the pipe manufacturer.
- I. Centerload all plastic pipe prior to pressure testing.
- J. All threaded plastic-to-plastic connections shall be assembled using Teflon tape.
- K. For plastic-to-metal connections, work the metal connections first. Use a non-hardening pipe dope on all threaded plastic-to-metal. All plastic-to-metal connections shall be made with plastic female adapters.
- L. All solvent weld mainline piping is to be secured with minimum one cubic foot thrust blocks at all directional changes. Bell and gasket pipe to have a Leemco joint restraint system installed on all fittings in lieu of thrust blocks.

3.5 CONTROLLER

- A. The exact location of the controller shall be approved by the Landscape Architect or Owner's authorized representative before installation. The electrical service shall be coordinated with this location.

- B. The Irrigation Contractor shall be responsible for the final electrical hook up to the irrigation controller.
- C. The irrigation system shall be programmed to operate during the periods of minimal use of the design area or in accordance with the irrigation schedule provided.

3.6 CONTROL WIRING

- A. Low voltage control wiring shall occupy the same trench and shall be installed along the same route as the pressure supply lines whenever possible.
- B. Where more than one wire is placed in a trench, the wiring shall be taped together in a bundle at intervals of 10 feet. Bundle shall be secured to the mainline with tape at intervals of 20 feet.
- C. All connections shall be of an approved type and shall occur in a valve box. Provide an 18-inch service loop at each connection.
- D. An expansion loop of 12 inches shall be provided at each wire connection and/or directional change, and one of 24 inches shall be provided at each remote control valve.
- E. A continuous run of wire shall be used between a controller and each remote control valve. Under no circumstances shall splices be used without prior approval.
- F. Pull boxes for low voltage control wires shall be provided at a spacing of 250 feet on center and at all crossings along the wire route. An expansion loop of 24 inches shall be provided at each control wire pull box.

3.7 VALVES

- A. Automatic control valves, manual valves, gate valves, and ball valves are to be installed in the approximate locations indicated on the drawings.
- B. Valve shall be installed in shrub areas whenever possible.
- C. Install all valves as indicated on the drawings.
- D. Valves to be installed in valve boxes shall be installed one valve per box.

3.8 VALVE BOXES

- A. Valve boxes shall be installed in shrub areas whenever possible.
- B. Each valve box shall be installed on a foundation of 3/4 inch gravel backfill, 3 cubic feet minimum. Valve boxes shall be installed with their tops 1/2 inch above the surface of surrounding finish grade in lawn areas and 2 inches above finish grade in ground cover areas.

3.9 BASKET STRAINER

- A. Install basket strainer unit.
- B. Install basket strainer at location approved in the field and at height required by local codes.

3.10 SPRINKLER HEADS

- A. Sprinkler heads shall be installed as indicated on the drawings.
- B. Spacing of heads shall not exceed maximum indicated on the drawings.
- C. Riser nipples shall be of the same size as the riser opening in the sprinkler body.
- D. Pop-up sprinkler heads shall not be installed using side outlet openings.

3.11 DRIP IRRIGATION

- A. Provide sample layout for one complete drip valve control zone, including all components, dripline and/or emitter spacing and wire staples, for review and approval by Landscape Architect.
- B. Thoroughly flush all driplines and distribution tubing prior to installing drip emitters, air relief valves, flush valves and similar components.
- C. All drip irrigation shall be installed prior to installation of plant material.

3.12 MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Quick coupler valves shall be set approximately 12 inches from walks, curbs, header boards, or paved areas where applicable.
- C. Unless designed as an integral part of the irrigation head, anti-drain valves will be installed under every head. The anti-drain valve will be the same diameter as the riser and be integral to the riser assembly.
- D. Install rain sensors as indicated on the drawings and as recommended by the manufacturer.

3.13 FLUSHING THE SYSTEM

- A. Prior to installation of sprinkler nozzles, the valves shall be opened and a full head of water used to flush out the lines and risers.
- B. Sprinkler nozzles shall be installed after flushing the system has been completed.

3.14 ADJUSTING THE SYSTEM

- A. Contractor shall adjust valves, align heads, and check coverage of each system prior to coverage test.
- B. If it is determined by the Landscape Architect or Owner's authorized representative that additional adjustments or nozzle changes will be required to provide proper coverage, all necessary changes or adjustments shall be made prior to any planting.
- C. Automatic control valves are to be adjusted so that the sprinkler heads operate at the pressure recommended by the manufacturer.

3.15 TESTING AND OBSERVATION

- A. Do not allow or cause any of the work of this section to be covered up or enclosed until it has been observed, tested and accepted by the Landscape Architect, Owner, and/or governing agencies.
- B. The Contractor shall be solely responsible for notifying the Landscape Architect, Owner, and governing agencies, a minimum of 48 hours in advance, where and when the work is ready for testing.
- C. When the sprinkler system is completed, the Contractor shall perform a coverage test of each system in its entirety to determine if the water coverage for the planted areas is complete and adequate in the presence of the Landscape Architect.
- D. The Contractor shall furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from the plans, or where the system has been willfully installed when it is obviously inadequate, without bringing this to the attention of the Landscape Architect.
- E. Final inspection will not commence without completed record drawings as prepared by the Irrigation Contractor.

3.16 MAINTENANCE

During the maintenance period the Contractor shall adjust and maintain the irrigation system in a fully operational condition providing complete irrigation coverage to all intended plantings.

3.17 COMPLETION CLEANING

Clean-up shall be made as each portion of the work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed, and any damage sustained on the work of others shall be repaired to original conditions.

END OF SECTION

SECTION 05090

ANCHORS AND FASTENERS

PART 1 - GENERAL

0.01 SECTION INCLUDES

- A. Anchors and fasteners for** connection to concrete and steel construction.
- B. General requirements for** welding of steel products.
- C. Shrinkage-resistant grout** and grouting of structural framing baseplates, equipment anchors and miscellaneous metal fabrications.

0.02 RELATED SECTIONS

- A. Section 05500 - Metal Fabrications:** Fabrications to be fastened, welded and grouted.
- B. Section 07600 - Sheet Metal:** Fabrications from sheet metal, for weather protection.
- C. Section 09900 - Painting:** Field priming requirements, applicable to areas damaged during welding and other anchoring and fastening operations.
- D. Division 15 - Plumbing:** Equipment and other mechanical and plumbing components to be fastened, welded and grouted.
- E. Division 16 - Electrical:** Equipment, fixtures and other electrical components to be fastened, welded and grouted.

0.03 QUALITY ASSURANCE

- A. Inspection:** Testing Agency will provide special inspection during all field welding, and high-strength bolt installations and tightening operations, expansion bolt installations and installations of epoxy-type anchors in concrete, in accordance with California Building Code (CBC) requirements.
 - 1. Minimum qualifications of qualified welding inspector shall be those required for AWS Certified Welding Inspector (CWS), as defined in provisions of AWS QCI - Standard Guide for Qualifications and Certification of Welding Inspectors, published by American Welding Society.
 - 2. Additionally, all welding inspectors shall be approved by Authority Having Jurisdiction (AHJ).

- 3. For expansion bolts and epoxy-type anchors in concrete, comply with ACI 318, Chapter 17.
- B. Welder Qualifications:** Welders shall be qualified by tests as prescribed in AWS Standard Qualification Procedure, B3.0-41, to perform the type of welding required.
- C. Field-Verified Dimensions:** Prior to fabrication, field verify dimensions and details of construction. Immediately report variances in writing to Architect.

0.04 PROJECT CONDITIONS

- A. Field Inspection of Fabricated Products:** Prior to installation, inspect products for damage and verify markings and dimensions against reviewed submittals.
- B. Environmental Conditions:** Do not install products intended for interior locations when spaces are uncovered and unprotected from inclement weather.
- C. Coordination:** Coordinate metal fabrications Work with Work specified in other Sections so that related Work shall be accurately and properly joined.

PART 1 - PRODUCTS

1.01 ANCHORS, FASTENERS AND ACCESSORY MATERIALS

- A. Anchors and Fasteners, General:** Same material, color and finish as the metal to which applied, unless otherwise indicated.
- B. Exterior Exposure:** Provide stainless steel.
- C. Type, Size and Spacing:** Unless otherwise indicated, provide fasteners of type, grade and class required for intended use and sized and spaced as required for loads and substrate.
- D. Screw Head, Typical:** Unless otherwise noted, exposed screws shall be Phillips oval or flat head, countersunk.
- E. Standard Bolts and Nuts, Steel:** ASTM A 307, Grade A, hexagonal head.
- F. High-Strength Threaded Fasteners:**
 - 1. Heavy hex structural bolts: ASTM A 325, Type 1, Supplementary Requirements S.1, with threads included in shear plane and marked "A325T," unless otherwise noted on Contract Drawings.
 - a. Conform to the provisions of California Building Code (CBC), Chapter 22.
 - b. Manufacture with identifying mark placed on top of the head.
 - 2. Washers:
 - a. Hardened Type: ASTM F 436, Type 1, style as required.
 - b. Direct Tension Load Indicating Type: ASTM F 959 Type 325 or

Type 490.

3. Nuts: ASTM A 563, Heavy Hex, Grade DH, plain (non-zinc coated).
 4. Option: At Contractor's option the following bolts may be used with standard washers instead of direct tension load indicating type, where required:
 - a. Load Indicator Bolts, manufactured by Bethlehem Steel Corporation.
 - b. Tension Steel Bolts, manufactured by Bristol Machine Company.
 - c. Tension Control Bolts, manufactured by Lejeune Bolt Company.
- G. Threaded Rod:** For threaded stud anchors, comply with ASTM A 36. For threaded anchor rods, comply with ASTM F 1554.
- H. Lag Screws and Bolts, Steel:** ANSI B18.2.1, type and grade best suited for the purpose, hexagonal or square head.
- I. Wood Screws, Steel:** ANSI B18.6.1, with Phillips or square drive head.
- J. Plain Steel Washers:** FS FF-W-92, round, carbon steel.
- K. Lock Washers:** FS FF-W-84, helical spring, carbon steel.
- L. Toggle Bolts:** Not permitted for structural connections. Depending upon substrate, use expansion anchor or use screw into appropriate backing material.
- M. Concrete Anchors, Epoxy Adhesive Type:** Manufacturer, product, type and size as identified on Structural Drawings. If products are not indicated on Drawings, then provide anchors as directed by the Architect (Structural Engineer) and approved by Authority Having Jurisdiction (AHJ). Equivalent products of other manufacturers will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
- N. Concrete and Masonry Anchors, Wedge-Type:** Manufacturer, product, type and size as identified on Structural Drawings.
 1. Equivalent products of other manufacturers, if approved by Authority Having Jurisdiction (AHJ), will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
 2. If products are not indicated on Drawings, then provide anchors as directed by the Architect (Structural Engineer) and as approved by Authority Having Jurisdiction (AHJ), will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
- O. Concrete and Masonry Screws, Self-Threading:** Manufacturer, product, type and size as identified on Structural Drawings. If products are not indicated on Drawings, then provide anchors as directed by the Architect (Structural Engineer) and approved by Authority Having Jurisdiction (AHJ). Equivalent products of other manufacturers, if acceptable to Authority Having Jurisdiction (AHJ), will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.

- P. Fiber Plugs and Screws:** Not permitted.
- Q. Lead Expansion Shields:** Not Permitted.
- R. Powder-Actuated Driven Fasteners:** Comply with notes on Drawings.
- S. Welding Rods and Bare Electrodes:** As indicated on (Structural) Drawings for welding of structural (load-bearing) members. If not indicated, select rods and electrodes in accordance with AWS D1.1 - Code for Welding in Building Construction, applicable to metal alloy to be welded.

1.02 GROUTING COMPOUNDS

- A. Specified Manufacturers:** Products of the following manufacturers are specified and will be acceptable provided they comply with referenced standards all other requirements of the Contract Documents:
 - 1. Dayton Superior Corporation, Chemical Operations, Oregon, IL (815/732-3136 or 800/745-3707; local office, Santa Fe Springs, CA, 310/946-5504 or 800/745-3701).
 - 2. Euclid Chemical Co., Cleveland, OH (216/531-9222 or 800/321-7628).
 - 3. L&M Construction Chemicals, Inc., Omaha, NE (402/453-6600 or 800/362-3331).
 - 4. Master Builders Technology, Inc., Cleveland, OH, (216/831-5500; local representative, Rancho Cucamonga, CA, 909/466-6267).
 - 5. W.R. Meadows, Inc., Elgin, IL (700/683-4500; local representative Walnut, CA, 909/469-2606 or 800/342-5976).
 - 6. The Rawl Plug, Inc., New Rochelle, NY (914/235-6300).
 - 7. Sika Corporation, Lyndhurst, NJ (201/933-8800; local representative, Santa Fe Springs, CA, 310/941-0231).
 - 8. Sonneborn Building Products, Division of ChemRex, Inc., Minneapolis, MN (612/835-3434 or 800/433-9517).
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified Section 01 6000 - Product Requirements.
 - 1. The Burke Co., Buffalo, NY (716/832-5959; local representative, Fountain Valley, CA, 714/556-4510).
 - 2. Larsen Products Corp., Rockville, MD (301/770-5200 or 800/633-6668).
 - 3. Tamms Industries Co. (A.C. Horn), Mentor, OH (216/974-2399 or 800/218-2667; local representative, Los Angeles, CA, 213/269-1846).
 - 4. Thoro System Products, Miami, FL (800/327-1570).
 - 5. Stonhard, Inc., USA, Maple Shade, NJ (800/736-9300).
 - 6. Symons Corporation, Des Plaines, IL (708/298-3200; local representative, Industry, CA, 818/330-6855).
- C. Metallic Shrinkage-Resistant Grout:** For filling under equipment and interior miscellaneous metal fabrications (not for structural steel construction); pre-mixed factory-packaged compound,

metallic aggregate, minimum 5000 psi 28-day compressive strength. Confirm product selection with manufacturer's recommendations for intended use.

1. Firmix by Euclid Chemical Co.
2. Ferrogrout by L&M Construction Chemicals, Inc.
3. Embeco 636 or Embeco 885 by Master Builders Technology, Inc.
4. Kemox G by Sika Corporation.
5. Ferrolith G by Sonneborn.

D. Non-Metallic Shrinkage-Resistant Grout: For filling under baseplates and around anchors for exterior miscellaneous metal fabrications; pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with CE-CRD-C621, minimum 5000 psi 28-day compressive strength.

1. Sure Grip Grout by Dayton Superior.
2. Euco N.S. by Euclid Chemical Co.
3. Crystex by L&M Construction Chemicals, Inc.
4. Masterflow 713 or Masterflow 928 by Master Builders Technology, Inc.
5. Sealtight 588 Grout by W.R. Meadows.

E. Shrinkage-Resistant Setting Grout: For setting railing posts and similar components in sleeves or blockouts in concrete; pre-mixed, natural aggregate, minimum 5000 psi 28-day compressive strength, Master Builders Technology, Inc., Set Grout.

F. Non-Shrink Polymer (Epoxy) Grout: For setting anchor bolts in concrete.

1. For anchor bolts for structural members: As noted on Structural Drawings.
2. For anchor bolts for non-structural components: Polymer (epoxy) grout, Brutem MP or AB by Master Builders Technology, Inc., or approved equal, as recommended by manufacturer for intended use.

PART 2 - EXECUTION

2.01 PREPARATION

- A. Preparation for Cutting and Fitting:** Obtain Architect's review prior to site cutting or making adjustments not indicated.
- B. Welding Preparation:** Clean and strip site primed steel items to bare metal where site welding is indicated.
- C. Blocking and Bracing:** Make provision for erection loads with temporary bracing. Keep work in alignment.

- D. Coordination with Cast in Place Concrete:** Furnish setting templates and place items required to be cast into concrete, as specified in Section 03200 - Reinforcing Steel.

2.02 INSTALLATION, TYPICAL

- A. Installation, General:** Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Field Welding:** Perform field welding in accordance with AWS D1.1.

2.03 BASES AND BEARING PLATES

- A. Setting Bases and Bearing Plates:** Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. After bearing plates have been installed and leveled, fill space between bottom of plate and concrete using flowable non-shrink grout to completely fill space to form solid bearing for base plate. Build forms to hold grout 1-inch minimum past edges of baseplates.
 4. For proprietary grout materials, comply with manufacturer's instructions.

2.04 FIELD CONNECTIONS

- A. Field Connections, General:**
1. Conceal connections where possible. Otherwise, make countersinks for concealment after fabrication, except where noted.
 2. Provide lugs, clips, anchors and miscellaneous fastenings necessary for complete assembly and installation.
 3. Fit or miter to hairline tolerances.
 4. Component parts of built-up members shall be well-pinned with closely-fitted contact.
- B. Coordination:** Make provisions to connect metal fabrications with or to receive Work specified in other Sections.
- C. Joints Exposed to Weather or Water:** Fabricate and secure joints to keep water out, or provide adequate drainage of water that penetrates.
- D. Installation and Testing of Expansion Anchors:** Comply with anchor manufacturer's installation instructions and conditions of approval of Authority Having Jurisdiction (AHJ), including applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report.

2.05 ANCHORING POSTS AND RAILINGS

A. Post Anchors Grouted in Concrete: Anchor posts by forming or core-drilling holes not less than 6 inches (125 mm) deep and 3/4 inch (20 mm) greater than outside diameter of post.

1. Clean holes of all loose material, insert posts, and fill annular space between post and concrete with non-shrink grout, mixed and placed to comply with grout manufacturer's instructions and recommendations.
2. Unless otherwise indicated, leave joint at post base exposed, wipe off surplus grout material and leave 1/8-inch (3-mm) build-up, sloped away from post.

B. Posts and Railings Bolted to Substrate: Use fasteners as indicated or, if not indicated, sized to suit dead and live loads. Coordinate framing and backing installation at steel and wood framing to provide suitable supports.

1. Where indicated, make connections to concrete and masonry substrates by bolting with expansion anchors.
2. Where indicated, make connections to steel shapes by through-bolting.
3. Where indicated, make connections to cold-formed steel stud or joist framing or sheet backing by screwing with sheet metal screws.
4. Where indicated, make connections wood substrates using lag bolts into wood framing or blocking.
5. Where indicated, install removable railing and fence sections in slip-fit metal sockets embedded into concrete. Accurately locate sockets to match post spacing.
6. Toggle bolts will not be acceptable.

2.06 FIELD WELDING

A. Field Welding: Weld joints, corners and seams continuously in compliance with AWS D1.1 and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.
5. Re-weld to fill holes. Putties and fillers will not be accepted.
6. Do not field weld galvanized components to remain unfinished. Grind welds smooth and flush with base material.
7. Provide continuous special inspections as noted on Structural Drawings.

B. Welding Inspection and Testing: Inspect and test welds during installation of load-carrying components as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in work. Record Work required and performed to correct deficiencies.
2. Perform visual inspection of all welds.
3. Perform ultrasonic inspections on partial- and full-penetration groove welds in compliance with ASTM E 164.

2.07 TOUCH-UP AND PREPARATION FOR FINISHING

- A. Cleaning:** Perform initial cleaning immediately after completion of installation. Prepare surfaces for finish painting as specified in Section 09900 - Field Painting, for interior locations.
- B. Galvanizing Touch-Up:** Touch up galvanizing immediately after installation, including after galvanizing is damaged due to field welding. Prepare surface and apply cold galvanizing compound in compliance with the manufacturer's instructions and recommendations.
- C. Primer Paint Touch-Up:** Immediately after erection or installation, touch up shop paint. Use products as specified in Section 09900 - Field Painting, for interior locations, and as specified in Section 09873 - Urethane Coating Systems for Metals, for exterior locations.
 1. Clean field welds, bolted joints, and areas where primer is damaged.
 2. Clean and primer paint welds and surrounding areas affected by welding.
 3. Paint with material used for shop painting, minimum 3 mils dry film thickness.

END OF SECTION

SECTION 05310

STEEL DECKING

PART 1 - GENERAL

0.1 SECTION INCLUDES

- A. Steel roof decking.
- B. Acoustical roof/ceiling decking.
- C. Related sheet steel shapes, fasteners and accessories.
- D. Wedge anchor fastening system for support of items hung from acoustical roof/ceiling decking.

0.2 RELATED SECTIONS

- A. Section 05081 - Galvanized Finishes on Steel: Galvanizing repair products and procedures applicable to steel decking.
- B. Section 05090 - Anchors and Fasteners: General requirements for anchors, fasteners and welding.
- C. Section 05120 - Structural Steel: Supporting structure of steel shapes at steel decking.
- D. Section 05500 - Miscellaneous Metal Fabrications: Clips and angles to support decking and reinforce openings in decking.
- E. Section 07270 - Firestopping and Smoke Seals: Mineral fiber fire safing insulation for installation at decking closures above fire-resistive walls and partitions.
- F. Section 07620 - Roofing Accessories: Pre-fabricated sheet metal curbs; roof access hatch.
- G. Section 09900 - Field Painting: Priming and finish coating of interior, exposed steel decking.
- H. Section 09920 - Coatings for Exterior Steel: Priming and finish coating of exterior steel decking.

0.3 REFERENCES

- A. American Iron and Steel Institute (AISI): AISI - Specification for the Design of Cold-Formed Steel Structural Members.
- B. ASTM International (ASTM):
 - 1. ASTM A 446 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

2. ASTM A 525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) By The Hot-Dip Process.
- C. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code - Steel.
 2. AWS D1.3 - Structural Welding Code - Sheet Steel.
- D. Steel Decking Institute (SDI): SDI - Design Manual for Composite Decks, Form Decks, and Roof Decks.

0.4 SYSTEM DESCRIPTION

- A. Steel Deck Structural Design: Design is based upon continuous span conditions, with minimum length for two span configuration.
- B. Diaphragm Action: See Structural Drawings for connection to supporting members and for seam attachments.

0.5 SUBMITTALS

- A. Shop Drawings: Submit detailed drawings showing layout and types of deck panels, anchorage details and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing or other accessories.
- B. Product Data:
1. Manufacturer's specifications and installation instructions for steel decking, accessories and manufacturer's load tables. Indicate by transmittal form that a copy of each instruction has been distributed to installer.
 2. Submit complete manufacturer's descriptive literature and specifications, including acoustical properties, for acoustical decking.
- C. Sustainable Design Submittal: For compliance with California Green Building Standards Code (CALGreen).
1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
 2. Include statement indicating costs for each product having recycled content.
- D. Design Calculations: Where decking size, gage or layout vary from Drawings or specified product, submit design calculation, prepared by a Structural Engineer registered to practice in the State of California, hired at no change in Contract Time and Contract Sum, for all loading and span conditions, demonstrating adequacy of proposed decking units and demonstrating compliance to SDI Design Manual for Floor Decks and Roof Decks. Costs of services of Engineer shall be included in Contract Sum.

- E. Manufacturer's Certificates of Conformance: Submit the following.
 - 1. A statement that decking manufacturer is not responsible for design intent of structural system shown on Contract Drawings.
 - 2. Certification for carbon steel.
 - 3. Certification for zinc-coated steel.
 - 4. Certification that decking complies with SDI Specifications.
- F. Test Reports: Submit current ICC Evaluation Service, Inc. (ICC ES) Evaluation Report acceptable to Authority Having Jurisdiction (AHJ). State the horizontal shear value allowed, based on test results. Minimum safety factor shall be 3.0 against ultimate load.
- G. Welder Certifications:
 - 1. Submit test certifications for each welder.
 - 2. Submit certification prior to welding operations.
 - 3. Certification shall attest that welders to be employed for Work have satisfactorily passed AWS qualification tests.

0.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall be regularly engaged and specializing, for the preceding 5 years, in producing specified products. Manufacturer shall be a member firm of Steel Deck Institute (SDI) in accordance with Quality Control provision specified in PART 1, herein.
- B. Codes and Standards: Comply with applicable provisions of following codes and standards.
 - 1. AISI Specifications for the Design of Light Gauge Cold-Formed Steel Structural Members.
 - 2. AWS D1.1 Structural Welding Code.
 - 3. AWS D1.3 Code for Welding Sheet Steel in Structures.
 - 4. SDI Design Manual for Floor Decks and Roof Decks.
- C. Coordination: Coordinate installation of sound-absorbing insulation strips in topside ribs of acoustical deck with roofing installation specified in Section 07540 - Thermoplastic Membrane Roofing to ensure protection of insulation strips against damage from effects of weather and other causes.
- D. Welder's Qualifications:
 - 1. All welding shall be done only by welders qualified to weld lightgauge metal.

2. Qualifications of welders, and duration of qualification period, shall be in accordance with applicable requirements of AWS D1.3.
3. Welders producing unsatisfactory welding, even though having passed qualification tests, shall immediately be re-certified or replaced by qualified welders.
4. Retest all welders whose certification is 12 months or older.
5. If recertification of welders is required, retesting shall be done at no change in Contract Time or Sum.

0.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Protect steel decking to avoid corrosion, deformation and other damage.
- B. Storage: Store decking and related materials to avoid contact with ground and properly supported in a sloped position for drainage. Keep decking covered and dry, using covers which do not allow condensation entrapment. Remove damaged materials from Project site immediately.

0.8 WARRANTY

- A. Extended Warranty, Roof Decking: Manufacturer's 10 year warranty, covering structural performance of decking and suitability as roofing substrate.

PART 1 - PRODUCTS

1.1 MATERIALS

- A. Steel for Galvanized Metal Deck Units: ASTM A 653, minimum yield of 38 ksi, galvanized according to ASTM A 924, G60 coating designation.
- B. Miscellaneous Steel Shapes: ASTM A 36. Refer also to Section 05120 - Structural Steel and Section 05500 - Miscellaneous Metal Fabrications.
- C. Welding Rods: As required by AWS D1.1 and AWS D1.3.
- D. Galvanizing Repair: As specified in Section 05081 - Galvanized Finishes on Steel.

1.2 NON-ACOUSTICAL STEEL ROOF DECKING

- A. Specified Manufacturer: EPIC Metals Corporation, Rankin, PA (877-696-3742).
- B. Acceptable Manufacturers: None identified. Equivalent products of other manufacturers will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements. Non-acoustical steel roof decking shall integrate with perforated, acoustical steel roof decking.

- C. Steel Roof Decking for Concealed and Exterior Exposed Conditions: Epicore ER3.5 Steel Deck Panels, manufactured by EPIC Metals Corporation, complying with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report ESR-2047. Physical properties:
 - 1. Metal: As indicated on Structural Drawings.
 - 2. Panel depth: 3-1/2 inches.
 - 3. Panel width: 24-inches.
 - 4. Rib spacing: 6-inches o.c.
 - 5. Minimum structural section properties: As indicated on Structural Drawings.
- D. Metal Finish: Hot-dipped galvanized.
- E. Finish Coating: For exposed steel decking, field-applied, as specified in Section 09970 - Coatings for Exterior Steel.

1.3 ACOUSTICAL STEEL ROOF/CEILING DECKING

- A. Specified Manufacturer: EPIC Metals Corporation, Rankin, PA (412/351-3913 or 877/890-3742).
- B. Acceptable Manufacturers: None identified. Equivalent products of other manufacturers will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
- C. Acoustical Steel Roof/Ceiling Decking: For exposed interior locations indicated on the Drawings, Epicore ER3.5A Roof Deck Ceiling Systems, manufactured by EPIC Metals Corporation, with perforated bottom flat areas and acoustical batt insulation, complying with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report ESR-2047. Physical properties:
 - 1. Metal: As indicated on Structural Drawings.
 - 2. Panel depth: 3-1/2 inches.
 - 3. Panel width: 24-inches.
 - 4. Rib spacing: 6-inches o.c.
 - 5. Minimum structural section properties: As indicated on Structural Drawings.
 - 6. Acoustical Properties: Minimum NRC .95.
- D. Acoustical Roof/Ceiling Decking Fabrication:
 - 1. Acoustical roof deck shall be cold-formed from steel coils conforming to ASTM A 653, structural quality, with minimum yield strength of 40 ksi, with hot-dip protective coating of zinc conforming to ASTM A 924, Class G90, as defined in ASTM A 653. Decking shall be formed with continuous dovetail shaped ribs.

2. Acoustical roof deck shall have full depth positive registering sidelaps that can be fastened by screws or powder-activated fasteners.
 3. Acoustical roof deck shall be fabricated with perforations.
 - a. Perforated areas shall be located in the bottom flat areas between the dovetail shaped ribs.
 - b. Minimum NRC value of .95 shall be provided. This value shall be established by sound absorption tests without use of fiberglass insulation above the panels.
- E. Finish on Acoustical Roof/Ceiling Decking:
1. Pretreatment: Before fabrication of panel, all surfaces of galvanized sheet steel shall be processed through continuous coil coating line, designed to degrease and clean metal, followed by chemical conversion coating to etch surface for proper bond characteristics.
 2. Primer: Before fabrication of panel, all surfaces of galvanized steel shall receive primer coating compatible with finish coat specified below. Primer shall be applied immediately after pretreatment chemical conversion process.
 3. Finish coating: Field-applied paint, as specified in Section 09900 - Field Painting.
- F. Acoustical Roof Decking Accessories:
1. Sheet metal accessories: As specified below under Article titled, "STEEL DECKING ACCESSORIES."
 2. Acoustical insulation: Encapsulated in polyethylene bags, provided for installation above perforations in bottom flat area between dovetail-shaped ribs of decking. To facilitate field painting of the perforated surfaces, bagged acoustical insulation shall be supported on corrosion-resistant mesh spacers.

1.4 STEEL DECKING ACCESSORIES

- A. Steel Decking Accessories, General: Provide decking manufacturer's standard type accessories for purposes indicated and for finished installation.
1. Accessories shall be same material and gage as decking units but not lighter than 20 gage, unless otherwise indicated.
 2. Provide cant strips, ridge and valley plates and various types of plates and closures as indicated or as necessary to complete work.
- B. Steel Roof Decking Accessories: Provide accessories as indicated or as necessary to complete Work shall include cant strips, ridge and valley plates and various types of plates and closures. Provide sheet metal accessories of same material, gage, and finish as deck, unless otherwise shown on Drawings or specified. Sheet metal accessories include but are not necessarily limited to:

1. Ridge plates.
 2. Valley plates.
 3. Steel cant strips.
 4. Eave plates.
 5. Closure plates at edge of decking.
- C. Adjusting Plates: As practicable, use adjusting plates of same gage and configuration as decking units. Plates of predetermined size shall be factory-cut.
- D. Metal Closure Strips: Provide galvanized sheet steel closures fabricated by decking manufacturer, of not less than 0.045-inch minimum (18 gage) sheet steel, to close openings between decking and other construction. Form metal to provide tight-fitting closures at open ends of cells or flutes and sides of decking.
1. End Closures: To close open ends of decking units.
 2. Closures Above Walls and Partitions: To close space above all partitions abutting decking where fire and smoke seals are required. Provide firestopping and smokestopping to fill between closures to maintain fire resistance rating of walls and partitions.
- E. Flexible Closures: For decking closures other at all partitions abutting decking where fire and smoke seals are not required, compressible foam closures, as standard with decking manufacturer, to fill large and small cells, complying with ICC Evaluation Service, Inc. (ICC ES) ESR-2255.
- F. Cover Plates: Provide cover plates or under-lapping sleeves for end-buttet floor deck units to cover gaps not otherwise covered by deck units and to cover welding access holes.
1. Fabricate cover plates of sheet steel of same type and not less than same thickness as decking.
 2. Form cover plates approximately 6-inches wide and match contour of deck units.
 3. Polyethylene-coated self-adhesive, 2-inch wide joint tape may be provided, instead of cover plates, on flat-surfaced decking.
- G. Sump Pans: Provide sump pans of minimum 14 gage galvanized sheet steel at drains, as indicated on the Drawings.
1. Provide level bottoms and sloping sides to direct water flow to drain.
 2. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3-inches wide.
 3. Recess pans not less than 1-1/2 inches below roof deck surface unless otherwise shown or required by deck configuration.

4. Cut holes for drains in the field.

1.5 WEDGE ANCHOR FASTENING SYSTEM

- A. Specified Manufacturer: EPIC Metals Corporation, Rankin, PA (412/351-3913 or 877/890-3742).
- B. Acceptable Manufacturers: None identified. Equivalent products of other manufacturers will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements. Wedge anchors shall be products produced by metal roof decking manufacturer.
- C. Wedge Anchor Fastening System: ANK38 Ankore nut system manufactured by EPIC Metals Corporation, consisting of threaded Ankore wedge nut, coupling nut and all-thread hanger rod.
 1. Wedge anchor components shall be manufactured of steel in the manufacturer's approved quality documentation.
 2. Wedge anchor fastening system shall comply with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report No. ESR-2255.
 3. Provide quantity of wedge anchor fastening assemblies to suit selected locations plus 10 percent spares. Deliver spares to City as directed by Construction Manager.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Supporting Structure Verification: Check alignment and levels of support framing. Do not proceed with metal deck installation until improper conditions have been corrected. Installation of decking shall constitute acceptance of supporting and surrounding construction.

2.2 DECKING INSTALLATION, GENERAL

- A. Steel Decking Installation, General: Install steel deck and accessories in accordance with SDI Design Manual for Composite Decks, Form Decks and Roof Decks and accessories in accordance with manufacturer's instructions and recommendations, reviewed shop drawings and requirements specified herein.
- B. Decking Placement: Do not start placement of deck units before supporting members are installed. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks. Unless otherwise indicated, provide 2-inch minimum bearing at supports.
- C. Decking Alignment: Place deck units on supporting structure, in straight alignment of cells of abutting units for entire length of run.

1. Adjust decking units and align at right angles to supports before permanently welding into place.
 2. Correct inaccuracies in alignment or leveling of supports before welding deck units into place.
- D. Laps: Lap decking units unless as required by manufacturer and as indicated on Structural Drawings.
- E. Securing of Decking: Secure steel decking to supporting structure flat and square, without warp or excessive deflection, as specified following under Article titled "WELDING OF STEEL DECKING".
- F. Cutting and Fitting: Cut and neatly fit deck units and accessories around other Work projecting through or adjacent to decking. Decking splice and joint locations shall be compatible with roof ridges and valleys. Decking shall not be partially cut nor shall decking be field altered except as shown on Structural Drawings and reviewed shop drawings.
- G. Loading of Decking: Do not use deck units for storage or working platforms until permanently secured. Do not exceed design live load as indicated on the Drawings.

2.3 WELDING OF STEEL DECKING

- A. Decking Unit Welding: Install decking units flat and square, secured to adjacent framing without warp or excessive deflection.
1. Weld steel decking in accordance with AWS D1.1 and D1.3 and as indicated on Structural Drawings.
 2. Weld through one thickness of sheet steel only.
 3. All welding at locations scheduled to remain exposed shall be neat, regular and even, ready for finish painting. Repair galvanized finish with cold galvanizing compound neatly applied over minimum area necessary to restore corrosion resistance. Comply with requirements specified in Section 05081 - Galvanized Finishes on Steel.
 4. Welding other than resistance-welding, shall be in accordance with applicable provisions of AWS D1.3.
 5. Welding corrections: Comply with AWS requirements and procedures.
- B. Welding Inspection: Testing Laboratory will provide special inspection as required by California Building Code (CBC) and as indicated on the Drawings.

2.4 OPENINGS

- A. Reinforcement of Openings: Reinforce decking or frame as necessary for rigidity and load-carrying capacity at all openings.
- B. Cutting and Drilling: Neatly cut or drill holes and other opening necessary for Work specified in other Sections. Obtain review and acceptance by Architect (Structural

Engineer) of holes or openings larger than 6-inches in diameter or diagonal, before drilling or cutting.

- C. Openings: Openings shall not interfere with seismic members such as chords or drag-struts.
 - 1. Reinforce decking or frame as indicated on the Drawings and as necessary for rigidity and support of other Work.
 - 2. Provide additional metal reinforcement and closure pieces as necessary for strength and continuity of decking.

2.5 DECKING ACCESSORIES

- A. Adjusting Plates: Provide in locations too narrow to accommodate full-size deck units, and install as recommended by decking manufacturer and as reviewed by Architect (Structural Engineer).
- B. End Closures: Provide galvanized sheet metal closures to close open ends of cells at columns, walls, and openings in deck.
- C. Closures Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld sheet metal closures into position to provide a complete decking installation.
 - 1. Provide sheet metal closures at both sides of all fire-rated partitions abutting decking.
 - 2. At fire-rated partitions, pack space between closures full with fire safing insulation as closures are installed.
 - 3. At non-fire rated partitions, pack space between closures full with unfaced acoustical batt insulation as closures are installed.
 - 4. Provide metal closure strips at open uncovered ends and edges of decking and in voids between decking and other construction.
 - 5. Provide flexible closure strips instead of metal closures, at Contractor's option, at tops of interior walls and partitions not of fire-resistive construction. Install flexible closures with adhesive in accordance with manufacturer's instructions.
- D. Bracing: Brace continuous metal edge and end closure pieces with minimum 20-gage steel strap at 72-inches on center maximum.
- E. Wedge Anchor Fastening System Installation: Comply with manufacturer's installation instructions and recommendations and applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report.
 - 1. Locate wedge anchor fastening assemblies at locations as directed by Architect through Construction Manager.

2.6 CLEANING AND PROTECTION

- A. Cleaning: Broom clean decking serving as roofing substrate and make ready for installation of roofing.
- B. Galvanizing Touch-Up: At all field welds to remain exposed, scratches and other defects in galvanized surfaces of steel decking, wire brush surface to expose clean bare metal and immediately apply galvanizing repair paint.
 - 1. Comply with requirements specified in Section 05081 - Galvanized Finishes on Steel.
 - 2. Restore factory-applied pretreatment, primer and intermediate coat, making surface ready to receive finish coating specified in Section 09900 - Field Painting, for exposed interior conditions, and Section 09920 - Coatings for Exterior Steel, for exposed exterior conditions.

END OF SECTION

SECTION 06172

METAL-WEB WOOD JOISTS

PART 1 - GENERAL

- 1.01 DESCRIPTION: This Section covers Contractor's survey work and engineering responsibilities where required under this Project.

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Open web, wood chord, metal joists.
- B. Related bridging, bracing and anchors.

1.2 RELATED SECTIONS

- A. Section 05120 - Structural Steel: Fabricated steel supports.
- B. Section 05500 - Miscellaneous Metal Fabrications: Fabricated steel connectors.
- C. Section 06100 - Wood Framing and Sheathing: Surrounding and supporting wood frame structure.
- D. Section 06192 - Wood I-Joists: Factory fabricated I-shaped wood framing members with plywood webs.

1.3 SYSTEM DESCRIPTION

- A. Design Criteria:
 - 1. Design Live Load: As indicated on the Drawings.
 - 2. Wood chord metal joists shall be sized and detailed to fit the dimensions and loads indicated on Drawings.
 - 3. Designs shall be in accordance with allowable values and section properties assigned and approved by the building code.

1.4 SUBMITTALS

- A. Shop Drawings: Indicate all critical dimensions for determining fit and placement in the building as well as loads the members are designed to support. Indicate framing system, sizes and spacing of joists, loads and joist cambers, bearing and anchoring details, bridging and bracing and framed openings. Review of shop drawings shall be completed prior to fabrication.
- B. Calculations: Submit structural calculations certified by Registered Civil or Structural Engineer licensed in State of California.

- C. Installation Instructions: Submit manufacturer's installation instructions and recommendations for Project conditions.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Conform to California Building Code (CBC), Chapters 16 and 23 for loads, seismic zoning, classification of building, and other loading criteria and fire-resistance requirements of floor-ceiling assembly and roof-ceiling assembly, as applicable.
2. In addition to conforming with all applicable Codes and regulations, manufacture wood chord metal joists in a plant acceptable to Authority Having Jurisdiction (AHJ), with inspection by an independent inspection and testing agency.

- B. Fabricator's Qualifications: Company specializing in fabrication of wood chord metal trusses with minimum of 5 years verifiable experience. Design joists under direct supervision of Registered Civil or Structural Engineer experienced in wood chord metal joist design and licensed in State of California.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Packaging: Piece-mark and wrap wood chord metal joists in packages before arrival at jobsite.
- B. Protection: Members shall be protected from weather and damage during transportation, erection, and construction.
- C. Storage: Store material at site off the ground in a vertical position.

1.7 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate and fit metal chord wood joists with carpentry Work and other related Work. Scribe and cope as required for accurate fit. Locate joists and related furring, nailers, blocking, grounds and similar supports to allow proper attachment of other Work.

PART 2 - PRODUCTS

2.1 WOOD CHORD METAL JOISTS

- A. Specified Manufacturer: Red Built, LLC; Chino, CA (909) 465-1208
- B. Acceptable Manufacturers: None identified. Equivalent products of other manufacturers will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements, provided products meet or exceed the section modulus of elasticity and moment of inertia (EI) of the specified products, and are acceptable to the Authority Having Jurisdiction (AHJ). Depths of wood chord metal joists shall not exceed those the product indicated on the Drawings, unless approved by Architect.

- C. Wood Chord Metal Joists: Sloped top chord, level bottom chord, double top and bottom chords, complying with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report ESR-1774 Red Built series and sizes of joists as indicated on Drawings.
- D. Structural Wood Chord Members: Red Built - MSR Lumber, manufactured in accordance with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report ESR-1774.
 - 1. Moisture content shall be between 6 and 7 percent.
 - 2. Laminated veneer lumber shall have modulus of elasticity (E) of not less than 2.0×10^6 .
- E. Steel Web Members: Accurately die-stamped, electrically-welded, cold-rolled steel tubing, 45,000 psi minimum yield strength, electro-galvanized.
- F. Connecting Pins and Bearing Accessories: Structural carbon steel, size as required for member design, electrogalvanized in compliance with ASTM A 307 or ASTM A 449.
- G. Joist Bridging: Type, size and spacing as recommended by joist manufacturer, or as indicated on the Drawings.
- H. Adhesives: Waterproof types, as standard with joist manufacturer.
- I. Fabrication: Shop fabricate all joists in accordance with Reference Standards and for use in accordance with ICC Evaluation Service, Inc. (ICC ES) Evaluation Report ESR-1774

2.2 ACCESSORIES

- A. Wood Blocking, Support Members and Framing for Openings: In accordance with Section 06100 – Rough Carpentry.
- B. Framing Anchors and Fasteners: Comply with requirements specified in Section 06100 – Rough Carpentry, except provide framing anchors and fasteners as required and recommended by joist manufacturer, as applicable. Fasteners shall be galvanized steel.
- C. Bearing Plates: Electrogalvanized steel, as indicated on Drawings or, if not indicated, as recommended by manufacturer.

2.3 WOOD CHORD METAL JOISTS FABRICATION

- A. Wood Chord Metal Joists Fabrication: Shop fabricate joists in accordance with applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report, including conditions of acceptance by the Authority Having Jurisdiction (AHJ).
 - 1. Fabricate wood chord metal joists in accordance with notes on Drawings.
 - 2. Provide continuous chords without joints.
 - 3. For spans greater than 20'-0", manufacture wood chord metal joists with camber based on radius of 2250'-0", unless otherwise indicated on the Drawings.

2.4 SOURCE QUALITY CONTROL

A. Source Quality Control:

1. Provide continuous inspection of fabrication by a compliance assurance or inspection agency listed by the National Evaluation Service Committee as part of manufacturer's standard in-plant inspection policies and procedures.
 - a. Inspector shall be subject to approval for that purpose by Authority Having Jurisdiction (AHJ).
2. To be eligible for approval, the fabrication inspector shall be examined as to his knowledge and experience in glued construction.
3. After fabrication and inspection, stamp each joist with an identifying mark, noting name and plant number of manufacturer, grade, applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report number, and identification of quality control agency.

B. Structural Wood Chord Members:

1. The fabrication inspector shall make a verified report identifying the members by mark and including pertinent data such as grade and specie of lumber, the type of glue, the extremes of moisture content and such other information as may be required.
2. The fabrication inspector's verified report shall show, of his own personal knowledge, the Work covered by the report has been performed and materials used and installed in every product in accordance with, and in conformity to, the duly approved plans, shop drawings and specifications.
3. The verified report, together with an identified copy of the lumber grade certificate shall be mailed to Authority Having Jurisdiction (AHJ).

C. Steel Web Members: Round tubular steel web members shall be certified as to conformance to ASTM A500, Grade B, by mill certificate.

1. Members shall be identified by heat or melt number.
2. One tension and on bend test shall be made for each heat.
3. The tests shall be made by an independent laboratory on samples selected by the fabrication inspector, who will be in overall charge of fabrication inspection.
4. One copy of test report shall be forwarded to the Authority Having Jurisdiction (AHJ) for each project.

D. Welding: All welding operations shall be inspected by a qualified welding inspector who will furnish a written report to the Authority Having Jurisdiction (AHJ) verifying that the welding has been performed in accordance with the plans and specifications.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordination: Coordinate placement and installation of support items.
- B. Scheduling: Coordinate and sequence wood chord metal joist installation and details with Work specified in other Sections, to ensure proper interface of joists with adjoining components, to minimize cutting and penetration of joists and to limit erected joists to the shortest possible exposure to the elements before closing-in of building envelope.

3.2 INSTALLATION

- A. Installation: Erect and secure joists as indicated on Drawings, the reviewed shop drawings and manufacturer's installation instructions and recommendations.
 - 1. Space, adjust and align joists in proper locations before permanently fastening. Align joists between supports and hold in place with temporary bracing until sheathing is secured in place.
 - 2. Immediately fasten joists to supporting construction after setting in proper location, with joists plumb, square and true to line. Use fasteners as indicated on the Drawings and in accordance with applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report, including conditions of acceptance by the Authority Having Jurisdiction (AHJ).
 - 3. Make connections and install all blocking, stiffeners and bridging as erection progresses and before construction loads are imposed on joists.
 - 4. Do not permit temporary construction loads which cause member stresses beyond design limits.
- B. Openings: Frame openings between joists with lumber as specified in Section 06100 – Rough Framing and as indicated on Drawings. Place headers and supports at wall openings as required.
- C. Blocking and Stiffeners: Install blocking and stiffeners as required and shown for lateral support of members, to provide nailing surface for sheathing and finish materials and to fireblock cavities in accordance with California Building Code (CBC), Chapter 23.
- D. Erection Bracing: Provide erection bracing in addition to specified bridging to keep joists straight and plumb and to assure adequate lateral support until sheathing material has been applied.
- E. Construction Loads: Do not permit temporary construction loads which cause member stresses beyond design limits.
- F. Tolerances: 1/2-inch maximum from true position.
- G. Field Cutting and Modifications: Do not alter joists in field except as permitted for penetrating elements such as piping and conduit.

1. Comply with details shown on the Drawings and according to applicable ICC Evaluation Service, Inc. (ICC ES) Evaluation Report, including conditions of acceptance by the Authority Having Jurisdiction (AHJ).
2. Do not repair damaged or defective joists. Joists which are damaged or found to not conform to specified requirements shall be rejected and immediately removed from the Project site. Provide new joists at no change in Contract Time and Contract Sum.

END OF SECTION

SECTION 06181

GLUE LAMINATED STRUCTURAL UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. **Prefabricated, glue laminated wood** units equivalent to sawn lumber framing ("minilams").
- B. **Related steel framing** hardware and attachment brackets.

1.02 RELATED SECTIONS

- A. **Section 01400 - Quality Control:** Tests and inspections for glue-laminated structural units.
- B. **Section 05500 - Metal Fabrications:** Custom fabricated metal framing anchors for glue laminated wood units. Custom fabricated metal framing anchors.
- C. **Section 03200 - Reinforcing Steel:** Embedding anchors and brackets for glue laminated wood members into concrete.
- D. **Section 06100 – Rough Carpentry:** General requirements applicable also to glue laminated wood members. Heavy timber construction is Sawn wood members for field-fabricated, heavy-timber trusses; heavy-timber decorative beams, corbels and trellis framing; and solid wood decking, used as roof deck at exposed roof overhangs.
- E. **Section 06181 – Glued Laminated Structural Units:** Pre-engineered and factory-manufactured lumber.
- F. **Section 06192 – Composite Wood Web Joists:** Manufactured wood framing members.
- E. **Section 09900 - Painting:** Field finishing of exposed glue laminated structural units with stain and varnish.

1.03 SUBMITTALS

- A. **Shop Drawings:** Indicate pertinent dimensions, camber, grades, species, shop applied finishes, cuts and drilled holes, fasteners, erection details and connection materials and finishes.
- B. **Sustainable Design Submittals:**
 - 1. Product data: For laminating adhesive used for structural glued-laminated timber, indicating that product contains no urea formaldehyde.

2. **Certificates:** Chain-of-custody certificates certifying that lumber used in manufacture of structural glue-laminated timbers are from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body. Include statement indicating costs for each certified wood product.

C. Certificates:

1. **Certificates of Compliance:** Certify compliance with AITC 110-83, PS 56, ANSI/AITC Standard A190.1 and ASTM D 3737.
2. **FSC Chain-of-Custody Certificate:** As specified above.

1.04 QUALITY ASSURANCE

- A. Manufacturer:** Certified by American Institute of Timber Construction (AITC).
- B. Industry Standard:** Comply with ANSI/AITC A 190.1 - Structural Glued Laminated Timber.
- C. Regulatory Requirements:** Conform to requirements of California Building Code (CBC) for loads, seismic zoning, classification of building, and other loading criteria and fire-resistance requirements of floor-ceiling and roof-ceiling assemblies, as applicable. Members shall be fabricated and inspected in accordance with the requirements of ANSI/AITC A 190.1 - Structural Glued Laminated Timber.
- D. Industry Standards:** Fabrication shall comply with the following standards.
1. ANSI/AITC A190.1 - Structural Glued Laminated Timber.
 2. ASTM D3737 - Structural Glu-Laminated Timbers, Softwood and Hardwood Species.
- E. Manufacturer Qualification:** Provide factory-glued structural units, produced by an AITC-licensed firm qualified to apply the AITC Quality Inspected mark.
- F. Product Identification:** Factory-mark each piece of glued laminated structural units with AITC Quality Inspected mark. Place AITC mark on timber surfaces which will not be exposed in completed Work.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Protection:** Protect members in accordance with AITC requirements. Piece-mark and wrap structural units before shipping to jobsite. Maintain wrapping until units are in place and ready to receive adjoining framing members.
1. For members to be exposed to view, individually wrap members.
 2. For members to be concealed, bundle wrap or load wrap members.
- B. Storage:** Comply with AITC requirements. Protect members from weather and damage during transportation, storage, erection, and construction.

1. Schedule the delivery and the erection of glued laminated timber to avoid extended on-site storage, and to avoid delaying subsequent work.
2. Store units on sleepers above ground.
3. If individually wrapped, slit bottom of wrappings intermittently to allow moisture to escape.

PART 2 - PRODUCTS

2.01 LUMBER-SIZE GLUE LAMINATED WOOD STRUCTURAL UNITS

- A. Specified Manufacturer:** None identified.
- B. Acceptable Manufacturers:** None identified. Equivalent products of other manufacturers will be considered in accordance with the "or equal" provision specified in Section 01600 – Material and Equipment, subject to acceptability of member sizes and structural performance equivalence.
- C. Lumber-Size Glue Laminated Wood Structural Units:** Type and size as indicated on the Drawings.
1. Members not exposed to view and not exposed to weather: Douglas fir, Industrial appearance grade, Combination Symbol as indicated on the Structural Drawings.
 2. Members exposed to view or exposed to weather: Alaskan Yellow Cedar, Architectural appearance grade, Combination Symbol as indicated on the Structural Drawings with 95% heartwood.
- D. Camber:** As indicated on Drawings.
- E. Adhesive:** ANSI/AITC A190.1, wet-use type. Adhesive shall be formaldehyde-free. Adhesive color for Alaskan Yellow Cedar shall closely match the color of the wood.
- F. End Sealer:** Manufacturer's standard, transparent, colorless wood sealer, effective in retarding transmission of moisture at cross-grain cuts.
- G. Penetrating Sealer:** Manufacturer's standard, translucent, penetrating wood sealer that will not interfere with application of wood stain and transparent finish, or paint finish.

2.02 GLUE LAMINATED WOOD STRUCTURAL UNITS FABRICATION

- A. Glue Laminated Wood Structural Units Fabrication, General:** Fabricate members in compliance with ANSI/AITC A190.1, ASTM D3737, and AITC 117, using laminating stock and adhesives of type to suit specified Combination Symbol and exposure.
1. Field verify dimensions and Project conditions before fabrication.
 2. Each lamination shall be graded on the basis of the requirements of the nominal size of the individual lamination. When lumber is resawn, regrade

- members on basis of new net size, at no change in Contract Time and Contract Sum. Comply with AITC 200, referenced in ANSI/AITC A190.1.
3. Provide pre-glued, plain scarf end joints in laminations.
 - a. Portions of scarfs in adjacent laminations shall be separated by a minimum of 6-inches.
 - b. Strength reducing defects such as wane will not be acceptable in or near an end joint.
 - c. Sum of knots, which appear in the beveled surface of a scarf, shall not exceed one-fourth the nominal width of lamination when lamination is 1-5/8 inch or less in thickness.
 4. Provide pre-glued edge joints.
 - a. For lumber stock glued edge-wise and used in top or bottom lamination of glue laminated units for exterior use or when direction of load is parallel to wide face of the lamination.
 - b. For lumber stock used in other laminations, laminations may consist of two or more pieces placed side-by-side, provided longitudinal edge joints in adjacent laminations are staggered at least 2-inches laterally.
 5. Cut and fit members accurately to length to achieve tight joint fit.
 6. Fabricate members with camber built in. Provide camber as indicated on Drawings.
 7. Do not splice or join members in locations other than those indicated, without approval of Architect (Structural Engineer).

B. Appearance Grade: Provide grades as follows, complying with AITC 110.

1. Locations concealed from view: Industrial appearance grade.
2. Locations exposed to view: Architectural appearance grade.

C. Sealing: After end trimming, seal exposed members and members exposed to wet or damp conditions, in accordance with AITC requirements.

2.03 CONNECTORS, ANCHORS, AND ACCESSORIES

A. Connectors, Anchors, and Accessories: Provide stock- and custom-fabricated connectors of structural steel (ASTM A36 (ASTM A36 M)) shapes, plates and bars, welded into assemblies of types and sizes indicated, with steel bolts (ASTM A 307), lag bolts, and other fasteners, as indicated and as necessary.

1. At dry conditions, finish each assembly and fastener prior to use with rust-inhibitive primer, 2 mils (0.05 mm) dry film thickness. Coordinate primer with requirements specified in Section 09900 - Painting.
2. At damp and wet conditions, finish each assembly and fastener unit with hot-dip zinc coating (ASTM A153). Coordinate with primer requirements specified in Section 09920 Coatings Systems for Exterior Metals.

B. Fabrication: Fabricate connectors and use hardware so joints are neatly fitted, welded and, at exposed locations, ground smooth. Comply with general requirements for steel fabrications specified in Section 05500 - Miscellaneous Metal Fabrications.

C. Painted Finish at Connectors:

1. Interior conditions: As specified in Section 09900 - Field Painting.
2. Exterior conditions: As specified in Section 09920 - Coatings for Exterior Steel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordination and Sequencing: Coordinate and sequence glue laminated units installation and installation details with Work specified in other Sections.

1. Do not install glue laminated members until supporting construction is in place and is braced and secured.
2. Ensure proper interface of glue laminated members with adjoining components, to minimize cutting and penetration of glue laminated members and to limit erected glue laminated members to the shortest possible exposure to the elements before closing-in of building envelope.

B. Coordinate routing of pipes, ducts and conduits to avoid penetrations through glue laminated structural units.

3.02 ERECTION

A. Erection: Erect and secure glue laminated units as indicated on Drawings, the reviewed shop drawings and manufacturer's installation instructions and recommendations.

1. Space, adjust and align glue laminated members in proper locations before permanently fastening. Align glue laminated members between supports and hold in place with temporary bracing until sheathing is secured in place.
2. Set members level and plumb, or to indicated slope, in correct positions.
3. Provide temporary bracing and anchorage to hold members in place until permanently secured.
4. Fit members together accurately without trimming, cutting, or any other unauthorized modification.
5. Immediately fasten glue laminated members to supporting construction after setting in proper location. Make connections as erection progresses and before construction loads are imposed on glue laminated members. Use fasteners as indicated on the Drawings.
6. Do not permit temporary construction loads which cause member stresses beyond design limits.

B. Erection Bracing: Provide erection bracing as necessary to keep glue laminated members straight and plumb and to assure adequate lateral support until other framing and sheathing materials have been applied.

C. Field Cutting and Modifications:

1. Do not alter glue laminated members in field except as approved by Architect for penetrating elements such as piping and conduit.
2. Do not repair damaged or defective glue laminated members. Glue laminated members which are damaged or found to not conform to specified requirements shall be rejected and immediately removed from the Project site. Provide new glue laminated members at no change in Contract Time and Contract Sum.

D. Weather Protection

1. Protect installed glue laminated members from exposure to weather and potential discoloration from sun and rain before finishing.

3.03 TOLERANCES

- A. Framing Members:** 1/4-inch maximum from true position.

END OF SECTION

SECTION 07265

VAPOR EMISSION REDUCTION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Fluid-applied, water vapor control coating system** applied to all concrete floors indicated to receive wood flooring, resilient flooring and carpet. System shall include sealer for water vapor control and protective portland cement-based topcoat suitable for protection during construction activities and future floor covering removable, surface preparation and installation of new finish flooring.
1. Concrete substrate preparation shall include shot blasting and other preparatory measures necessary to provide suitable condition for application of water vapor control coating system.
 2. Completed surface condition shall be suitable for installation of finish flooring specified in other Sections.

1.02 RELATED SECTIONS

- A. Section 03300 - Cast in Place Concrete:** Concrete floor slabs; remediation of defective concrete, including concrete floor slabs with excessive moisture vapor emission.
- B. Section 09625 - Resilient Athletic Flooring System:** Flooring installed over concrete substrate.
- C. Section 09645 - Cushioned Wood Flooring Assemblies:** Flooring installed over concrete substrate.
- D. Section 09650 - Resilient Flooring:** Flooring over concrete substrate.
- E. Section 09690 - Carpet Tile:** Flooring installed over concrete substrate.

1.03 REFERENCES

- A. ASTM International (ASTM):** Formerly American Society for Testing and Materials.
1. ASTM E 96 - Standard Test Methods For Water Vapor Transmission of Materials
 2. ASTM F 1869 - Standard Test Method For Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 3. ASTM F 710 - Standard Test Method for Preparing Floors To Receive Resilient Flooring.

1.04 SUBMITTALS

- A. Product Data:** Provide data for concrete floor cleaning, coating and preparation materials.
- B. Laboratory Testing:** Submit current independent laboratory reports, dated within 2 years of project start, for specified performance. Reports dated beyond 2 years are not acceptable.
- C. Installer's Qualifications:** Valid manufacturer's approved applicators certificate for warranted system.
- D. Installation Instructions:** Indicate procedures and processes.
- E. Warranty:** Submit manufacturer's warranty, as specified.
- F. Insurance Certificate:** Submit product manufacturer's warranty certificate listing City as additional insured.

1.05 QUALITY ASSURANCE

- A. Coating Manufacturer's Qualifications:** Manufacturer specializing in single- and two-component products meeting specified ASTM third party laboratory testing.
- B. Installer's Qualifications:** Manufacturer-approved, licensed and certified for the application of specified products.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Project Conditions:** Maintain temperatures of ambient temperature between 55 and 85 degrees F, 72 hours prior to, during and after application.

1.07 WARRANTY

- A. Extended Warranty:** Manufacturer shall furnish extended warranty to City agreeing to correct defective Work for period of 15 years from dated established by Notice of Completion.
 - 1. Manufacturer's warranty shall cover water vapor emission coating failure, including but not limited to, suppression of water vapor emission, alkalinity and migrating salts through concrete surfaces. Emission levels after application shall not exceed flooring manufacturer's requirements.
 - 2. Manufacturer shall provide product liability insurance in the amount of \$6,000,000 per occurrence and list City as additional insured.
 - 3. Installation shall include a cement topcoat to provide sustainable surface for future flooring updates and replacements to allow warranty coverage to be extended.
- B. Warranty Repair Work:** Include removal and replacement of flooring products, removal of portland cement topcoat, removal of water vapor emission coating,

preparation of concrete substrate and application of new water vapor emission control coating system.

1. Remedial work shall include all costs to City for incidental damages, including necessary removal and reinstallation of furniture, fixtures and equipment.
2. Remedial work shall include removal and replacement of all flooring products in room so that consistent appearance and performance of flooring surface is restored.

PART 2 - PRODUCTS

2.01 VAPOR EMISSION COATING SYSTEM

- A. Specified Manufacturer:** Synthetics International, (866/646-0356).
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
1. DiamondStone LLC (Diamond-VRS), (888/817-8663).
 2. Ardex Engineered Cements (Ardex MC), (724/203-5001 or 888/512-7339).
- C. Water Vapor Emission Control System:** Synthetic 30 manufactured by Synthetics International, fluid-applied, water vapor control coating system that penetrates and suppresses water vapor emission from portland cement concrete and creates alkali resistance to 14 pH.
1. Water vapor control coating system shall be two-coat application of proprietary two-component, low viscosity, polymer coating which forms highly insoluble film, reducing water vapor by 95 percent (ASTM E 96) and resistant to 14 pH (ASTM D 1308).
 2. Water vapor control coating system shall remain resistant to 100% RH when tested according to ASTM F 2170, In-Situ Relative humidity exposure.
 3. Completed application shall maintain water vapor emission rate of less than 2.0 lbs. when tested according to ASTM F 1869.
- D. Properties:** Water vapor control coating system shall be tested by independent testing laboratory tested in accordance with the following procedures and results:
1. Water Vapor Transmission - WRT:
 - a. ASTM E 96 Grains/ft²/hr: Less than 0.6.
 - b. ASTM E 96 Pounds/1000 ft² 24 hours: Less than 2.0.
 - c. ASTM E 96 grams/h· m²: Less than 0.7.
 2. Water Vapor Permeance - WVP:
 - a. ASTM E 96 Perms (inch-pounds) of less than 2.4.
 - b. ASTM E 96 Grams/Pa· s· m² x 10⁻⁹ of less than 13.6
 - c. ASTM E 96 Nanograms/ Pa · s · m² of less than 136.3

3. Alkali Resistance - 30 days:
 - a. ASTM D 1308 - Resistant to 35% potassium hydroxide exposure.
 - b. ASTM D 1308 - Resistant to 14 pH solution exposure.
4. Concrete Adhesion - Pull off:
 - a. ASTM D 4541 Adhesion of 375 to 600 psi (100% concrete cohesive failure).
5. Low Emitting - VOC Content:
 - a. EPA Method 24 testing of less than 62 g/liter.
 - b. Meets LEED EQ Credit 4.2
 - c. Meets CHPS EQ Credit 2.2
 - d. Contains no formaldehyde, formaldehyde precursors and zero-carcinogens.
 - e. Contains zero hazardous air pollutants (HAPs).
 - f. Meets indoor air quality requirements for office, schools and healthcare by emission chamber testing.

2.02 ACCESSORY PRODUCTS

- A. Moisture Tolerant Primer:** Two-component, low viscosity liquid for chemically bonding cement products to vapor control coating.
- B. Portland Cement Topcoat:** Portland cement, single-component floor prep product as approved by coating manufacturer. Product shall be applied at nominal 1/8-inch thickness.
- C. Water Vapor Emission Test Kits:** American Moisture Test, Inc. (866/670-9700), suitable for testing according to ASTM F 1869.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examination:**
 1. Verify substrates meet manufactures requirements before starting preparation and application.
 2. Verify that items which penetrate substrate to receive coating are securely installed.

3.02 PREPARATION

- A. Preparation:**
 1. Remove foreign materials detrimental to system, such as curing compounds, sealers, loose patching materials or surface oil) shall be removed by mechanical scarification or shot-blasting.
 2. Repair cracks, joints, low spots and bumps as acceptable to Architect and according to criteria of manufacturer of water vapor emission mitigation.
 3. Vacuum all surfaces. Water vapor emission mitigation system shall not be applied to frozen, dirty, on-absorptive or glossy surfaces. Do not acid etch or use clean sweeping agents.

4. Ensure that prepared surfaces are solid, free of loose particles, cracks, pits, rough projections or foreign matter detrimental to maximum adhesion of the water vapor control coating system.

3.03 APPLICATION

A. Application of Water Vapor Control Coating System: Comply with manufacturer's instructions and recommendations.

1. Apply moisture-tolerant primer to ensure bond of all cement products to vapor control coating.
2. Apply ultra low-viscosity moisture-alkaline penetrant over entire concrete floor surface, using lint-free nap roller or floor brush, and saturate entire concrete surface. Allow penetrant to cure according to manufacturer's requirements.
3. Apply penetrant to saturate surfaces, cracks and joints in accordance with manufacturer's spread rates and curing requirements.

B. Application of Topcoat: Mix and apply portland cement-based topcoat product to provide smooth floor surface suitable for installation of flooring. Cured thickness shall comply with manufacturer's requirements for surface capable of future flooring removal and replacement.

3.04 FIELD QUALITY CONTROL

A. Field Testing: In accordance with requirements specified in Section 01400 - Quality Control.

1. Testing shall be performed according to ASTM F 1869 after application and curing of water vapor control coating, to verify water vapor emission rate. Testing shall be minimum of 10 tests per 1,000 sf of floor area or portion thereof, using suitable, prepackaged calcium chloride dome test kits.
2. Should testing result in water vapor emission greater than 2.5 lbs. per 1,000 square feet in 24 hours, clean floor and reapply water vapor control coating according to manufacturer's instructions.
3. Retest and perform additional remedial measures according to manufacturer's instructions and recommendations until water vapor emission result of 2.5 lbs. is achieved.

END OF SECTION

SECTION 07600

SHEET METAL

PART 1 - GENERAL

- 1.01 DESCRIPTION: Division 1 applies to this Section. Provide sheet metal items complete as indicated, specified, and required.

A. Work In This Section: Principal items include:

1. Sheet metal flashings in connection with roofing.
2. Reglet and counterflashing assemblies.
3. Miscellaneous metal flashing and counter flashing as required, except where provided by mechanical and electrical trades.
4. Factory-manufactured reglets and counterflashing.
5. Factory-manufactured, formed aluminum parapet copings.
6. Gutters and downspouts.
7. Drip flashings.
8. Beam to wall flashings.
9. Equipment platforms.
10. Window and door head flashings.
11. Diverters.
12. Scuppers
13. Conductor heads
14. Coping caps.
15. Shop priming and field touch-up.
16. Caulking.

B. Related Work Not In This Section:

1. Sheet metal in connection with Plumbing, Air Conditioning, and Electrical.
2. Metal accessories for drywall, lathing, and acoustical treatments.
3. Finish painting and factory applied metal finishes.
4. Sleeves for embedded items.
5. Louvers and vents.

- 1.02 QUALITY ASSURANCE: Drawing details and requirements herein govern. Conform to the current "Architectural Sheet Metal Manual" published by Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) for conditions not indicated or specified and for general fabrication of sheet metal items.

- 1.03 SUBMITTALS: Refer to Section 01300 for procedures.

A. Shop Drawings: Submit for fabricated sheet metal showing details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

B. Samples and Product Data: Submit Samples and data for materials or assemblies as Architect may request.

- 1.04 **WARRANTY:** Refer to Section 01740. Furnish to the Owner a written warranty against all defects in materials, workmanship and/or water tightness for all Work of this Section in fully watertight condition for a period of 2 years, including drain fittings, sheet metal in connection with roofing.

PART 2 - PRODUCTS

2.01 **BASIC MATERIALS:**

Galvanized steel:	ASTM A525, coating G90, mill phosphatized for paint adhesion, 24 gage unless otherwise indicated or specified.
Aluminum:	T6065-T5 alloy, temper best suited for each purpose.
Lead:	FSQQ-L-201 4 lbs. sheet lead
Solder:	ASTM B32, B284.
Solder flux:	Standard brand non-corrosive acid-base type.
Fasteners:	Zinc or cadmium coated steel or stainless steel.
Felt:	ASTM D226, 15-pound type.
Primer:	Approved brand of zinc-dust zinc-oxide primer per Section 09900 with manufacturer's pretreatment materials.
Sealant:	Conforming to Section 07900.

2.02 **RELATED MATERIALS:**

- A. Reglets and Counterflashings:** Fry Reglet Corp. flashing systems complete with unions and preformed corners of necessary types for particular locations, of 26 gage galvanized steel, or approved equals by Metco Metal Products Co., Pacific Loxtite Flashing Co., National Cornice Works, Redco, Lane-Air, or equal. Use single manufacturer's products throughout equivalent to Type CO at concrete, Type MA at masonry, Type ST at plaster, or Type SM, as required by Drawings and details.

- 2.03 **GENERAL FABRICATION REQUIREMENTS:** Fabricate to avoid distortion and overstress of fastenings due to expansion and contraction. Provide expansion joints where necessary in continuous runs of sheet metal, constructed watertight and spaced 30-feet apart maximum. Lock and solder corners and blind hem exposed edges. Make joints with 4" lap and solder unless otherwise shown or specified. Fill single lock seams with sealant where soldering is not feasible. Extend flanges 4" minimum onto roof and wall surfaces. Fabricate sheet metal items in nominal 8-foot lengths unless otherwise shown or specified.

- A. Soldering:** Do soldering slowly, immediately after application of flux, seams showing evenly flowed solder. Clean and neutralize finished soldering.
- B. Shop Priming:** Clean completed items, apply pretreatment, and prime all exposed surfaces with specified primer.
- C. Finish:** Refer to either Section 05900 – Metal Finishes or Section 09920 – Coating Systems for Exterior Metals.

2.04 FORMED ALUMINUM PARAPET COPINGS:

- A. Specified Manufacturer:** MM Systems Corporation, 404/938-7570 or 800/241-3460; local representative, Specialty Building Components, Whittier, CA, 310/945-8951.
- B. Acceptable Manufacturers:** Equivalent products of W.P. Hickman Co., Asheville, NC (704/274-4000) will be acceptable in accordance with the "or equal" provision specified in Section 01600 Requirements- Equivalent products of other manufacturers will be considered in accordance with the substitution provision specified in Section 01600 - Requirements.
- C. Formed Aluminum Parapet Coping:** MM Systems Snap-Lok Coping System, multi-part coping system, style to suit size indicated on Drawings and existing wall conditions.
 - 1. Coping shall be formed from 0.063 inch (1.6 mm) aluminum sheet to profile and of thickness indicated.
 - 2. Anchor plate shall be minimum nominal 0.0276-inch (0.7-mm) thick, zinc-coated steel anchor plate or cleat located at coping joint.
 - 3. Provide formed aluminum gutter chair or gutter/splice plate or compression pad/gutter.
 - 4. Inside and outside corners shall be prefabricated, with miters welded before finishing.
 - 5. Coping system shall require no exposed fasteners.

0.05 FABRICATION AND FINISHING

- A. Formed Aluminum Parapet Coping Fabrication:**
 - 6. Furnish units in longest practicable lengths to minimize number of end joints. Minimize site splicing.
 - 7. Provide hairline mitered corners where coping changes directions or abuts other materials.
 - 8. Provide factory splices, guttering and other components of manufactured coping system. Installed coping shall present continuous faces and edges, with no apparent joints from ground level.
 - 9. Back paint components in contact with cementitious materials to prevent electrolysis.
- B. Metal Finishes, General:** Comply with NAAMM - Metal Finishes Manual, for finish designations and application recommendations, except as otherwise indicated. Apply finishes in factory after products are fabricated. Protect finishes on exposed surfaces with protective covering before shipment.
- C. Aluminum Finishes:**
 - 1. Concealed aluminum components: AA-M10 (unspecified mill finish).
 - 2. Exposed aluminum components: PVDF coating system containing minimum 70 percent Kynar 500/Hylar 5000 polyvinylidene fluoride (PVDF) resin, shop- or factory-applied as specified in Section 05900 -

Fluoropolymer Paint Finishes on Aluminum. Color shall match other aluminum components, as noted on the Drawings or Architect's selection.

D. Concealed Steel Components: Hot-dipped galvanized or stainless steel.

2.06 **FABRICATED ITEMS:** Of 24 gage galvanized steel except as otherwise indicated on drawings or specified.

A. Drip Flashings: Hemmed exposed edges, 1-piece lengths.

B. Gutters and Downspouts: As detailed, gutter joints riveted and soldered tight or filled with sealant, all galvanized. Provide 1/4" mesh balloon strainers at all downspout outlets. Provide covered expansion joints midway between outlets.

C. Diverter: Fabricate as detailed on drawings of 20 gage galvanized steel, all joints soldered. Install as detailed and in accordance with SMACNA requirements.

D. Scuppers: All joints locked and soldered watertight, flanges extending at least 4" into roofing, outer edges hemmed.

E. Conductor Head: Of 20 gage galvanized, all joints locked and soldered, top edge beaded for stiffening, outlet flange riveted and soldered. Provide a 1/4" mesh galvanized leaf strainer at top, secured in place but removable.

F. Equipment Platforms: All joints locked and soldered watertight, flanges extending at least 4" into roofing, outer edges hemmed.

2.07 **SHEET METAL FINISHES**

A. Sheet Metal Finishes: Unless otherwise indicated, all exposed exterior sheet metal is intended to receive field-applied primer and finish coatings.

1. Sheet metal fascias, parapet caps, fascia gutters, downspouts, flashing and trim exposed to public view: Fabricated from factory-finished Galvalume sheet steel as specified, including finish color.
2. Sheet metal exposed at metal roofing: Fabricated from factory-finished Galvalume sheet steel as specified, including finish color. Sheet metal flashing and trim shall be integral components of metal roofing system.
3. Sheet metal at other locations not exposed to public view: Hot-dipped galvanized sheet steel, field coated (primed and painted) as specified in Section 09920 - Coatings for Exterior Steel,
4. Sheet metal at valley (built-in) gutters: Primer and finish coatings as specified in Section 09920 - Coatings for Exterior Steel, for weathering and corrosion resistance.

PART 3 - EXECUTION

3.01 **GENERAL INSTALLATION REQUIREMENTS:** Install metal items as indicated, according to approved submittals, and as required to complete the Work. Securely fasten and assemble, and make watertight and weathertight.

- A. Coordinate Sheet Metal Items** in connection with roofing for proper installation and furnish in sufficient time to avoid delay in roofing construction. Install roofing sheet metal simultaneously with roofing.
- B. Caulking:** Provide sealant calking as indicated and required to seal and complete Work of this Section. Conform to Section 07900.
- C. Isolation:** Isolate sheet metal from contact with concrete or masonry with one layer of roofing felt, except embedded items.

0.02 PARAPET COPINGS INSTALLATION

- A. Installation of Parapet Copings:** Install extruded aluminum parapet coping in accordance with manufacturer's instructions and recommendations, ensuring weather-tight installation.

- 3.03 COMPLETION: Examine installed sheet metal, water test if necessary or directed, and correct damaged or defective items.

END OF SECTION

ROOF ACCESS HATCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Roof access** hatches.
- B. Access** ladders

1.02 RELATED SECTIONS

- A. Section 05500** - Miscellaneous Metal Fabrications: Fixed roof access ladders.
- B. Section 07540** – Thermoplastic Membrane Roofing: Requirements for provisions in roofing accessories to receive TPO roofing.
- C. Section 07600** - Sheet Metal Flashing and Trim: Roof flashing.
- D. Section 08710** - Door Hardware: Padlock for roof hatch.

1.03 SUBMITTALS

- A. Product Data:** Submit manufacturer's complete descriptive literature and specifications.
- B. Installation Instructions:** Submit manufacturer's installation instructions and recommendations. Include instructions for the particular products and conditions of Project.

1.04 WARRANTY

- A. Extended Warranty, Roof Hatches:** Manufacturer's standard warranty for period of 5 years from date established by Notice of Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Specified Manufacturer:** The Bilco Company, New Haven, CT (203/934-6363; local representative, Specialty Building Components, Whittier, CA, 562/945-8951).
- B. Acceptable Manufacturers:** Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements. Equivalent products of other manufacturers will be considered in accordance with the substitution provision specified in Section 01600 - Product Requirements.

1. Dur-Red Products, Cudahy, CA (323/771-9000).
2. Milcor, Lima, OH (419/227-6899).
3. Wasco Products, Inc., Sanford, ME (207/324-8060 or 800/388-1181).

2.02 ROOF HATCHES

A. Roof Access Hatches, General:

1. Covers shall be reinforced to support a minimum live load of 40 psf (195kg/m²) with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
2. Operation of the covers shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the covers shall not be affected by temperature.

B. Vertical Ladder Roof Access Hatches (Scuttles): Bilco Type E, steel roof scuttle for installation at vertical roof access ladder, single-leaf door, pre-assembled by manufacturer. Scuttle shall have clear inside curb dimensions of 3-feet 0-inches (914 mm) by 3-feet 0-inches (914 mm).

1. Curb: 12-inches high, fabricated from 14 gage steel, formed with 3-1/2-inch flanges with drilled holes for attachment to roof deck. Provide curb with integral cap flashing formed from 14 gage galvanized steel.
2. Cover: 14 gage galvanized steel sheet with 3-inch beaded flange, neatly welded.
3. Cover hardware: Heavy pintel hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and padlock hasps inside and outside, and thermoplastic rubber gasket.
4. Cover operator: Automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of cover to closed and latched position. Compression spring operators shall be enclosed in telescopic tubes to provide, smooth, easy and controlled cover operation throughout entire arc of opening and closing.
 - a. Upper tube shall be outer tube to prevent accumulation of moisture, grit and debris inside lower tube assembly.
 - b. Lower tube shall interlock with flanged support shoe welded to curb assembly.
 - c. Compression spring tubes shall be anti-corrosive composite material. Springs shall have electrocoated acrylic finish for corrosion resistance.
5. Hinges: Heavy pintle hinges, zinc-plated and chromate sealed.
6. Latch: Enclosed two-point spring latch with interior and exterior turn handles, with interior and exterior padlock hasps. Latch strike shall be a stamped component bolted to the curb assembly.
7. Hold-open: Covers shall automatically lock in open position with rigid hold-open arm equipped with 1-inch (25.4mm) diameter red vinyl grip handle to permit easy release for closing.
8. Cover operator: Automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of cover to closed

- and latched position.
9. Hardware attachments: Cover hardware shall be bolted into heavy gage channel reinforcing welded to underside of cover and concealed within insulation space.
 10. Access ladder safety post: Bilco Company, Model 1 LadderUP, safety post of high strength steel with telescoping tubular section that locks automatically when fully extended. Provide one for each roof scuttle (vertical ladder hatch).
 - a. Upward and downward movement shall be controlled by a stainless steel corrosion-resistant alloy spring balancing mechanism.
 - b. Finish: Black enamel.
 - c. Mounting: Factory assembled with fasteners for securing to rungs of access ladder, specified elsewhere.
 11. Access hatch finish: Factory primer finish, ready for field finish painting as specified in Section 09920 - Coatings for Exterior Steel.
 12. Cover hardware: Heavy pintel hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles and padlock hasps inside and outside, and thermoplastic rubber gasket.
 13. Cover operator: Automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of cover to closed and latched position.

C. Access Hatch Finish: Intended to be unpainted, hot-dipped galvanized steel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation: Install prefabricated roof accessories in accordance with manufacturer's instructions and recommendations.

1. Touch-up galvanized steel finish as necessary, as specified in Section 09920 - Galvanized Finishes on Steel.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. **Flush hollow** steel doors.
- B. **Rolled steel door frames**, welded construction, for exterior door openings.
- C. **Rolled steel door frames**, knock-down construction for interior door openings and borrowed lights (interior windows).
- D. **Vision lights** and louvers in doors.

1.02 RELATED SECTIONS

- A. **Section 06100 – Rough Carpentry:** Framing of door openings.
- B. **Section 08710 - Door Hardware:** Products and other requirements for steel frames preparation.
- C. **Section 08800 - Glass and Glazing:** Glass and glazing for steel frames and door vision lights.
- D. **Section 09900 - Field Painting:** Field finishing of interior hollow metal frames and interior faces of exterior steel doors.
- E. **Section 09920 - Coatings for Exterior Steel:** Field finishing of exterior hollow metal frames and exterior faces and edges of exterior steel doors.

1.03 SUBMITTALS

- A. **Shop Drawings:**
 - 1. Submit shop drawings and schedules for doors and frames.
 - 2. Indicate frame configuration, anchor types and spacings, location of cutouts for hardware, reinforcement, and finish.
 - 3. Indicate door elevations, internal reinforcement and closure method.
 - 4. Coordinate submittal with Door Hardware Schedule submittal specified in Section 08710 - Door Hardware.
 - 5. Coordinate submittal with submittals for Section 08210.

1.04 QUALITY ASSURANCE

- A. **Industry Standards:** Steel doors and frames, and their installation, shall conform to the following requirements of the Steel Door Institute:

1. ANSI A250.8 - Standard Steel Doors and Frames (supersedes SDI 100).
2. SDI-105 - Recommended Erection Instructions for Steel Frames.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:** Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspection:** Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Storage:** Store doors and frames at building site under cover. Place units on minimum 4-inches high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4-inch spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Sheet Steel for Doors and Frames:** Prime quality cold rolled, annealed, stretcher leveled steel, conforming to Commercial Standard CS 242 or CS 211, with bonderized finish.
- B. Hot-Rolled Steel Sheets and Strip:** Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- C. Cold-Rolled Steel Sheets:** Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.
- D. Metallic-Coated Steel Sheet:** ASTM A 653/A 653M, Commercial Steel (CS), Type B.
 1. Interior conditions: Minimum A40 (ZF120) zinc-iron-alloy (Galvannealed) coating designation.
 2. Exterior conditions: Minimum G60 (Z180) or A60 (ZF180)] metallic coating designation.
- E. Supports and Anchors:** Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.
- F. Inserts, Bolts, and Fasteners:** Manufacturer's standard units. Where items are built into exterior walls, hot-dip galvanize in compliance with ASTM A153, Class C or D as applicable.

G. Shop-Applied Primer: Applied after fabrication, rust-inhibitive enamel or paint, either air-drying or thermosetting, complying with ANSI A224.1 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames, suitable as a base for finish paints specified in Section 09900 - Field Painting.

H. Field-Applied Primer and Finish Paints:

1. Exterior conditions: As specified in Section 09920 - Coatings for Exterior Steel.
2. Interior conditions: As specified in Section 09900 - Field Painting.

2.02 ROLLED STEEL FRAMES, WELDED CONSTRUCTION

A. Rolled Steel, Welded Steel Frames: Full-formed sheet steel frames for doors, transoms, sidelights, borrowed lights, fixed windows and other openings, of types and styles as shown on Drawings and schedules, with concealed fastenings, welded construction, ANSI A250.8 or equivalent custom fabricated frames conforming to referenced NAAMM standards, 16 gage minimum gage steel, galvanized steel, shop primer finish.

B. Shapes: As indicated on the Drawings.

C. Fabrication: Mitered and welded corners and intersections.

1. At exterior frames, fully weld across both outside and inside of frame, for full length of joint, from exterior face to interior face. Create weathertight joint.
2. At interior frames, as minimum, fully weld outside of frame across frame face.
3. Weld, grind and fill welds for invisible joint while retained shape of formed metal.

D. Reinforcements, General: Provide in accordance with SDI 107.

1. Hinge Reinforcements: 9 gage, full mortise.
2. Closer Reinforcements: 9 gage.
3. Strike Reinforcement: 11 gage.

E. Wide Openings: Reinforce frames wider than 48 inches with roll formed steel channels, minimum 12 gage, fitted tightly into frame head, or provide frames of minimum 14 gage steel.

F. Preparations for Door Hardware: Comply with ANSI A115. Provide factory-prepared cutouts from hardware instructions and templates. Refer to Section 08710 - Door Hardware. Prepare cutouts with fully drilled and tapped fittings.

G. Plaster Guards: 24 gage, at strike and head cutouts, welded to back of hardware openings at locations where grout, plaster or other materials might interfere with

hardware installation and operation. Provide plaster guards at cement plaster (stucco) and mortar-set tile conditions, typically.

- H. **Anchors, General:** Provide in accordance with ANSI A250.8 (SDI 105). Anchors at fire rated frames shall also conform to UL Standard 10B.
- I. **Anchors at Stud Partitions:** Provide at least 3 wall anchors per jamb at hinge and strike levels.
- J. **Anchors at Door Frames in Concrete:** Frames erected after concrete construction.
 - 1. Floor anchors: 12 gage angle welded to frame, full width of frame section, one each jamb.
 - 2. Jamb anchors: 12 gage channel or Z welded to frame full width of frame section less wall finish thickness with tube sleeve welded to anchor and to flame stop, drilled and deep dimpled for anchor and flat head screw for completely concealed fastening.
 - 3. Head Anchors: Provide anchors same as for wall, located at center of head, for pairs of doors only.
- K. **Anchors at Door Frames in Concrete:** Frames erected before concrete construction.
 - 1. Jamb anchors: 12 gage T-anchor, loose in frame, full width of frame engaging frame returns, T-leg equal to wall thickness less 2-inches or frame width whichever is less. T-leg shall be 6-inches long with 1/2-inch diameter hole for reinforcement bar dowel, 3 per jamb.
 - 2. Head anchors: Provide T-anchor same as wall anchors, located at center of head, at pairs of doors only.
- L. **Glazing Stops:** Channel glazing stops, miter at corners, drill and countersink for oval head screws, completely fit ready for removal and glazing at site.
- M. **Built-up Transom and Sill Bars:** Fabricate from same material as for frames as detailed. Fabricate concealed portions from tube stock, double channels, roll formed sections or break shape; maintain structural adequacy. Fabricate exposed portions, break shape to profile detail.
- N. **Double Mullions:** Fabricate same as frame, back to back with welded and filled seam.
- O. **Door Silencers:** Drill stops at frames to receive button-type silencers specified in Section 08710 - Door Hardware.
 - 1. Provide three silencers on strike jamb stop for single leaf doors and two at head stop for pairs of doors.
 - 2. Omit silencers where head and jamb where door seals (weatherstripping and smoke or sound seals) are specified.
 - 3. Omit silencers where in violation of fire rating.

2.03 FLUSH STEEL DOORS

- A. Flush Steel Doors, General:** Full flush panel steel doors, SDI 100, grade and model as specified, or equivalent custom products produced in conformance to referenced NAAMM standards.
- B. Steel Doors for Exterior Locations:** Extra Heavy-Duty rated, SDI 100, Grade III, Model 2 (full flush composite construction with vertical edge seam) or equivalent custom products produced in conformance to referenced NAAMM standards, minimum 16-gage faces. Provide flush top and bottom, not open channel.
- C. Internal Construction:** Core material as indicated below, with internal sound deadener on inside of face sheets where appropriate in accordance with SDI standards and as require for fire resistance rating.
 - 1. Non-rated, exterior doors: Polyurethane or polystyrene foam, for thermal insulation. Provide thermal-rated assemblies with U factor of 0.24 Btu/(hr x ft sq x degrees F) or better.
 - 2. Non-rated, interior doors: Honeycomb, polyurethane, polystyrene, unitized steel grid, vertical steel stiffeners, or rigid mineral fiber core.
- D. Facing Material:**
 - 1. Interior dry conditions: ASTM A 653/A 653M, Commercial Steel (CS), Type B, minimum A40 (ZF120) zinc-iron-alloy (Galvannealed) coating designation.
 - 2. Exterior and interior damp or wet conditions: ASTM A 653/A 653M, Commercial Steel (CS), Type B, minimum G60 (Z180) or A60 (ZF180)] metallic coating designation.
- E. Door Tops and Bottoms:** Seal top and bottom edges integrally with door construction, or use minimum 16 gage steel channels to form flush closure. Tops shall be fully weather sealed.

2.04 VISION LIGHT

- A. Specified Manufacturer:** Air Louvers, Inc., Pico Rivera, CA (310/948-3495).
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
 - 1. Anemostat Door Products, Division of Dynamics Corporation of America, (213/775-7441 or 800/9829000).
 - 2. Leslie-Locke, Inc., (404/953-6366 or 800/321-3415).

C. Vision Lights:

1. Non-rated Vision Lights; Air Louvers Model VLF, square profile for 3/8" laminated glass. Confirm glass type and thickness with notes in the Door Schedule in the Drawings
2. Finish: Manufacturer's standard grey primer finish for field applied finish paint to match the door face as specified in Section 09900 – Field Painting.

2.05 DOOR LOUVERS

A. Specified Manufacturer: Air Louvers, Inc., Pico Rivera, CA (310/948-3495).

B. Acceptable Manufacturers: Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.

1. Anemostat Door Products, Division of Dynamics Corporation of America, (213/775-7441 or 800/9829000).
2. Leslie-Locke, Inc., (404/953-6366 or 800/321-3415).

C. Louvers, Exterior Steel Doors: Formed sheet metal, Z-blade configuration, 18 gage steel, Air Louvers Model 900, with Style A-1 mounting frame, factory prime finish, for field-applied finish paint to match door face.

2.06 HARDWARE PREPARATION

A. Hardware Preparation, General: Conform to SDI 107, SDI 109 and ANSI A115.1 through A115.14.

B. Reinforcement: SDI 100, Table IV.

C. Hardware Locations: SDI 100.

D. Lock Strikes: Set out for proper clearance for silencers, weatherstripping and sound seals.

E. Preparation for Contacts for Security Alarm System: At doors indicated on the Drawings or identified by Owner to have alarm contacts, factory prepare door frames provide to suit alarm contact. Preparation shall not void fire rating of frame.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Welded Steel Frames Installation:** Install frames in compliance with ANSI A250.8 and SDI 105. At fire-rated openings, comply with requirements of listing authority.
1. Install frames in conformance to ANSI/SDI-100 and ANSI/SDI-105. Comply with requirements for fire-rated assembly.
 2. Install frame solid in the wall, plumb and square, with proper opening width and height.
 3. Fasten clip angles to floor construction and brace frames so as to retain their position and clearance during construction of adjacent Work.
 4. Install anchors for stud partitions on hinge jamb immediately above each hinge reinforcing plate and below the top hinge reinforcement (minimum 4 per jamb) and locate anchors directly opposite on the strike jamb.
- B. Welded Steel Frames Installation:**
1. Install frame solid in the wall, plumb and square, with proper opening width and height.
 2. Fasten clip angles to floor construction and brace frames so as to retain their position and clearance during construction of adjacent Work.
 3. Install anchors for concrete at each jamb for each 2-feet 6-inches of height or fraction thereof starting at 12-inches above the finished floor (minimum 3 per jamb).
 4. Install anchors for stud partitions on hinge jamb immediately above each hinge reinforcing plate and below the top hinge reinforcement (minimum 4 per jamb) and locate anchors directly opposite on the strike jamb.
 5. Grouting: Grout exterior door frames solid after installation.
- C. Flush Steel Doors Installation, General:** Comply with manufacturer's instructions and recommendations and to ANSI A250.8 and SDI 105. Hang doors and adjust for proper clearances and operation. Refer to Section 08710 - Door Hardware for hardware requirements.
- D. Flush Steel Doors Installation Tolerances:** Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI-100. For fire-rated doors, conform to NFPA Standard No. 80 and Uniform Building Code Standard 17-2.
- E. Vision Lights and Louvers Installation:** Conform to manufacturer's instructions, including requirements for fire rated installations.

3.02 ADJUSTING AND CLEANING

- A. Protection Removal:** Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.
- B. Repairs:**

1. Make repairs only if permitted by Architect. Otherwise, replace damaged components.
2. Fill surface depressions with metallic paste filler, allow to thoroughly cure, sand flush, and smooth for an invisible appearance with adjacent metal surfaces.
3. Sand smooth all rusted areas.
4. Apply touch-up paint using air drying primer compatible with shop-applied finish.

3.03 CLEANING AND PROTECTION

- A. Prime Coat Touch-up:** Immediately after installation, sand smooth all corroded (rusted), damaged and deteriorated areas of prime coat and apply touch-up coat of compatible air-drying primer. Refer to requirements for field-applied primer in Section 09900 - Painting, for interior conditions, and Section 09920 - Coatings for Exterior Steel, for exterior conditions.
- B. Protection:** Protect installed frames and doors from damage.
1. Provide protective coverings and other devices as necessary, in conformance to requirements specified in Section 01500 - Temporary Facilities and Controls.
 2. Remove protective devices from prefinished components for Completion review.
- C. Final Adjustments:** Check and readjust operating hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.
- D. Cleaning:** Clean doors and frames of surface contaminants detrimental to bonding of field-applied finishes.

END OF SECTION

SECTION 08400

ALUMINUM-FRAMED STOREFRONTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. **Storefront framing and** glazing support members of extruded aluminum, for building entrances, exterior window walls and exterior fixed windows where vertical unanchored span is less than 10 feet.
- B. **Glazed aluminum-**framed entrance doors.

1.02 RELATED SECTIONS

- A. **Section 05090 - Anchors and Fasteners:** General requirements for anchors and fasteners to building substrates.
- B. **Section 05500 - Metal Fabrications:** Miscellaneous structural support and backing components.
- C. **Section 05900 – Metal Finishes:** Painted finish on aluminum framing components.
- D. **Section 07600 - Sheet Metal Flashing and Trim:** Head and sill flashing at storefront framing.
- E. **Section 07900 – Caulking and Sealants:** Perimeter sealing between aluminum-framed storefront or window and surrounding construction.
- F. **Section 08425 – Automatic Swing Doors:** Door openers for aluminum-framed entrance doors.
- G. **Section 08710 - Door Hardware:** Door hardware for aluminum-framed entrance doors.
- H. **Section 08800 - Glass and Glazing:** Glass and glazing products.
- I. **Section 08911 – Curtain Wall Aluminum-Framed:** Entrance framing and glazing support members of extruded aluminum, for modifications to existing building entrance and adjacent fixed glazing, where vertical dimension is less than 10 feet.

1.03 DESIGN REQUIREMENTS

- A. **Thermal Performance:** Provide for free and noiseless vertical and horizontal thermal movement of components subjected to expansion and contraction of glazing system components resulting from an ambient temperature differential of 120 degrees F, which may result in a metal surface temperature range of 180 degrees F within glazing system framing, without causing buckling, excessive

stresses on structural elements or fasteners, stresses on glazing, failure of seals, reduction of performance, or other detrimental effects on appearance and performance.

B. Structural Performance: Design structural support framing components under direct supervision of a Structural Engineer experienced in design of this Work and licensed to practice in the State of California, in compliance with California Building Code (CBC) requirements.

1. Design Wind Load: As required by Authority Having Jurisdiction (AHJ) and indicated in notes on Structural Drawings, for locale, exposure, height and Project conditions. At a minimum, system shall resist load of 90 mph (40 m/s) basic wind speed, Exposure C.
2. Mullion Deflection: Maximum 1/175 or flexural limit of glass with full recovery of glazing materials, whichever is less, ASTM E 330 and allowable stress with a safety factor of 1.65 minimum.

C. Weathering Performance:

1. Internal Drainage: Drain to exterior all water entering joints, condensation occurring in glazing channels or migrating moisture within system. All drainage shall be concealed and through face of system.
2. Air Infiltration: Through framing and glazing assembly, 0.06 cfm/sf at 6.24 psf of surface area, when tested according to ASTM E 283.
3. Water Leakage: No leakage at pressure differential of 8 psf, when tested according to ASTM E 331. Water leakage is defined as any amount of water which appears on any interior exposed surface of glass or metal.

D. Resistance to Forcible Entry: Jambs adjacent to door locks shall resist a force of 1600 pounds.

1.04 SUBMITTALS

A. Product Data: Storefront framing systems, including aluminum-framed entrance doors. Submit prequalifying Test Reports containing construction detailing and installation instructions.

B. Shop Drawings: Complete, indicating elevation views of all units, attachments to surrounding construction of Project, type of glazing, and all door hardware and weatherstripping. Include full-size details. Include details of provisions for accommodation of thermal and building movement.

C. Calculations: Submit calculations demonstrating that system complies with applicable California Building Code (CBC) and other requirements as required by Authority Having Jurisdiction (AHJ). Structural calculations shall be prepared by a Structural Engineer licensed to practice in the State of California, demonstrating compliance with structural performance criteria.

D. Certification: Manufacturer's certification that products meet or exceed minimum California Building Code (CBC) requirements and design criteria.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:** Comply with California Building Code (CBC) requirements for structural performance, safety glazing, accessibility and exit devices.
- B. Installer's Qualifications:** Installer shall be licensed or otherwise approved by aluminum-framed storefront and entrance manufacturer and shall have a minimum of five years experience in the installation of comparable aluminum-framed storefront and entrance systems. Installer shall employ workers who are thoroughly trained in the necessary skills and are completely familiar with the specific requirements and techniques needed to perform the required work.
- C. Single-Source Responsibility:** Storefront framing and doors shall be the product of one manufacturer.
- D. Testing:** Storefront and entrance system shall have been tested by an independent testing and inspection agency engaged and paid by the manufacturer.
- E. Product Options:** Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of aluminum storefront framing. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1.06 PROJECT CONDITIONS

- A. Coordination:** Coordinate curtain wall installation with adjacent Work specified in other Sections, to provide proper allowances for tolerances in construction, fabrication, and installation of various elements of the Work specified in other Sections. Sizes, locations and alignment of storefront components and wall openings shall take such tolerances into account in the design and installation so as not to adversely affect the allowable width constraints of the aluminum storefront perimeter sealant joints.
- B. Dimensions:** Verify dimensions shown on Drawings and obtain field measurements of actual construction prior to preparing shop drawings and ordering products.
- C. Substrate Conditions:** Verify that conditions of substrate and adjoining Work are suitable for proper installation of aluminum framed storefront Work. Verify that conditions of substrate and adjoining Work are suitable for proper installation of entrance and storefront Work. Do not begin work until unsatisfactory conditions have been corrected. Commencement of installation shall be considered as acceptance of the substrate and conditions as being suitable for the installation of product(s).

1.07 WARRANTY

- A. Extended Warranty for Aluminum-Framed Storefront and Entrances:** Submit a written warranty signed by authorized representatives of the Contractor and installer agreeing to repair or replace defective Work related to aluminum-framed storefront and entrances and joint sealing to surrounding construction during a 5-year period following date established by Notice of Completion.
1. "Defective" is defined to include the following:
 - a) Failure of the system to meet structural, air and water infiltration, and thermal performance requirements, including resulting glass breakage.
 - b) Failure of glazing and weather seals, including leakage.
 - c) Failure of structural sealant glazing, including leakage and failure of bond.
 - d) Failure of operational parts to function normally.
 - e) Deterioration or discoloration of finishes.
 2. Extended warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents, and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Specified Manufacturer:** Arcadia Architectural Products, Los Angeles, CA (323/269-7300).
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Requirements.
1. Kawneer Company, Inc., (770/449-5555).
 2. United States Aluminum Corporation, (213/268-4230).

2.02 STOREFRONT, ENTRANCE, WINDOW WALL AND FIXED WINDOW FRAMING

- A. Aluminum Members:** Alloy and temper recommended by the manufacturer for strength, corrosion resistance and specified finish.
1. Aluminum Extrusions: ASTM B 221.
 2. Aluminum sheet or plate: ASTM B 209, flat sheet with strength and durability properties of alloy 5005-H32.
 3. Aluminum bars, rods and wire: ASTM B 211.
- B. Carbon Steel Reinforcement for Aluminum Framing Members:** Comply with ASTM A 36 (ASTM A 36M) for structural shapes, plates and bars, ASTM A 611 for cold rolled sheet and strip, or ASTM A 570 (ASTM A 570M) for hot rolled sheet and strip.

- C. Brackets and Reinforcements:** Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Fasteners:** Provide fasteners of aluminum, nonmagnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components. Fasteners that are subject to loosening or turning out due to vibration, thermal and/or structural movements use self-locking devices.
1. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125 inches (3.2 mm) thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
 2. Material: Provide fasteners of aluminum, non-magnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
 3. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125-inch (3.2 mm) thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
 4. Exposed Fasteners: Do not use exposed fasteners except for application of hardware. For application of hardware, use Phillips flat-head machine screws that match the finish of member or hardware being fastened.
- E. Dissimilar Metals:** Isolate aluminum from steel, galvanized steel and cementitious products with suitable paint or sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead, bitumen or materials incompatible with joint sealers.
- F. Concealed Flashing:** Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Framing System Gaskets and Sealants:** Manufacturer's standard, recommended by manufacturer for joint type.
1. Weatherseal shall accommodate a 50 percent increase or decrease of joint width as measured at time of application in accordance with ASTM C 719. Provide manufacturer's recommended backer rod.
 2. Sealants for aluminum framing joints to one another shall be as standard with the manufacturer.
 3. For sealing of perimeter of aluminum framing to adjoining construction, provide sealants as specified in Section 07900 - Joint Sealants.
- H. Glazing Materials:** As recommended by storefront system manufacturer, EPDM extrusions.
- I. Anchors to Building Substrates:** As specified in Section 05090 - Anchors and Fasteners. Provide aluminum, non-magnetic stainless steel, zinc plated steel, or

other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components. Do not use exposed fasteners.

2.03 FRAMING SYSTEMS

- A. Framing Systems, General:** Provide systems for storefronts and fixed windows of sizes and details as indicated on Drawings. Provide accessory trim as indicated on the Drawings to suit wall openings.
- B. Drainage:** Provide inconspicuous weep holes or equal method to ensure positive drainage of internal moisture or condensate to the exterior. Detail all weep holes on Shop Drawings for Architects approval.
- C. Entrance, Window Wall-Curtain Wall and Fixed Window Framing System**
 - 1. INTERIOR: Arcadia AF450 Series, nominally 2-inches by 4-1/2 inches, offset glazing system with 1/4" glass.
 - 2. EXTERIOR: Arcadia AFG451 Series, nominally 2-inches by 4-1/2 inches, offset glazing system for 1-inch glass (shear block system).
- D. Reinforced Mullions:** See Drawings for frame sizes and locations. Fabricate as necessary to accommodate applied loads, nominal outside dimensions to suit framing system, with internal reinforcement of shaped steel structural section.
- E. Door Mullions:** Provide framing members with integral or applied stops, for outswing door operation.
- F. Vertical Movement:** Provide for allowances to account for building deflection and other movements in framing.
- G. Attachment Provisions:** Provide internal reinforcement in framing sections for rigid attachment of framing members, suitably located and sized to withstand imposed loads.
 - 1. Fasteners: Provide fasteners of aluminum, non-magnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
 - 2. Exposed Fasteners: Where possible, use countersunk phillips head screws, finished to match framing system in exposed conditions.
 - 3. Material: Provide fasteners of aluminum, non-magnetic stainless steel, zinc plated steel, or other material warranted by the manufacturer to be noncorrosive and compatible with aluminum components, hardware, anchors and other components.
 - 4. Reinforcement: Where fasteners screw-anchor into aluminum members less than 0.125-inch (3.2 mm) thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.

2.04 ENTRANCE DOORS

- A. Exterior Glazed Aluminum Doors:** Arcadia Series as indicated on drawings, wide stile design, 1-3/4 inches thick, for 1/4-inch glazing, with square glazing stops and with nominal 5-inch wide vertical stiles, 5-1/8 inch top rail and minimum 10-inch high composite bottom rail, complying with applicable California Building Code (CBC), Chapter 11B accessibility requirements.
- B. Door Weatherstripping:** Provide manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.
- C. Aluminum Entrance Door Hardware:** As scheduled in Section 08710 - Door Hardware. For hardware products not scheduled, provide products as standard with aluminum entrance door manufacturer, suitable for heavy institutional use.

2.05 FRAMING AND DOORS FINISH

- A. Aluminum Framing and Doors Finish:** Refer to Section 05900 – Metal Finishes.

2.06 STOREFRONT FRAMING FABRICATION

- A. Storefront Framing Fabrication, General:** Fabricate aluminum entrance and storefront components to designs, sizes and thicknesses indicated and to comply with indicated standards.
- B. Pre-Fabrication:** Complete fabrication, assembly, finishing, hardware application, and other Work to the greatest extent possible before shipment to the Project site. Disassemble components only as necessary for shipment and installation.
 - 1. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. Complete these operations for hardware prior to application of finishes.
 - 2. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
 - 3. Pre-glaze door and frame units to greatest extent feasible.
- C. Welding:** Comply with AWS recommendations. Welding behind finished surfaces shall be performed in such a manner as to minimize distortion and discoloration on the finished surface.
 - 1. Grind exposed welds smooth to remove weld spatter and welding oxides.
 - 2. Restore mechanical finish.
- D. Reinforcing:** Install reinforcing as required for hardware and as necessary for performance requirements, sag resistance and rigidity.

- E. Dissimilar Metals:** Separate dissimilar metals with bituminous paint, or a suitable sealant, or a non-absorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead.
- F. Continuity:** Maintain accurate relation of planes and angles with hairline fit of contacting members.
- G. Fasteners:** Conceal fasteners wherever possible.

2.07 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials, General:** For 1-inch thick glazing, as specified in Section 08800 - Glass and Glazing and as indicated on Drawings.
- B. Safety Glazing:** Provide safety glazing as required by California Building Code (CBC) and as indicated on Drawings.

2.08 DOOR HARDWARE

- A. Door Hardware for Aluminum Entrances and Storefronts:** As specified in Section 08710 - Door Hardware. Factory prepare doors and framing for specified hardware.
 - 1. Weatherseals shall be provided with storefront framing and entrance doors.
 - 2. Hinges, closers, locksets, exit devices, pulls, thresholds and other components shall be provided as specified in Section 08710 - Door Hardware.

2.09 ACCESSORY MATERIALS

- A. Bituminous Paint:** Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

PART 3 - EXECUTION

3.01 FABRICATION

- A. Fabrication:** Shop or field fabricate framing system into complete units.
- B. Workmanship:** Fabricate framing in accordance with the manufacturer's instructions and recommendations. Accurately miter and fit all members to hairline joints. Weld or mechanically fasten along entire line of contact on the unexposed side.

3.02 FRAMING INSTALLATION

- A. Framing Installation, General:** Install framing with adequate provision for building movements, settling, expansion and contraction without distorting or breaking glass.
- B. Anchoring:** Firmly anchor framing using fasteners as required by structural calculations, sized to suit loads and type suitable for substrate, to positively attach members for long life under hard use.
- C. Adjustment:** Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Protection:** Wherever aluminum is in contact with concrete or dissimilar metal, apply isolation material compatible with joint sealant specified in Section 07900 - Joint Sealants.
- E. Protection:** Wherever aluminum is in contact with concrete or dissimilar metal, apply bituminous paint or other isolation compatible with adjacent materials and approved in advance by the Architect as acceptable.
- F. Sill Flashing:** Install sheet metal sill flashing to prevent water migration under framing. Comply with requirements specified in Section 07600 - Sheet Metal Flashing and Trim. Set sill flashing in bedding sealant as specified in Section 07900 - Joint Sealants.

3.03 DOORS INSTALLATION

- A. Doors Installation:** Assemble doors in shop with glazing installed.
- B. Door Joints:** Make joints rigid and suitable for heavy use.
- C. Hardware:** Shop install hardware using templates provided. Refer to Section 08710 - Door Hardware for related Work and additional installation requirements for door hardware generally.
- D. Adjustment:** Adjust operating hardware and door operation for smooth movements, without binding and without exceeding allowable forces of handicapped accessibility regulations.

3.04 GLAZING

- A. Glazing Installation, General:** Install glazing as specified in Section 08800 - Glass and Glazing, except butt glazing shall be as recommended by framing system and glass manufacturers.
- B. Testing:** Water test all storefront and glazing after completion by spraying with hose heavily for 5 minutes. Repair all leaks discovered by testing procedures and repeat test until leak-free performance is achieved.

3.05 JOINT SEALING

- A. Joint Sealing:** Install perimeter sealant in compliance with requirements specified in Section 07900 - Joint Sealants, to seal between aluminum framing and surrounding construction.

3.06 TOLERANCES

- A. Erection Tolerances:** Install entrance and storefront systems to comply with the following maximum tolerances:
1. Variation from Plane: 0.03 inches per foot maximum or 0.25 inches per 30 feet whichever is less.
 2. Alignment: Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm). Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).
 3. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.07 FIELD QUALITY CONTROL

- A. Water Spray Test:** After completing the installation of test areas indicated, test storefront system for water penetration according to AAMA 501.2 requirements.
- B. Field Testing Services:** Testing Laboratory will conduct tests and inspections of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
 - a) Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C 1401, Appendix X2 shall be used.
 - 1) A minimum of four areas on each building face shall be tested.
 - 2) Repair installation areas damaged by testing.
 2. Structural-Sealant Glazing Inspection: After installation of curtain-wall systems are complete, structural-sealant glazing shall be inspected and evaluated according to ASTM C 1401 recommendations.
 3. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum uniform and cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "DESIGN REQUIREMENTS" Article, but not less than 8.0 psf (300 Pa) and shall not evidence water penetration. Conduct three tests, at 10 percent, 50 percent and 75 percent completion.
- C. Remedial Work:** Repair or remove work where test results and inspections indicate that it does not comply with specified requirements. Retesting and additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.

3.08 CLEANING

- A. Protective Coverings:** Remove protective materials from prefinished aluminum surfaces immediately prior to cleaning for Substantial Completion review.
- B. Cleaning:** For initial cleaning and for cleaning prior to Substantial Completion review.
 - 1. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths.
 - 2. Take care to remove soiling and dust accumulation from corners.
 - 3. Flush thoroughly and wipe surfaces clean.
 - 4. Remove excess sealant and spilled sealant immediately according to instructions by sealant manufacturer that will not discolor framing finish.
- C. Glass Cleaning:** See Section 08800 - Glass and Glazing.

END OF SECTION

SECTION 08911

ALUMINUM-FRAMED CURTAIN WALL

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. **Curtain wall framing system** and glazing support system of extruded aluminum, for conditions where vertical unsupported dimension exceeds 10 feet.

1.02 RELATED SECTIONS

- A. **Section 05090 - Anchors and Fasteners:** General requirements for anchors and fasteners to building substrates.
- B. **Section 05500 - Metal Fabrications:** Miscellaneous structural support and backing components.
- C. **Section 05900 – Metal Finishes:** Painted finish on aluminum framing components.
- A. **Section 07900 - Joint Sealants:** Perimeter sealing between aluminum framing and surrounding construction.
- B. **Section 08400 - Aluminum-Framed Storefronts:** Entrance framing and glazing support members of extruded aluminum, for modifications to existing building entrance and adjacent fixed glazing, where vertical dimension is less than 10 feet.
- C. **Section 08800 - Glass and Glazing:** Glass and glazing products.

1.03 DESIGN REQUIREMENTS

- A. **Contract Drawings and Specifications:** The intent of these documents is to provide a performance criteria for the design, fabrication and installation of aluminum window wall systems. Contractor shall be responsible for engineering design and testing of all components and materials, as well as fabrication, installation and in-place performance of the window wall systems.
1. The details shown on Architectural Drawings are intended as a guide for aesthetic and interfacing requirements with other Work.
 2. The requirements shown on Architectural Drawings are intended to establish basic dimensions, sight lines and profiles of components.
 3. Glazed aluminum curtain wall systems, including anchorages and sealant joints to surrounding construction, shall be capable of withstanding, without failure, the effects of the following:
 - a) Structural loads.
 - b) Thermal movements.
 - c) 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, including seismic loads for delta S and delta M.

- B. Delegated Design:** Design structural-sealant-glazed curtain walls, including comprehensive engineering analysis by a qualified structural engineer, registered to practice in the State of California, using performance requirements and design criteria indicated.
- C. Structural-Test Performance:** Provide structural-sealant-glazed curtain walls tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. 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.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- D. Structural Performance:** Design of framing and structural sealant glazing shall be by curtain wall framing manufacturer. Component sizes, internal reinforcements and connection details shall suit loadings determined by framing manufacturer in compliance with applicable California Building Code (CBC) requirements as interpreted by Authority Having Jurisdiction (AHJ).
1. Design Wind Load: As required by Authority Having Jurisdiction (AHJ), for locale, exposure, height and Project conditions. At a minimum, system shall resist 100 mph (44 m/s) basic wind speed.
 2. Mullion Deflection: Maximum 1/175, 3/4-inch or flexural limit of glass, with full recovery of glazing materials, whichever is less, tested according to ASTM E 330 with allowable stress with a safety factor of 1.65 minimum.
- E. Story Drift:** Provide structural-sealant-glazed curtain-wall systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As required by California Building Code (CBC) and requirements of Authority Having Jurisdiction (AHJ).
- F. Air and Water Infiltration:** Design and installation of framing system shall be according to manufacturer's instructions and recommendations to permanently resist leakage of air and water through the system in accordance with the following:
1. Internal Drainage: Drain to exterior all water entering joints, condensation occurring in glazing channels or migrating moisture within system.
 2. Air Infiltration: Through framing and glazing assembly, 0.06 cfm/sf at 6.24 psf of surface area, when tested according to ASTM E 283.
 3. Water Penetration: There shall be no water leakage on any internal exposed surface of the curtain wall system, as defined in AAMA 501, when tested in accordance with ASTM E 331 at a minimum differential pressure of 20 percent of inward design wind load but not less than 8.0 lbf per sq. ft.

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- G. Thermal Performance:** Provide for free and noiseless vertical and horizontal thermal movement of component parts. Design for surface temperature from + 20 degrees F to 180 degrees F.
- H. Seismic Performance:** Delta S and delta M according to California Building Code (CBC).
1. Test Performance: No glass breakage, anchor failures, or structural damage when tested according to AAMA 501.4.
- I. Resistance to Forcible Entry:** Jambs adjacent to door locks shall resist a force of 1600 pounds.

1.04 SUBMITTALS

- A. Shop Drawings:** Complete, indicating elevation views of all units, attachments to surrounding construction of Project, type of glazing and door weatherstripping installed in framing. Include full-size details. Coordinate and submit with shop drawings for Section 08400 - Aluminum-Framed Storefronts. Submit two additional copies to Authority Having Jurisdiction (AHJ) for review and approval. Include:
1. Elevations: Appearance of curtainwall framing layouts.
2. Details:
- a) Interface with adjacent construction; include requirements for support and bracing at openings.
- b) Installation details.
- B. Calculations:** Submit calculations demonstrating that system and anchorages comply with applicable California Building Code (CBC) and other requirements as required by Authority Having Jurisdiction (AHJ). Structural calculations shall be prepared and signed by a structural engineer licensed in the State of California Engineer and shall demonstrate compliance with structural performance criteria. Submit two additional copies of calculations to Authority Having Jurisdiction (AHJ) for review and approval.
- C. Certification:** Manufacturer's certification that framing system meets or exceed minimum requirements of California Building Code (CBC) and design requirements specified above.
- D. Test Data:** Submit certified test reports, verifying compliance with design requirements specified above in Article titled, "DESIGN REQUIREMENTS."
1. Preconstruction Sealant Test Reports: Compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with sealants; include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed to obtain adhesion.
2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for structural-sealant-glazed curtain-wall systems.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements:** Comply with California Building Code (CBC) requirements for the following:
1. Structural performance of framing and glazing, including seismic performance.
 2. Safety glazing.
 3. Accessibility.
 4. Exits.
- B. Single-Source Responsibility:** All curtain wall components shall be the products of one manufacturer. Coordinate with products specified in Section 08400 - Aluminum-Framed Storefronts.
- C. Testing:** Curtain wall system shall have been tested by an independent testing and inspection agency engaged and paid by the curtain wall manufacturer.
- D. Installer's Qualifications:** Installer shall be licensed or otherwise approved by aluminum-framed curtain wall manufacturer and shall have a minimum of five years experience in the installation of comparable aluminum-framed curtain wall systems and shall employ workers who are thoroughly trained in the necessary skills and are completely familiar with the specific requirements and techniques needed to perform the required Work.
- E. Preconstruction Sealant Testing:** Perform sealant manufacturer's standard tests for compatibility and adhesion of sealants with each material that will come in contact with sealants and each condition required by curtain-wall systems.
1. Test a minimum of five samples of each metal, glazing, and other material.
 2. Prepare samples using techniques and primers required for installed systems.
 3. Perform tests under environmental conditions that duplicate those under which systems will be installed.
 4. For materials that fail tests, determine corrective measures required to prepare each material to ensure compatibility with and adhesion of sealants, including, but not limited to, specially formulated primers. After performing these corrective measures on the minimum number of samples required for each material, retest materials.
- F. Preconstruction Testing Service:** Testing Laboratory will test structural-sealant-glazed curtain-wall systems for compliance with specified requirements for performance and test methods. Provide test specimens and assemblies representative of proposed materials and construction.
1. Select sizes and configurations of assemblies to adequately demonstrate capability of structural-sealant-glazed curtain-wall systems to comply with performance requirements and according to AAMA 501 recommendations.
 2. Before performing testing, remove at least one of every type of glazing panel from each test specimen and replace them using reglazing procedures required for systems specified.
 3. Notify Architect seven days in advance of the dates and times when assemblies will be constructed.

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- G. Structural-Sealant Joints:** Design reviewed and approved by structural-sealant manufacturer.
- H. Preinstallation Conference:** Conduct conference at Project site in compliance with requirements specified in Section 01041 - Project Coordination. Review methods and procedures related to structural-sealant-glazed curtain-wall systems including, but not limited to, the following:
1. Review structural load limitations.
 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 3. Review required testing, inspecting, and certifying procedures.

1.06 PROJECT CONDITIONS

- A. Coordination:** Coordinate curtain wall installation with adjacent Work specified in other Sections, to provide proper allowances for tolerances in construction, fabrication, and installation of various elements of the Work specified in other Sections. Sizes, locations and alignment of windows and window openings shall take such tolerances into account in the design and installation so as not to adversely affect the allowable width constraints of the window perimeter sealant joints.
- B. Dimensions:** Verify dimensions shown on Drawings and obtain field measurements of actual construction prior to preparing shop drawings and ordering products.
- C. Substrate Conditions:** Coordinate and verify that conditions of substrate and adjoining Work are suitable for proper installation of aluminum-framed curtain wall and joint sealant Work. Verify that conditions of substrate and adjoining Work are suitable for proper installation of storefront Work. Do not begin work until unsatisfactory conditions have been corrected. Commencement of installation shall be considered as acceptance of the substrate and conditions as being suitable for the installation of product(s).

1.07 WARRANTY

- A. Extended Warranty for Curtain Wall Framing:** Submit a written warranty signed by authorized representatives of the Contractor and installer agreeing to repair or replace defective Work related to aluminum-framed curtain wall and joint sealing to surrounding construction during a 5-year period following date established by Notice of Completion.
1. "Defective" is defined to include the following:
 - a) Failure of the system to meet structural, air and water infiltration, and thermal performance requirements, including resulting glass breakage.
 - b) Failure of glazing and weather seals, including leakage.
 - c) Failure of structural sealant glazing, including leakage and failure of bond.
 - d) Failure of operational parts to function normally.
 - e) Deterioration or discoloration of finishes.
 2. Extended warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents, and

is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Specified Manufacturer:** Arcadia Architectural Products, Los Angeles, CA.
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers, including those listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
 - 1. Kawneer Company, Inc., Norcross, GA (770/449-5555).
 - 2. United States Aluminum Corporation, Vernon, CA (323/268-4230).
 - 3. Vistawall Architectural Products, Modesto, CA (209/545-5231).

2.02 FRAMING, GENERAL

- A. Aluminum Extrusions:** ASTM B 221, 6063-T5 alloy, temper as suitable for use.
- B. Aluminum Sheet:** Flat sheet complying with ASTM B 209 (ASTM B 209M), 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.
- C. Brackets and Reinforcements:** Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. 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.
- E. Anchors:** Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
- F. Dissimilar Metals:** Isolate aluminum from steel, galvanized steel and cementitious products with suitable paint or sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces. Do not use coatings containing lead, bitumen or materials incompatible with joint sealers.
- G. Concealed Flashing:** Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing Sealants:

1. Sealants for aluminum framing joints to one another shall be as standard with the manufacturer.
2. For sealing of perimeter of aluminum framing to adjoining construction, provide sealants as specified in Section 07900 - Joint Sealants.

2.03 ALUMINUM-FRAMED CURTAIN WALL SYSTEM

A. Framing System, General: Provide system of extruded aluminum framing members, connectors, closures and anchors to suit configurations indicated on Drawings.

1. Manufacturer shall be responsible for design of aluminum-framed curtain wall and structural sealant glazing in compliance with design requirements specified above and California Building Code (CBC).
2. Design shall include attachment details to structural framing behind curtain wall, as indicated on the Drawings, and shall include internal structural reinforcements in aluminum framing members as necessary to maintain consistent member sizes.

B. Aluminum-Framed Curtain Wall: Arcadia Series T500-OPG25700 nominally 2-1/2 inches by 7 inches pressure plate glazing system for 1" insulated glass. Refer to Section 08800 - Glass and Glazing and to Drawings.

1. Perimeter, exposed vertical and horizontal framing members: Nominally 2-1/2 inches wide by 7 inches in depth indicated on the Drawings.
2. Concealed (structural silicone glazed, two-sided system) vertical framing members:

C. Head Receptor: Provided sub-head receptor at head of openings to allow for deflection and other movements in framing. Anchorage at curtain wall head member shall be designed to accommodate expected seismic and thermal movement.

D. Glazing Gasket: Compression-type design, replaceable, molded or extruded santoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).

E. Structural-Sealant Joints: Designed to produce tensile or shear stress of less than 20 psi (138 kPa).

1. Structural sealant for butt-glazed installation shall be capable of withstanding tensile and shear stresses imposed by aluminum-framed systems without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - a) Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - b) Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.
2. Secondary seal or weatherseal silicone sealants shall be compatible with the structural silicone sealant. Weatherseal shall accommodate a 50 percent

increase or decrease of joint width as measured at time of application in accordance with ASTM C 719. Provide manufacturer's recommended backer rod.

- D. Door Weatherstripping:** Provide manufacturer's standard replaceable compressible weatherstripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.

2.04 FRAMING FINISH

- A. Aluminum Framing and Doors Finish:** Refer to Section 05900 – Metal Finishes.

2.05 GLASS AND GLAZING MATERIALS

- A. Glass and Glazing Materials, General:** As specified in Section 08800 - Glass and Glazing and as indicated on Drawings.

- B. Safety Glazing:** Provide safety glazing as required by California Building Code (CBC), as specified in Section 08800 - Glass and Glazing and as indicated on Drawings.

- C. Glazing Gaskets:** As recommended by storefront system manufacturer, EPDM extrusions.

- D. Glazing Sealants:** As recommended by manufacturer for joint type and as follows:

1. **Structural Sealant:** ASTM C 1184, neutral-curing silicone formulation compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant, and approved by structural-sealant manufacturer for use in curtain-wall systems indicated.
 - a) Color: Black.
 - b) Type: Manufacturer's standard single or two component.
 - c) Minimum Tensile Strength: 100 psi (690 kPa).
 - d) Modulus of ElastiOwner: As required by structural-sealant-glazed curtain-wall system design to meet performance requirements.
2. **Weatherseal Sealant:** ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; neutral-curing silicone formulation compatible with structural sealant and other system components with which it comes in contact; and recommended by structural- and weatherseal-sealant and curtain-wall manufacturers for this use.
 - a) Joint Movement Capability: Accommodates a 50 percent increase or decrease in joint width at time of application when measured according to ASTM C 719.
 - b) Color: Matching structural sealant.

- E. Contact and Weather Seal:** Silicone, ultraviolet radiation resistant for 2000 to 4000 micro-watts minimum for 21 days; types, cure and minimum adhesion tensile strength as determined and recommended by framing system manufacturer for conditions of the Project.

2.05 SHEET METAL FABRICATIONS

- A. Aluminum Sheet Metal Fabrications:** As indicated on the Drawings for sunshade element integrated into curtain wall framing.
1. Coordinate dimensions and attachment methods of ornamental formed-metal items with those of adjoining construction to produce integrated assemblies with closely fitting joints and with edges and surfaces aligned, unless otherwise indicated.
 2. 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 wide hem on the concealed side, or ease edges to a radius of approximately 1/32-inch and support with concealed stiffeners.
 3. 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. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
 4. Build in straps, plates, and brackets as needed to support and anchor fabricated items to adjoining construction. Reinforce ornamental formed-metal items as needed to attach and support other construction.
 5. Provide support framing, mounting and attachment clips, splice sleeves, fasteners, and accessories needed to install ornamental formed-metal items.
 6. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed. Use welding and brazing procedures that will blend with and not cause discoloration of metal being joined.
 7. Finish sheet metal fabrications to match curtain wall framing.

2.06 CURTAIN WALL FABRICATION

- A. Fabrication:** Shop or field fabricate curtain wall framing system into complete units. Fabricate components that, when assembled, have the following characteristics:
1. Sharp profiles, straight and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
 4. Physical and thermal isolation of glazing from framing members.
 5. Accommodations for thermal and mechanical movements of glazing and framing to prevent glazing-to-glazing contact and to maintain required glazing edge clearances.
 6. Structural-sealant joints that do not carry gravity loads of glazing.
 7. Provisions for field replacement of glazing from exterior. Include accommodations for using temporary support device (dutchman) to retain glazing in place while sealant cures.

B. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Seal joints watertight, unless otherwise indicated.
3. Pressure equalize system at its interior face.
4. Install glazing in compliance with requirements specified in Section 08800 - Glass and Glazing. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

- C. Workmanship:** Accurately fabricate framing in accordance with the manufacturer's instructions and recommendations. Surfaces exposed to view shall be without blemishes.

PART 3 - EXECUTION

3.01 FRAMING INSTALLATION

- A. Framing Installation, General:** Install framing with adequate provision for settling, expansion and contraction without distorting or breaking glass and without loss of weatherability.
- B. Anchoring:** Firmly anchor framing using fasteners as recommended by manufacturer, sized to suit loads and type suitable for substrate, to positively attach members for long life under hard use.
- C. Adjustment:** Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- D. Fire Containment:** Install perimeter fire-containment systems (safing insulation) as specified in Section 07270 - Firestopping and Smoke Seals.
- E. Protection:** Isolate aluminum from steel, galvanized steel and cementitious products with suitable paint or sealant, or a nonabsorptive plastic or elastomeric tape, or a gasket between the surfaces.

3.02 GLAZING

- A. Glass Installation:** Install glazing as specified in Section 08800 - Glass and Glazing, utilizing curtain wall manufacturer's recommended glazing methods to achieve performance criteria.

3.03 PERIMETER SEALING

- A. Perimeter Sealing:** Install backer rod and joint sealant at perimeter of aluminum framing as specified in Section 07900 - Joint Sealants.

3.04 TOLERANCES

A. Erection Tolerances:

1. Maximum variation from plumb: 0.06-inch in every 3 ft non-cumulative or 0.5-inch per 100 ft, whichever is less.
2. Maximum misalignment of two adjoining glass panes and framing abutting in plane: 1/32-inch.
3. Sealant space between framing system components and adjacent construction: Within limits according to sealant manufacturer's instructions and recommendations.

3.05 FIELD QUALITY CONTROL

A. Manufacturers' Field Surveillance: Aluminum framing and silicone joint sealer manufacturers shall provide field surveillance of the installation of their products according to provisions specified in Section 01400 - Quality Control.

1. Manufacturers' field surveillance services shall be included in Contract Sum and Contract Time.
2. Manufacturers' representatives shall submit written report to Construction Manager, Architect and Contractor, describing installation procedures, inspections and tests conducted, unacceptable conditions, remedial measures to be performed, and other pertinent observations.

B. Field Testing Services: Testing Laboratory will conduct tests and inspections of representative areas to determine compliance of installed systems with specified requirements. Testing will take place as follows and in successive stages as indicated on Drawings. Do not proceed with installation of next area until test results for previously completed areas show compliance with requirements.

1. Structural-Sealant Compatibility and Adhesion: Structural sealant shall be tested according to recommendations in ASTM C 1401.
 - a) Destructive test method, Method A, Hand Pull Tab (Destructive) in ASTM C 1401, Appendix X2 shall be used.
 - 1) A minimum of four areas on each building face shall be tested.
 - 2) Repair installation areas damaged by testing.
2. Structural-Sealant Glazing Inspection: After installation of curtain-wall systems are complete, structural-sealant glazing shall be inspected and evaluated according to ASTM C 1401 recommendations.
3. Water Penetration: Areas shall be tested according to ASTM E 1105 at minimum uniform and cyclic static-air-pressure difference of 0.67 times the pressure specified under Part 1 "DESIGN REQUIREMENTS" Article, but not less than 8.0 psf (300 Pa) and shall not evidence water penetration. Conduct three tests, at 10 percent, 50 percent and 75 percent completion.

C. Remedial Work: Repair or remove work where test results and inspections indicate that it does not comply with specified requirements. Retesting and additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional Work with specified requirements.

3.06 CLEANING

- A. Protective Coverings:** Remove protective materials from prefinished aluminum surfaces immediately prior to cleaning for Substantial Completion review.
- B. Cleaning:** For initial cleaning and for cleaning prior to Substantial Completion review.
 - 1. Wash down exposed surfaces using a solution of mild detergent in warm water, applied with soft, clean wiping cloths.
 - 2. Take care to remove soiling and dust accumulation from corners.
 - 3. Flush thoroughly and wipe surfaces clean.
 - 4. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and framing finish manufacturers.
- C. Glass Cleaning:** See Section 08800 - Glass and Glazing.

END OF SECTION

SECTION 09645

CUSHIONED WOOD FLOORING ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Gymnasium Flooring:** Anchored and cushioned wood sports flooring system, providing adjustable performance levels, consisting in general of vapor barrier, pre-manufactured subfloor panels adjusted to specified performance level, anti-squeek collared steel anchors, resilient pads, maple flooring, accessories field finishing with painted court lines and clear varnish.

1.02 RELATED SECTIONS

- A. Section 03100 - Concrete Formwork:** Forming of slab depression for cushioned wood flooring assembly, depth according to wood flooring manufacturer's instructions for system to be installed.
- B. Section 03300 - Cast in Place Concrete:** Concrete substrate on which wood flooring system shall be installed, steel troweled and finished smooth to tolerance according to flooring manufacturer's requirements.
- C. Section 06200 - Finish Carpentry:** General requirements for custom-fabricated wood trim at wood flooring.
- D. Section 07265 - Vapor Emission Reduction System:** Testing and mitigation of excessive moisture vapor transmission from concrete substrate.
- E. Section 08710 - Door Hardware:** Metal thresholds at door openings.
- F. Section 09900 - Field Painting:** Finishing of wood products other than wood flooring system.
- G. Section 11485 - Gymnasium Equipment:** Sleeves and anchors integrated with wood flooring system.
- H. Section 12600 - Telescoping Stands:** Interior, telescoping bleachers for installation over cushioned wood flooring system.

1.03 SUBMITTALS

- A. Product Data:** Submit manufacturer's detailed technical product data and installation instructions for wood flooring system. Include instructions for handling, moisture protection, anchorage, finishing, protection and maintenance.
- B. Shop Drawings:** Submit shop drawings indicating method of construction, relationships to surrounding construction, perimeter venting, base and trim details and other information and components not fully dimensioned or detailed in

manufacturer's product data. Include layout, colors, widths and dimensions of game lines and markings.

- C. **Samples:** Submit samples of flooring finish together with color chips for game line markings. Indicate full variation of wood coloration.
- D. **Qualification Data:** For Installer.
- E. **Maintenance Data:** For wood sports-floor assemblies and finish systems to include in maintenance manuals.

1.04 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A qualified manufacturer that is certified for wood sports floor assemblies.
- B. **Installer's Qualifications:** Approved by or acceptable to flooring system manufacturer, with minimum of three years of experience in installation of wood flooring for recreational projects, MFMA Mill Accredited Installation Company. Upon request of Architect, submit list of completed projects and references verifying experience.
- C. **Maple Flooring:** Comply with MFMA grading rules for species, grade, and cut.

1.05 DELIVERY, STORAGE AND HANDLING

- A. **Delivery:** Deliver flooring in unopened bundles with grade marking intact.
- B. **Storage:** Store flooring materials in an area where temperature can be maintained at approximately 65 degrees F and relative humidity can be kept below 50 percent. Store flooring in the area where it will be installed for at least 3 days immediately prior to installation.

1.06 PRE-INSTALLATION CONFERENCE

- A. **Scheduled Date:** Convene a pre-installation conference one week prior to commencing Work specified in this Section.
- B. **Attendance:** Require attendance by Contractor's superintendent and other supervisory and quality control personnel having responsibility for wood flooring, supervisory personnel of flooring applicator and, if applicable, representative of flooring products manufacturer. Construction Manager and, if authorized by Construction Manager, Architect will attend.
- C. **Agenda:** Review Drawings and Specifications for suitability for installation of wood flooring system. Review installation procedures and coordination required with related Work. Discuss changes and deviations from Drawings and Specifications, if any, recommended or required.

1.07 PROJECT CONDITIONS

A. Project Conditions: Comply with requirements of wood flooring manufacturer.

1. Moisture generating activities: Install resilient flooring assemblies after other finishing operations, including gypsum board, plaster and painting, have been completed.
2. Overhead Work: Do not proceed with wood flooring installation until overhead construction, including painting, lighting, athletic equipment, HVAC and electrical Work are completed.
3. Temperature and humidity: Do not deliver flooring to the site until concrete, plaster and tile Work are dry. Do not proceed with installation of wood flooring until spaces have been enclosed and are at approximate humidity condition planned for occupancy. Comply with wood flooring manufacturer's criteria.
4. Floor slab tolerances: Ensure that concrete slab substrate is level and flat, within tolerances required by wood flooring manufacturer.
5. Floor slab water vapor pressure: If water vapor transmission exceeds 4.5 pounds per 1,000 square feet (2.20 kg per 100 square meters), conduct water vapor mitigation to reduce pressure to specified maximum. Comply with requirements specified in Section 07265 - Vapor Emission Reduction System.

B. Wood Conditioning: Conditioning period shall begin not less than seven days before sports-floor assembly installation, is continuous through installation, and continues not less than seven days after sports-floor installation.

1. Environmental conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants, but not less than 35 percent or more than 50 percent, in spaces to receive sports-floor assemblies during the conditioning period.
2. Wood conditioning: Move wood components into spaces where they will be installed, no later than beginning of the conditioning period.
 - a) Do not install sports-floor assemblies until wood components adjust to relative humidity of, and are at same temperature as, spaces where they are to be installed.
 - b) Open sealed packages to allow wood components to acclimatize immediately on moving wood components into spaces in which they will be installed.
3. Post-conditioning period: After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

1.08 WARRANTY

A. Extended Warranty: Furnish 3-year warranty signed by manufacturer and installer, agreeing to repair or replace wood flooring which shrinks, warps, cracks, or otherwise deteriorates excessively, or which buckles, delaminates or breaks its anchorage or bond with substrate, or otherwise fails to perform as required, due to failures of materials or workmanship and not due to unusual exposure to moisture or other abusive forces or elements not anticipated for application.

PART 2 - PRODUCTS

2.01 GYMNASIUM HARDWOOD STRIP FLOORING SYSTEM

- A. Specified Manufacturer:** Connor Sports Flooring, (906/822-7311 or 800/833-7144).
- B. Acceptable Manufacturers:** Equivalent products of other manufacturers listed below, will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
1. Action Floor Systems, Inc., LLC, Mercer, WI (715/476-3512 or 800/746-3512).
 2. Superior Floor Company, Inc., Wausau, WI (715/842-5358).
 3. Robbins Sports Surfaces, Cincinnati, OH (513/871-8988 or 800/543-1913).
- C. Hardwood Strip Flooring System for Gymnasium:** Alliance as manufactured by Connor Sports Flooring, with factory-assembled subfloor panels shall provide nominal 3/4" x 4" x 8' UL plywood nailers with 3/4" Rezill pads attached. Sleeper anchorage struts shall be nominal 1/2" x 4" UL grade plywood with pre-drilled anchor pockets.
- D. Maple Flooring:** Northern Hard maple flooring , 25/32-inch x 2-1/4 inches, Second & Better Grade, TGEM, MFMA Grade marked and stamped. A FSC Certification is not required.
1. Grade 2 Maple Flooring to be placed as indicated on the drawings.
- E. Thresholds:** 8-inch wide ribbed aluminum, for transition from other flooring to wood.
- F. Fasteners:**
1. Cushion Support Plates: 1-3/4 inches long steel drive (or length as dictated by site conditions - achieving a minimum 900 lbs pull-out strength) applied with an air driven or low velocity powder actuated tool.
 2. Upper Nailer Strips: 7/8-inch coated subfloor staples.
 3. Resilient Cushion: 2-inch staples.
 4. Subfloor Cover: 2-inch staples.
 5. Flooring fasteners: 1-3/4 inch barbed cleats or coated staples.
- G. Outlet Box Covers:** See Section 11485 - Gymnasium Equipment.
- H. Field-Applied Finishes:** Paints shall comply with requirements of South Coast Air Quality Management District (SCAQMD) Rule 1113.
1. Sports Floor Sealer: Sport Tone Waterborne Sport Floor Sealer (2 coats) and Defense Waterborne Sport Floor Finish, 2 coats.

2. Markings paint: By Bona (USA) Sport (800) 872-5515 (game line paints). High-gloss enamel compatible with finish and recommended by manufacturers for this purpose. Colors are as follows unless otherwise selected by the Architect.
 - a. Base White #1115
 - b. Base Green #1114
 - c. Base Black #1116
 - d. Base Red #1113

2.02 ACCESSORY MATERIALS

- A. **Trowelable Leveling and Patching Compound:** Latex-modified, hydraulic-cement-based formulation approved by resilient wood flooring assembly manufacturer.
- B. **Vapor Retarder:** Black or white high-density polyethylene, cross-laminated, approximately 6.4 mils thick, Permalon X-100 by Permalon Division, Reef Industries, Inc., Houston, TX (800/231-2417), or equal. Unreinforced polyethylene will not be acceptable.
 1. Adhesive tape for vapor retarder sheet joint sealing: Griffolyn Fab Tape, black double-sided asphalt based pressure-sensitive tape, produced by Reef Industries, Inc., Houston, TX (800/231-6074).
 2. Adhesive for adhering vapor retarder to concrete perimeter: Spray-applied contact adhesive, compatible with sheet barrier and substrate materials, with excellent water-resistive qualities, Miracle Adhesives Corporation, Bellmore, NY (800/647-2253), Miracle 1330 Spray Adhesive, or equal.
- C. **Perimeter Base:** 3-inches by 4-inches (76 mm by 100 mm) vented black or brown rubber, as selected by Architect.
- D. **Thresholds:** For transition from floating wood flooring assembly to adjoining finish flooring, ribbed aluminum with clear anodized finish.
- E. **Temporary Protective Covering:** Non-staining reinforced kraft paper (polyethylene sheeting shall not be used), overlaid with plywood or particle board sheets at traffic areas.

PART 3 - EXECUTION

3.01 SUBSTRATE CONDITIONS

- A. **Inspection:** Prior to commencing installation, carefully inspect conditions under which wood flooring will be installed and completed adjoining Work. Verify that adjoining Work is complete to the point where installation of wood flooring may properly occur.
- B. **Moisture Emission:** Test concrete slab on grade for water vapor emission and conduct mitigation as necessary to achieve vapor pressure not exceeding maximum allowed by wood flooring manufacturer.

1. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 4.5 lb of water/1000 sq. ft. (2.04 kg of water/92.9 sq. m) in 24 hours.
2. Comply with requirements specified in Section 07265 - Vapor Emission Reduction System, to mitigate excessive moisture vapor emission and achieve specified maximum water vapor pressure.

3.02 PREPARATION

- A. Subfloor Cleaning:** As necessary, clean subfloor to achieve conditions specified above. Vacuum subfloor surface.
- B. Subfloor Filling and Leveling:** Grind high spots and fill low spots on concrete substrates to produce a maximum 1/8-inch (3-mm) deviation in any direction when checked with a 10-foot (3-m) straight edge.
1. Apply, trowel and float floor filler as necessary to provide smooth, flat, hard surface.
 2. Fill all cracks wider than 1/8-inch.
 3. Prohibit traffic until filler is cured.
- C. Substrate Cleaning:**
1. Remove coatings including curing compounds and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone; use mechanical methods recommended by manufacturer. Do not use solvents.
 2. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Vapor Retarder Installation:**
1. Lay vapor retarder sheet loose over concrete subfloor with edges lapped 6-inches and sealed with tape.
 2. Turn up and seal sheet to face of wall adhesive mastic.
 3. Apply adhesive to both surfaces, allow approximately 10 minutes to set up and then press together smoothly and evenly, without gaps or fishmouths, for full contact bond.

3.03 GYMNASIUM WOOD STRIP FLOORING INSTALLATION

- A. Subfloor Installation:** Layout subfloor assembly with sleepers at right angle to finish flooring.
1. Place subfloor panels to maintain spacing between panel edges as provided between pre-assembled sleepers.

2. Lap panel nailer ends onto designated cross struts, providing 1/4-inch end joint spacing and secure with nails or staples and construction adhesive.
3. Align subfloor panels to provide correct stagger of concrete anchors in adjacent rows. Provide 1-1/2" expansion voids at perimeter and at vertical obstructions.
4. Install solid blocking at doorways, under bleachers in stacked position and below portable goals.
5. Secure sleeper struts to concrete with steel anchors inserted into anchor pockets provided. Maintain proper anchor penetration with manufacturer's installation tools and procedures.

B. Gymnasium Wood Strip Flooring System Installation: Comply with manufacturer's installation instructions and recommendations. Make provisions for expansion and contraction.

1. Lay out flooring in directions and patterns as indicated on the Drawings.
2. Install maple flooring parallel to main playing court by power nailing or stapling at all sleeper locations. End joints shall be properly driven up.
3. Size joints between flooring strips to allow for intermediate expansion in accordance with ambient humidity conditions. Provide allowances for humidity from swimming pool in the facility.
4. Provided 1-1/2 inch expansion voids at perimeter and at all vertical obstructions.
5. Completed flooring shall be level, smooth and even.

3.04 FIELD FINISHING

A. Preparation: Prepare surfaces for applied finish in accordance with finish manufacturer's instructions and recommendations, to achieve a smooth, even, uniform surface. Allow installed flooring to acclimate to ambient conditions for at least 10 days before sanding.

B. Sanding: Comply with flooring manufacturer's sanding guidelines for specific products.

1. Machine sand with coarse, medium, and fine grades of sandpaper to achieve a level, smooth, uniform surface without ridges or cups.
2. After sanding with drum sander, buff entire floor using 100 grit screenback or equal grit sandpaper, with a heavy-duty buffing machine.
3. Remove sanding dust by tack or vacuum.
4. Flooring shall present a smooth surface without drum stop marks, gouges, streaks or shiners.

C. Clear Finish Application: Apply seal and finish coats of finish system according to manufacturer's written instructions.

1. Sealer: Two coats.
2. Finish: Not less than two coats.

- D. Preparation for Markings and Sealer:** Prepare surfaces for applied finish in accordance with finish manufacturer's instructions and recommendations, to achieve a smooth, even and uniform finish.
1. Surface scuffing: Screen or steel wool and vacuum and/or tack between each coat, after preceding coat dries.
 2. Flooring shall present a smooth surface without drum stop marks, gouges, streaks or shiners.
 3. Water-based finishes: Use finishing methods recommended by finish manufacturer to reduce grain raise and sidebonding effect.
- E. Game Lines, Graphics and Markings Application:** As indicated on the Drawings.
1. Apply game-line and markings paint between final seal coat and first finish coat according to paint manufacturer's instructions.
 - a. Layout game lines, graphics and markings as indicated on the Drawings.
 - b. Provide game line dimensions as indicated on the Drawings.
 - c. Provide colors as indicated on the Drawings.
 2. Mask flooring to provide sharp edges. Where game lines cross, break minor game line at intersection; do not overlap lines.
- F. Final Clear Finish Coats:** Over game-lines, graphics and markings, not less than two coats.
- G. Finish Appearance:** Smooth, even gloss, without brushstrokes.
- H. Base and Transitions Installation:**
1. Resilient (venting) base: After completion of field finishing, install vented cove base anchored to walls with suitable adhesive. Provide pre-molded outside corners and neatly mitered inside corners.
 2. Wood base and transitions: Before field finishing. Use headless nails. Fill and finish nail penetrations.

3.05 PROTECTION AND CLEANING

- A. Initial Protection:** Prevent traffic on finished floor for a minimum of 10 days.
- B. Temporary Covers:** Immediately after wood flooring Work is completed and finish is cured, cover flooring with a protective paper supplemented with clean plywood or wood particleboard, along traffic routes.
- C. Final Cleaning:** For Completion review, remove protective coverings, repair all damage to the flooring and clean and machine buff the entire floor area.

END OF SECTION

SECTION 10800

TOILET ACCESSORIES

PART 1 - GENERAL

- 1.01 Description: Division 1 applies to this Section. Provide toilet accessories complete as indicated, specified, and required.

A. Work In This Section: Principal items include:

1. Toilet room accessories: Dispensers, grab bars, mirrors, shelves, electric hand dryers and other accessories as indicated on the Drawings or as selected by the Architect.

B. Related Work Not In This Section:

1. Section 05090 - Anchors and Fasteners: General requirements for anchors and fasteners to building substrates.
2. Section 06100 – Rough Carpentry: Recess framing for toilet accessories at wood frame construction.
3. Section 07900 – Calking and Sealants: Sanitary sealant for use at toilet accessories.
4. Section 08800 - Glass and Glazing: Unframed mirrors; mirror cleaning requirements.
5. Section 09250 - Gypsum Board: Cut-outs for recessed toilet accessories.
6. Section 10162 – Toilet Partitions: Coordination of mounting of accessories on and in partitions; accessories provided with toilet compartments.
7. Division 16 - Electrical: Power provisions to electric hand dryers.

1.02 SUBMITTALS

- A. Product Data:** If other than specified products by specified manufacturer, submit catalog cuts for all items.
- B. Shop Drawings:** If other than specified products by specified manufacturer, submit drawings showing cutouts and locations of backing.
- C. Samples:** If other than specified products by specified manufacturer and if requested by Architect, submit samples of each product. Samples will be returned following review.
- D. Installation Instructions:** For Project record only, submit instructions showing mounting heights in compliance with applicable accessibility requirements and showing backing, blocking and anchoring requirements appropriate to Project conditions.

1.03 QUALITY ASSURANCE

- A. Coordination:** Verify anchoring requirements for substrate conditions and manufacturer's recommendations. Furnish appropriate fasteners for Project conditions. Furnish backing information and templates for cutouts for proper layout and installation of supporting construction.
- B. Regulatory Requirements:** Installation shall conform to requirements of 2016 California Building Code (CBC) Chapter 11B - Accessibility, including:
1. California Building Code (CBC), Section 1115B, Bathing and Toilet Facilities.
 2. California Building Code (CBC), Section 1117B, Other Building Components.
 3. California Building Code (CBC), Section 1118B, Space Allowances and Reach Ranges.

PART 2 - PRODUCTS

2.01 TOILET ROOM ACCESSORIES

- A. Specified Manufacturer:** Bobrick Washroom Equipment, Inc., (818/764-1000).
- B. Acceptable Manufacturer:** Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
1. American Specialties, Inc. (ASI), Yonkers, (914/476-9000).
 2. Bradley Washroom Accessories Division, (414/354-0100).
- C. Toilet Room Accessories, General:** Embossed, stamped nomenclature or labels on exposed faces of units will not be accepted.
1. Accessories indicated to be provided by Contractor: Bobrick stainless steel accessories as scheduled and noted on the Drawings.
 2. Accessories indicated to be Owner-Furnished/Contractor-Installed (OFCI): As indicated on the Drawings. Toilet paper dispenser at accessible toilet stalls shall have 3-inch maximum projection from wall.
- D. Accessibility Compliance:**
1. Limit projection of a surface- or semi-surface mounted accessories from encroaching more than 3-inches from the face of the wall or partition, and no closer than 1-1/2 inches to the tangent point of the grab bar.
 2. Toilet paper and feminine napkin disposals located on grab bar side of accessible toilet room or stall shall not project more than the grab bar. Do not mount toilet paper and other dispensers above grab bar.
- E. Finish:** Bright polished stainless steel and chrome plating, unless otherwise noted.

- F. **Locks:** Keyed (tumbler lock) accessories shall be keyed alike with the exception of coin receiving boxes on vending equipment.
- G. **Manufacturer and Product Identification:** Embossed, stamped nomenclature or labels on exposed faces of units will not be accepted.
- H. **Grab Bars:** Bobrick Series as scheduled and noted on the Drawings, 1-1/2-inches o.d., 18 gage Type 304 stainless steel tubing, 1-1/2 inches clear between grab bar and mounting surface, concealed mounting with 3-inch diameter flange secured with 4 set screws.
 - 1. Provide peened, non-slip gripping surface.
 - 2. Provide grab bars in configurations indicated on the Drawings.
 - 3. Grab bars shall provide 1-1/2 inches clearance from tangent point of grab bar and mounting surface.
 - 4. Grab bars shall not project more than 3-inches into the 48-inch minimum clear space in front of water closet, in compliance with California Building Code (CBC) Section 1115B.4.1.3.
- I. **Toilet Tissue Dispensers:** Continuous flow type in compliance with California Building Code (CBC) Section 1115B.8.4.

2.02 CUSTODIAL ROOM ACCESSORIES

- A. **Specified Manufacturer:** Bobrick Washroom Equipment, Inc., (818/764-1000).
- B. **Acceptable Manufacturer:** Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
 - 1. American Specialties, Inc. (ASI), (914/476-9000).
 - 2. Bradley Washroom Accessories Division, (414/354-0100).
- C. **Custodial Room Accessories:** Bobrick stainless steel accessories as scheduled and noted on the Drawings.
- D. **Finish:** Brushed stainless steel and satin chrome plating, unless otherwise indicated.

2.03 METAL-FRAMED MIRRORS

- A. **Specified Manufacturer:** Bobrick Washroom Equipment, Inc., (818/764-1000).
- B. **Acceptable Manufacturer:** Equivalent products of the manufacturers listed below will be acceptable in accordance with the "or equal" provision specified in Section 01600 - Product Requirements.
 - 1. American Specialties, Inc. (ASI), (914/476-9000).
 - 2. Bradley Washroom Accessories Division, (414/354-0100).

- C. Metal Framed Mirrors:** Bobrick framed mirror and framed mirror/shelf combination, series as scheduled and size as noted on Drawings, stainless steel narrow face frame, factory-assembled mirrors, with galvanized steel wall hanger assembly.
1. Frame corners shall be heliarc welded, ground and polished smooth and shall have continuous, integral stiffeners on all sides. Protect frame corners by friction-absorbing filler strips.
 2. Mirror back and hanger: Screw-locking design, formed 20 gage (0.9mm) galvanized steel, incorporating lower support member, forming rigid rectangle which engages lower backplate louvers to keep bottom of mirror against wall. Secure back to locking clips with concealed stainless steel screws.
 3. Protect mirror back with full-size, shock-absorbing, water-resistant, non-abrasive 3/16-inch (5mm) thick polyethylene padding.
 4. Glass shall be ASTM C 1036, Type I, Class 1 mirror glass with electrolytically copper plated by galvanic process and guaranteed for 10 years against silver spoilage.

2.04 ELECTRIC HAND DRYERS

- A. Electric Hand Dryers:** Bobrick Model B-3725 electric hand dryer, with recess kit, sensor operation, brushed stainless steel finish, UL listed and labeled to suit serving electric power indicated on Electrical Drawings.
- B. Cover Color:** As indicated on Drawings or, if not indicated, as selected by Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Installation of Toilet Room Accessories:** Install accessories in accordance with manufacturer's instructions and recommendations.
1. Comply with applicable accessibility and use requirements, including California Building Code (CBC) Section 1115B.8, with mounting heights according to Table 1115B-1.
 2. Toilet paper and feminine napkin disposals located on grab bar side of accessible toilet room or stall shall not project more than 3-inches from finished wall surface nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.
- B. Grab Bars Installation:** At concrete or masonry walls, install grab bars, using expansion anchors as specified in Section 05090 - Anchors and Fasteners.
1. Secure to toilet partition using 3-inch diameter stainless steel back plates with studs, couplings and stainless steel machine screws.

2. At wood stud walls, secure to wood blocking using No. 10 full threaded stainless steel wood screws of sufficient length to penetrate blocking 1-1/4 inches minimum.
 3. At concrete or masonry walls, install bars, using sheet metal screws and expansion anchors.
 4. At plaster or gypsum board walls, provide spacers of same thickness as wall material to prevent crushing of wall material.
- C. Mirrors:** Install mirror on manufacturer supplied concealed wall hanger and secure in place with theft-resistant locking screws.
- D. Fasteners:** Install accessories in areas and at locations indicated, using concealed fasteners wherever possible.
1. Secure accessories to solid masonry and to backing, blocking or framing only.
 2. Use lag screws, wood screws or sheet metal screws as appropriate for substrate and as required for anticipated loads. Hollow wall fasteners (toggle bolts and molly fasteners) will not be accepted. Comply with Section 05090 - Anchors and Fasteners, for anchors and fasteners to building substrates.
 3. Mount surface mounted fixtures with positive mechanical methods to ensure tamper-resistant anchorage.
- E. Sequence:** Install accessories after room finishes such as plaster, painting and tile Work have been completed. Install recessed elements before finish Work. Secure accessories to substrate with all vertical lines plumb and all horizontal lines level.

3.02 INSTALLATION OF ELECTRIC DRYERS

- A. Installation of Electric Dryers:** Comply with manufacturer's instructions and recommendations. Comply with applicable accessibility and use requirements, including California Building Code (CBC) Section 1118B.
- B. Electrical Connections:** Connect dryers to electric service, in compliance with requirements specified in Division 16 - Electrical.

3.03 CLEANING AND PROTECTION

- A. Cleaning, Initial:** Remove labels and soiling. Clean and polish accessories to bright finish. Clean mirrors as specified in Section 08800 - Glass and Glazing for glass.
- B. Protection:** Protect accessories from damage and soiling. Prohibit use of accessories, unless otherwise directed. Remove and replace damaged or defective accessories.

- C. Cleaning, Final:** Clean mirrors for Completion review, as specified for glass cleaning in Section 08800 - Glass and Glazing.

END OF SECTION

SECTION 11485

GYMNASIUM EQUIPMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Gymnasium sports equipment:

1. Basketball backstops and accessories.
2. Wall Pads.
3. Divider Curtain.
4. Volleyball Equipment.
5. Pickleball Equipment
5. Gymnasium Accessories.

B. Electronic scoreboards and timers.

1.02 RELATED SECTIONS

- A. Section 05090 - Anchors and Fasteners:** Requirements for anchoring to concrete, masonry and steel construction.
- B. Section 05120 - Structural Steel:** Structural steel framing to support basketball backstops.
- C. Section 05500 - Miscellaneous Metal Fabrications:** Requirements for minor structural framing added as necessary for installation of gymnasium equipment.
- D. Section 08710 - Door Hardware:** Lock cylinder requirements for keyed switches.
- E. Section 09645 – Cushioned Wood Flooring Assemblies:** Floor through which volleyball and pickleball new posts sockets shall anchor to concrete substrate.
- F. Section 12760 – Telescoping Stands:** Indoor bleachers for Gymnasium.
- E. Division 16 - Electrical:** Requirements for electrical connections, including conduit and outlet/junction boxes.

1.03 SUBMITTALS

- A. Product Data:** All standard production products.
- B. Shop Drawings:** All products specifically for the Project.
- C. Samples:** Assembly of wall pad showing corner construction and attachment method.

- D. Contract Closeout Submittals:** Submit operation and maintenance data for each type of folding door. Include manufacturer's printed instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use conditions. Include precautions against materials and methods which may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

- A. Regulatory Requirements:** Comply with regulations of governing authority over athletic event, including materials, dimensions, arrangements and colors.

1.05 WARRANTY

- A. Extended Warranty:** All basketball backstop support structures including clamps, fittings and tube to have a minimum warranty of 25 years from date established by Notice of Completion. Warranty for other items shall be as indicated in product specifications.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Specified Manufacturers:

1. Gymnasium equipment, except electronic scoreboards: Gared Performance Sports System, Noblesville, IN; Richard Sivas, Herk Edwards, Inc.; (310)373-0543.
2. Floor plates for volleyball equipment: Gared Performance Sports System, Noblesville, IN; Richard Sivas, Herk Edwards, Inc.; (310)373-0543.
3. Wireless electronic scoreboards: Daktronics, Inc., Brookings, SD (605/697-4300) or 888/325-8766; Bob Fechner, 714/865-6040).

- B. Acceptable Manufacturers:** None identified. No substitutions will be considered.

2.02 BASKETBALL BACKSTOPS

- A. Main Gym Backstops:** Model #3107, ceiling-suspended welded single front folding basketball structure, By Gared Performance Sports Systems, Noblesville, IN.

1. Overhead Structure
 - a) Unit shall be supported from 3-1/2" O.D. x 0.120" wall ASTM A-513 horizontal and 2-3/8" O.D. x 14 gauge (0.083") wall ASTM A-513 vertical structural steel tubing secured to the building with heavy gauge steel stampings or weldments (as required by building conditions). When truss span widths exceed 10'-0", 3-1/2" O.D. x Schedule 40 (0.216") wall ASTM A-500 Grade B will be used for the horizontals. Spans over 14'-0" may use welded bridge pipe.

2. Backstop
 - a) The backstop shall be of a single post design with a main vertical mast made of 6-5/8" O.D. x 0.120" wall ASTM A-500 Grade B structural steel tubing with 2-1/2" x 1-1/2" x 14 gauge (0.083") wall ASTM A-513 rectangular steel tube sway braces miter cut and welded in place to a top horizontal 4" x 1-1/2" x 0.18" web ASTM A-36 steel channel. Main mast will be suspended from superstructure with an offset hanger 3" in front of the pivot point. Units with less than 3" offset will not be approved as equal. Backstop shall be manufactured to allow 3" vertical adjustment for plumbing of the backboard. All fittings shall be heavy gauge steel stampings or weldments. A direct goal attachment is used to transfer stress from the goal to the main mast assembly preventing strain on the backboard.
 - b) Front brace shall be 1-7/8" O.D. x 14 gauge (0.083") wall ASTM A-513 steel tubing attached to the main mast 12" to 18" above the backboard. When truss heights are higher than 26'-0", front brace shall be 2-3/8" O.D. x 14 gauge (0.083") wall ASTM A-513 steel tubing. Folding brace shall be of a jackknife design with an adjustable hinge for easy installation and field adjustment. Backstop shall be raised and lowered with 1/4" galvanized aircraft cable with a breaking strength of 7000 lbs. Backstop manufactured in accordance with 1994 rule 1, section 8, stating that all parts of the backboard support system shall be at least 6" behind backboard.
 - c) White powder coat finish.
 - d) Back stop lock (Model 1100).
 - e) Motor Data – (model 1194) 3/4 HP, 9.5 amp with key switch and receptacle.
 - f) Quantity: 6 total (Contractor to verify with Architect).
3. Rectangular Glass Backboards
 - a) Model No. AFRG42 Aluminum Framed Rectangular Glass Backboard by Gared Performance Sports Systems.
 - b) Backboards shall be 42 inches high by 72 inches wide.
 - c) Backboard shall be manufactured from 1/2" tempered glass set in heavy extruded aluminum framing and cushioned by shock absorbing vinyl. Official border and target area permanently fired into glass.
 - d) Goal mounting structure shall be a heavy welded formed steel assembly, and directly attached to lower horizontal frame member to minimize stress on glass.
 - e) Backboard shall have limited lifetime warranty against defects in material and workmanship, and when used with Gared Performance Sports System's Direct Goal Attachment feature shall be protected against shatter and breakage of glass. Board must meet NCAA, FIBA and NFSHSA specifications
 - f) Pro mold cushion backboard edge. (Model PMCE). Color to be selected by Architect.
 - g) Quantity: 6 total (Contractor to verify with Architect).
4. Electric Basketball Backstop Height Adjuster

- a) Model No. 1170 Electric Adjust-A-Goal by Gared Performance Sports System.
 - b) Electric height adjuster shall be manufactured of steel using an electrically operated linear actuator to raise and lower backboard from 8' to 10' off of finished floor. Linear actuator shall be powered by a 115 volt single-phase motor and contain built in limit switches to ensure safe operation and positive stopping at 8' and 10' heights. Adjust-A-Goal features a direct goal attachment to transfers load of play directly through backboard to support structure. Adjust-A-Goal shall be operated with a flush mounted single keyed switch (eliminating the need to two keys) or portable power wand.
 - c) With hard wire kit for electric height adjuster (Model 1158).
 - d) Quantity: 6 total (Contractor to verify with Architect)
5. Break-Away Goal
- a) Gared Performance Sports System Model No. 2500.
 - b) The 2500 goal shall be constructed with an enclosed positive lock mechanism.
 - c) Goal shall be designed so that any possible entrapment areas have been eliminated.
 - d) Goal shall have official size 18" ring of 5/8" diameter steel with tube tie net attachment and a durable orange powder coated finish. Anti-whip net and hardware shall be included. Universal back plate shall accommodate most 42" and 48" rectangular and fan shape backboards.
 - e) Quantity: 6 total (Contractor to verify with Architect).

2.03 WALL PADDING

- A. Model No. 4130 Class "A" Fire Rated Neoprene Foam Wall Padding by Gared Performance Sports Systems, Noblesville, IN.**
- 1. Panels are 2' wide by 6' high, with custom sizes available. Panels of 2" thick CR Safeguard fire retardant neoprene foam meeting ASTM E84 with Class A rating flame spread index of 25 or less, and smoke development index of 450 or less. Each panel shall be covered with 14 oz. polyester reinforced laminated vinyl and cemented to 7/16" OSB exterior grade wood panels with one-inch nailing margins at top and bottom (for securing panels to wall). Available in fifteen (15) standard colors (color to be determined by Architect). All cutouts in panels shall be made in field to fit job conditions.
 - 2. Vinyl flammability rated as self-extinguishing by the California State Fire Code.
 - 3. See Architectural drawings for locations.

2.04 VOLLEYBALL EQUIPMENT

- A. Volleyball Equipment:** Model 6100 Volleyball System by Gared Performance Sports Systems.

1. The model 6100 shall consist of one standard with power winch and one standard with adjustable cable anchor collar. Post shall be telescoping type to meet all FIVB, USVBA, NCAA and NFHS requirements for competition. Post shall allow infinite height adjustment from 6' (1.854 m) to 8'4" (2.540 m) to meet all age group height settings from elementary school use to international competition for both men and women. EVS-01 shall incorporate an internal spring assist mechanism for easy, precise and infinite height adjustments. EVS easily locks in place with a pressure lock hand knob and post is clearly marked at normal competition heights.
2. The 6' (1.890 m) bottom upright shall be 3 1/2" O.D. (8.890 cm) schedule 80 aluminum tube, with a wall thickness of .300" (.7620 cm). The bottom upright is provided with a special rubber foot to protect finished floors and to provide precise net height adjustment. The upper telescoping adjustable tube shall be 2-7/8" OD (7.303 cm) schedule 80 aluminum tube, with a wall thickness of .276" (.7010 cm) with a 4" (10.16 cm) diameter pulley and oilite bushing. Both post sections have a clear anodized finish.
3. The tensioning winch shall incorporate a heavy-duty, self-locking worm gear mechanism. Winch shall be furnished with a heavy 2" (5 cm) wide high tensile nylon strap with heavy-duty snap hook to eliminate the possibility of hook breaking and guarantee safe connection to net top cable. The power winch is furnished complete with a folding handle for player safety.
4. Systems shall come complete with volleyball net. Net shall be 32' (9.75 M) long x 39" (1 M) high. Netting shall be high quality 4" square #36 black nylon cord with vinyl coated polyester hem double stitched around entire perimeter of net. Top hem of net shall be furnished with a 42'6" long x 1/8" diameter 2000 lb. minimum breaking strength galvanized aircraft cable with a nylon coating (3/16" OD) to protect against fraying. Ends of cable to have loops with heavy swaged type fittings for easy installation. Hems in end of net shall be furnished with a pocket for use with a 1/2" diameter fiberglass dowel rod. Ends of net shall have six 1" wide polypropylene tension straps with buckles for providing additional tightening of net. Bottom of net shall be furnished with a 1/4" diameter braided white nylon rope equipped with a spring loaded, pressure type rope tensioner.
5. System also to include Rope Tensioner and Combination Antenna and Boundary Marker.

B. Outlet Floor Cover Plates:

1. Floor plates shall be solid brass alloy with permanently attached hinged cover, with notch in cover for electrical cords to connect to outlet when cover in closed position. When closed, cover shall provide completely flat surface with no floor obstructions.
2. Floor plate shall be 6-7/16-inches outside diameter by 9/16-inch thick. The diameter of the opening shall be 5-1/8 inches. Floor plate shall be supplied with six #10 x 1-1/2 inch brass flat head wood screws for mounting plate to wood floor.
3. Provide each floor plate assembly cover plate with lock and one cover plate key for access through cover plate.

C. Volleyball Floor Cover Plates: Model 6432 by Gared Performance Sports Systems.

1. Floor plate shall be solid brass alloy with permanently attached hinged cover. Hinge and mounting holes in outer ring shall be completely concealed under the cover when in the closed position, allowing for a completely flat surface with no floor obstructions.
2. Floor plate shall be 7-1/2" outside diameter.

D. Volleyball Floor Sleeves: Model 6400 by Gared Performance Sports Systems.

E. Volleyball Transporter/Storage Cart: Model 6295 by Gared Performance Sports Systems.

1. Heavy-duty transporter/storage cart shall be capable of storing and transporting one referee stand and four volleyball posts.
2. Transporter/Storage Cart is provided with blue vinyl covered bottom shelf and pouch to allow for storage of nets, pads antennas and boundary markers.
3. Frame shall be rectangular steel tubing finished with attractive gloss black powder coat
4. Transporter/Storage Cart rolls 4" x 1-1/4" non-marking swivel casters.

F. Judge's Stand: Model 6446 by Gared Performance Sports Systems.

1. Judges stand shall be designed to attach to a collar by means of a removable, self-locking pin.
2. Collar slides over 3-1/2" O.D. volleyball standard and is rigidly positioned to post with allen-head set screws.
3. Frame shall be constructed of 1-1/2" x 1-1/2", 14-gauge square steel tubing and 1" OD steel tubing, welded together. Legs, steps, platform, and handrails shall all be one solid unit.
4. Judges platform shall consist of 1/2" thick, polyurethane finished Birch plywood, permanently bolted to stand.
5. Handrail/ladder section shall be spaced vertically 16" on center with three (3) ladder steps spaced horizontally of 16" centers.
6. Lower end of ladder tubes shall have 1/2" thick rubber bumper to protect finished floors. Ladder legs shall have 2" O.D. rubber wheels for easy transporting of stand. All metal components of stand shall be finished in black powder coat.
7. Judges stand shall be supplied complete with safety padding for player protection.
 - a) Upper section of stand shall have a snapped into place 1-1/2" polyethylene foam padding.
 - b) Lower ladder tubes shall have removable, hook and loop attached pads of 1" neoprene foam.
 - c) All pads shall be wrapped with 14 oz., polyester reinforced, dark blue vinyl (optional vinyl colors also available). Last two digits indicate pad color. Colors available: 01 White; 02 Marine Blue; 03 Brown; 04 Red; 05 Beige; 06 Orange; 07 Yellow; 08 Grey; 09

Maroon; 10 Dark Blue (standard); 11 Black; 12 Purple; 13 Forest Green.

8. Volleyball Post Padding: Model 6040 by Gared Performance Sports Systems.
 - a) Pads shall be hinged at corners to fold neatly around posts and tensioning winch to provide maximum player protection. Pads shall be constructed of 1-1/2" thick polyethylene foam filler covered with polyester reinforced vinyl with three (3) hook and loop fastening straps for quick set-up and take-down, and shall be constructed to accommodate winch, or judges stand when used.
 - b) Standard pads are Gray in color unless otherwise specified.
 - c) Pads are sold as pair unless otherwise specified.

2.05 GYMNASIUM DIVIDER CURTAINS

A Model No. 4040XL Top Roll Divider Curtain by Gared Performance Sports Systems Inc., Noblesville, IN.

1. Lower 2' vinyl section of curtain shall be solid vinyl coated polyester (avg. 18 or 22 oz. per square yard as required). Flammability rated as self-extinguishing by California State Fire Code. All seams to be welded with full 1" contact welds. A padded pocket shall be formed along bottom edge of curtain to accommodate a 1-5/8" diameter batten pipe for curtain support. Available in thirteen (13) standard colors (color to be determined by Architect). Upper section of curtain shall be vinyl coated polyester mesh (avg. 9 oz. per square yard). Flammability rated as self-extinguishing by California State Fire Code. Available in six (6) standard colors (color to be determined by Architect). Color samples provided upon request.
2. The 4040XL is supported from the roof structure by directly attaching to the underneath side of the roof truss or by attaching to 3.5" O.D. horizontal and 2 3/8" O.D. vertical structural tubing. Max. attachment height is 35'. Bridge pipe will be required when truss spans exceed 14'. All structure finish will be baked on white powder coat.
3. Drive shaft shall be supported by a carrier assembly spaced 9' +/- 2' O.C. Center support shall consist of a formed bracket with (2) 12" long steel rollers on which the drive shaft shall rotate. Steel rollers, designed to act as a guide for the vinyl, have permanently lubricated bearings for effortless movement of vinyl.
4. Curtain shall be operated by two (2) synchronized internal tubular motors (120 volt, 60 hertz, single phase). Each motor shall have a maximum torque of 352 inch pounds with a speed of 14 rpm, and shall be equipped with integral up and down limit switches with two locking push buttons. Motors shall be maintenance free, permanently lubricated and have overheating protection feature. Motors shall feature electromagnetic disk brakes that allow smooth and accurate stops without slippage and full braking power in event of power failure. Each motor shall feature three-stage planetary gear mechanism for quiet and reliable use. Curtain does not require cables, belts or straps for operation and all electrical components shall be neatly contained in overhead superstructure. Curtains with cables, belts or straps shall not be considered equal.

- Curtains with electrical components not contained in overhead superstructure shall not be considered equal.
5. Motors shall utilize a flush mounted single keyed switch to raise and lower the divider curtain (Eliminating the need for two keys). Key switch shall be located so that curtain is in full view of authorized operator at all times. Optional wireless remote control or keypad control operation available.
 6. Motors shall have a five (5) year warranty against material defects and workmanship. Curtain motors with less than a five (5) year warranty shall not be considered equal. Vinyl shall have one (1) year warranty against material defects and workmanship.
 7. Quantity: 1 total (Contractor to verify) – see Architectural plans for locations.

2.06 ELECTRONIC SCOREBOARDS

A. Scoreboards, General:

1. Scoreboards shall operate with 100 percent solid-state electronics, contained in all-aluminum enclosure.
2. Scoreboards shall be remotely controlled. (Spectrum radio for scoreboard controlled)
3. Scoreboards shall be ETL listed to UL standards 48 and 1433 and tested to CSA standards for outdoor use.

B. Gymnasium Scoreboard System: Daktronics BB-2155 single-sided basketball scoreboard, capable of also scoring volleyball and wrestling, (Remotely Controlled) with scores for HOME and GUEST to 199, period to nine, team FOULS to 99, PLAYER number to 99, player FOUL to 9, T.O.L (time outs left) to 9, possession and bonus indicators, period time display to 59:59 and during the last minute of period, display of time to 1/10 of a second.

1. Size: 6'-0" (1.83 m) high by 10'-0" (3.05 m) wide by 0'-6" (152 mm) deep.
2. Quantity: 2
3. Base weight: 275 lbs.
4. Base Power requirement: 270 W
5. Construction: All aluminum construction.
 - a) Scoreboard face and perimeter: 0.063" thick aluminum.
 - b) Scoreboard back: 0.050" thick aluminum.
 - c) Digit faceplates: 0.090" thick aluminum.
1. Color:
 - a) Panel Color ; Black
 - b) Striping; White
 - c) Caption: White
 - d) Digit Color: Mixed with Red and Amber
 - e) Caption Style; White Vinyl
2. Digits: PanaView Digits, seven bar segments per digit.
 - d) LED digit technology: Diffusant over LEDs to blend light, achieving a uniform look with 140 degree wide viewing angle.
 - e) Clock and score digits: 13" (330 mm) high.

- f) PERIOD and time outs left digits: 10" (254 mm) high.
 - g) Clock, colon, period digits and bonus indicators: Amber LEDs.
 - h) Score digits and possession indicators: Red LEDs.
 - 3. Captions:
 - a) HOME and GUEST captions: 6" (152 mm) high.
 - b) PERIOD caption: 4" (102 mm) high.
 - c) All captions: White vinyl applied directly to scoreboard face.
 - 4. Training: 4 hours minimum, on site training of City's personnel.
- C. **Horn:** Vibrating horn, mounted behind scoreboard face.
 - 5. Horn shall sounds automatically when period clock counts down to zero.
 - 6. Horn shall sound when manually when directed by scoreboard operator.
- D. **Power Cord:** Cord is 11-feet (3353 mm) long, color: white and plugs into standard grounded 120 V AC outlet mounted on ceiling hung backstop.
- E. **Shot Clocks:** Daktronics BB-2114 Basketball Shot Timers, one on each at the Main Court basketball backstops.
 - 1. Size: 1'-7" (483 mm) high by 1'-10" (569 mm) wide by 0'-6" (152 mm) deep.
 - 2. Weight: 15 lbs (7 kg).
 - 3. Power: 120 V AC (40 watt, 0.4 amp)
 - 4. Enclosure: Aluminum alloy 5052 enclosure with custom color paint finish as directed by Architect. Cabinet shall be capable of withstanding high-velocity impact from indoor sports balls without need for protective screens.
 - 5. Digits/indicators: 13-inches (330 mm) high, PanaView Digits, seven bar segments per digit, red LEDs.
 - 6. Display color: Black.
 - 7. Quantity: 2
- C. **Scoring Console:** All Sport 5000 by Daktronics. Scoring Console shall be capable of scoring multiple sports using changeable keyboard inserts.
 - 1. Control console: (2 total)
 - a) Electronics shall be housed in a rugged aluminum case.
 - b) Scoring console shall have 32-character liquid crystal prompting display to verify entries and recall information currently displayed.
 - c) Console face shall be water-resistant due to a sealed membrane keyboard.
 - d) Console shall be capable of controlling multiple scoreboards, stats displays and shot clocks, including other All Sport 5000 controlled displays currently owned by the City.
 - e) Recalls clock, score and period information if power is lost.
 - f) Runs Time of Day and Segment Timer modes.
 - g) Console shall have a maximum power requirement of 6 watts.
 - h) Console shall include 30-foot (6096 mm) control cable to connect to control receptacle junction box.

2. Control Cable: One pair shielded cable of 22 AWG minimum.
3. Accessories: Provide the following:
 - a) A durable hard-side carrying case for console.
 - b) Console shall have, 2.4 GHz spread spectrum radio control for wireless scoreboard control.
 - c) Hand held switch for main clock start/stop and horn.

2.07 GYMNASIUM ACCESSORIES

- A. Jaypro Sports – Rally Portable Pickleball New System.** RPP-3Port portable pickleball net system with optional center strap (P/N: CS-1 to adjust height to 34".
Quantity: 2
- B. Jaypro Sports Totemaster - Atlas Double Ball Cart.**
 1. The Atlas Double Ball Cart is from the Jaypro Totemaster line. Constructed of thick wall 1" square steel tube. These units are rugged and strong enough they can even hold an assortment of medicine balls. Heavy duty, non-marking swivel casters for easy transport. Protective powder coating for longer life.
 2. Constructed of 1" square steel tubing-Heavy duty.
 3. Non marking, swivel casters-Powder-coated-Stores up to 15 balls.
 4. Assembles to 51.5" L x 24" W x 36" H
 5. Quantity: 4 total (Contractor to verify).
- C. Jaypro Sports Portable Players Bench (Model PB-15).**
 1. 10" wide non-skid aluminum planks.
 2. 2" x 2" heavy duty galvanized steel legs for superior rust resistance.
 3. Planks are supported by a strong, galvanized steel understructure.
 4. Player bench without back rest.
 5. Seat plank is 19" from ground.
 6. Floor protection kit available for indoor use.
 7. Quantity: 8 total
- D. Jaypro Sports Scores Tables (Model ST-8FS) with possession indicator.**
Quantity: 2

PART 3 – EXECUTION

3.01 PREPARATION

- A. Preparation:**
 1. Coordinate support of basketball backstops and gymnasium divider curtains with roof structure to ensure proper distribution of loads and adequacy of attachment points. Ensure that building structure has been designed for loads of specific gymnasium divider shall be provided.

- Provide additional structural framing members as required in accordance with Section 05505 - Miscellaneous Metal Fabrications.
2. Coordinate configuration, size, and installation of basketball backstops and gymnasium divider curtains with height, slope, and type of building structure and lighting fixtures, mechanical equipment, ductwork, fire-suppression system, bleachers, athletic equipment, and other potential obstructions.
3. Field-verify dimensions prior to fabrication.
4. Coordinate electrical requirements for motorized operating mechanism to ensure proper power source, conduit, wiring, and boxes for keyed switches. Prior to installation, verify type and location of power supply. See "Electrical Contractor Shall Provide and Install"
5. Coordinate delivery of Volleyball Floor Sleeves and Covers with sub-contractors responsible for installation.
6. For installations made after wood gymnasium flooring is installed, provide protection and exercise care not to damage flooring.

3.02 INSTALLATION

- A. Installation, General:** Install equipment in accordance with manufacturer's written instructions and shop drawings.
1. Install even, plumb and level.
 2. Install control switch such that operator has view of complete basketball backstop during lowering and raising.
 3. Adjust limit switches of electric winch to ensure accurate position in both stored and lowered positions.

3.03 TESTING AND DEMONSTRATION

- A. Testing and Demonstration:** Operate basketball backstops to ensure proper lifting and lowering. Adjust as required to ensure smooth operation and accurate positioning.
- B. Instruction:** Instruct Construction Manager and staff in operation and required maintenance.

END OF SECTION

SECTION 15800
HEATING, VENTILATION AND AIR CONDITIONING

PART 1- GENERAL

1.01 DESCRIPTION

- A. Work under this section includes all labor, equipment, material, services, transportation, etc. required for and reasonably incidental to the complete and satisfactory installation of all of the HVAC Systems as indicated on the Drawings or specified herein.

1.02 WORK INCLUDED

- A. Packaged, Outdoor, Central-Station Air-Handling Units (Rooftop Units).
- B. Split-System Air-Conditioners and Heat Pumps.
- C. Refrigerant Piping and Specialties.
- D. Centrifugal Roof Ventilators.
- E. Diffusers, Registers, and Grilles.
- F. Ductwork, including single-wall rectangular and round ducts and fittings.
- G. Air Duct Accessories (fire and smoke dampers, backdraft dampers, volume dampers, flexible connectors, turning vanes, access doors, flexible ducts).
- H. Duct Insulation.
- I. HVAC Piping Insulation.
- J. Instrumentation and Control for HVAC (refer to Section 23 09 00).
- K. Testing, Adjusting, and Balancing.
- L. Duct Sealing and Leakage Testing.
- M. Seismic Restraints for HVAC Equipment and Ductwork.
- N. Submittals and Shop Drawings.
- O. Record Drawings.
- P. Operation and Maintenance Manuals.
- Q. Warranty.

1.03 GENERAL REQUIREMENTS

- A. This section of the specification shall be considered as a part of the entire specification and all applicable portions of General Conditions, Special Conditions, and Division 1 shall apply.
- B. Erection: The Contractor shall furnish the services of an experienced superintendent, who shall be constantly in charge of the erection of the work, together with all necessary journeymen, helpers, and laborers required to properly unload, erect, connect, adjust, start, operate, and test the work involved.

1.04 REFERENCES

- 1. AABC – National Standards for Field Measurement and Instrumentation, Total System Balance.

2. AMCA 210 – Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
3. AMCA 300 – Reverberant Room Method for Sound Testing of Fans.
4. AMCA 301 – Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
5. AMCA 99 – Standards Handbook.
6. ANSI/NFPA 90A – Standard for the Installation of Air-Conditioning and Ventilating Systems.
7. NFPA 90B – Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
8. AHRI 210/240 – Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
9. AHRI 340/360 – Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment.
10. AHRI 270 – Sound Rating of Outdoor Unitary Equipment.
11. ASHRAE 15 – Safety Standard for Refrigeration Systems.
12. ASHRAE 33 – Methods of Testing Forced-Circulation Air Cooling and Air Heating Coils.
13. ASHRAE 52.2 – Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
14. ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality.
15. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings.
16. ASHRAE 111 – Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
17. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.
18. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
19. ASME B31.5 – Refrigeration Piping and Heat Transfer Components.
20. ASTM A653/A653M – Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
21. ASTM B88 – Seamless Copper Water Tube.
22. ASTM B280 – Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
23. ASTM C518 – Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
24. ASTM C547 – Mineral Fiber Pipe Insulation.
25. ASTM C553 – Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
26. ASTM C612 – Mineral Fiber Block and Board Thermal Insulation.

27. ASTM C871 – Chemical Analysis of Thermal Insulation Materials for Leachable Chloride, Fluoride, Silicate, and Sodium Ions.
28. ASTM C916 – Adhesives for Duct Liner in Sheet Metal Air Ducts.
29. ASTM C920 – Elastomeric Joint Sealants.
30. ASTM C1071 – Fibrous Glass Duct Liner.
31. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
32. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
33. AWS A5.8 – Brazing Filler Metal.
34. AWS D1.1 – Structural Welding Code – Steel.
35. AWS D9.1 – Sheet Metal Welding Code.
36. NAIMA AH124 – Fibrous Glass Duct Liner Standard.
37. SMACNA – HVAC Duct Construction Standards – Metal and Flexible, latest edition.
38. SMACNA – HVAC Systems – Duct Design, latest edition.
39. SMACNA – Seismic Restraint Manual: Guidelines for Mechanical Systems, latest edition.
40. SMACNA – HVAC Air Duct Leakage Test Manual.
41. UL 181 – Factory-Made Air Ducts and Air Connectors.
42. UL 555 – Fire Dampers.
43. UL 555S – Smoke Dampers.
44. UL 705 – Power Ventilators.
45. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.
46. UL 1995 – Heating and Cooling Equipment.
47. California Building Code (CBC), current edition.
48. California Mechanical Code (CMC), current edition.
49. California Energy Code (Title 24, Part 6), current edition.
50. California Electrical Code (CEC), current edition.
51. California Fire Code (CFC), current edition.

1.05 SUBMITTALS AND SHOP DRAWINGS

- A. Contractor agrees that shop drawings submittals processed by the Owner do not become Contract Documents and are not Change Orders; that the purpose of the shop drawing review is to establish a reporting procedure and is intended for the Contractor's convenience in organizing his work and to permit the Owner to monitor the Contractor's progress and understanding of the design. If deviations, discrepancies, or conflicts between shop drawing submittals and the Contract Documents are discovered, the Contract Documents shall control and shall be followed.

- B. Materials and Equipment: As soon as possible and within 35 days after award of the contract, and before their purchase, the Contractor shall submit to the Owner seven bound booklets for approval containing a complete list of materials, specialties, and equipment he is to furnish. Literature shall be standard manufacturer's catalog cuts and items to be installed shall be clearly indicated. All submittals shall be made at one time.
- C. Each item shall be identified by manufacturer, brand and trade name, number, size, rating, and whatever other data is necessary to properly identify and check the materials and equipment. The words "as specified" will not be considered sufficient identification. Drawings shall be 1/4" scale.
- D. Accessories, controls, finish, etc., not submitted or identified with the submitted equipment shall be furnished and installed as specified.
- E. Approval of shop drawings shall not relieve Contractor of responsibility for providing all controls, wiring, components, etc. which are shown or specified, or all additional items required to provide complete and correctly operating mechanical systems.
- F. Submit product data for the following manufactured products, assemblies, and testing agencies required for this project:
 - 1. Packaged rooftop units, including rated capacities, operating characteristics, certified fan performance curves, certified sound-power ratings, motor ratings, electrical characteristics, dampers, roof curbs, and fan speed controllers.
 - 2. Split-system air-conditioning and heat pump units, including rated capacities and accessories.
 - 3. Refrigerant piping materials and specialties.
 - 4. Power ventilators, including AMCA-certified performance and sound data, motor ratings, dampers, roof curbs.
 - 5. Diffusers, registers, and grilles, including throw/drop data, static-pressure drop, and NC ratings.
 - 6. Ductwork materials, including liners, adhesives, sealants, and gaskets.
 - 7. Seismic-restraint devices.
 - 8. Fire and smoke dampers, including UL 555 and UL 555S listings.
 - 9. Insulation materials, including thermal conductivity, water-vapor permeance, thickness, and jacket data.
 - 10. HVAC piping insulation materials.
 - 11. Detailed TAB procedures, agenda, sample report forms, and copy of AABC National Project Performance Guarantee.
 - 12. Controls: Refer to Section 23 09 00.
- G. Prepare and furnish fully coordinated shop drawings showing ductwork and piping on separate drawings. The drawings shall be minimum 1/4" = 1'-0" scale and shall show dimensioning of piping and ductwork from gridlines, bottom of elevation marks for ductwork and piping and fittings, valves, dampers, devices, etc. with labels. In addition, coordinate with related work and reference on the same drawings major plumbing piping, structural steel, fire protection piping, conduit runs and cable trays.

Review and sign these drawings to verify coordination. Conflicts shall be brought to the attention of the Owner prior to issuance.

- H. Contractor shall provide detailed shop drawings minimum 45 days prior to installation for a complete functional system indicating all equipment, ductwork routing, changes in elevation, direction, sway bracing, etc. Contractor shall indicate all roof curb locations and sizes.

1.06 SUBSTITUTIONS

- A. Should the Contractor desire to substitute any material, equipment, or other items for those specified, he shall submit a complete list, including detailed equipment layouts and performance characteristics within 35 calendar days after the scheduled Start of Construction. Said data shall be submitted in 7 copies, assembled in individual brochures.
- B. The entire cost of all changes of any type due to substitution for materials specified shall be borne by the Contractor at no extra cost to the Owner.
- C. The contractor shall submit the amount of cost credit to the Contract in the event the proposed substitution is accepted.
- D. In all cases where substitutions are proposed after bids are received, the Contractor shall bear the cost of evaluation on the basis of 2-1/2 times technical salaries of engineering personnel involved.

1.07 AVAILABILITY OF SPECIFIED EQUIPMENT

- A. Verify prior to bidding that all specified equipment is available and can be obtained in time for installation during orderly and timely progress of the work.
- B. In the event that specified items will not be so available, notify the Owner prior to receipt of bids.
- C. Costs of delays because of non-availability of specified items, when such delays could have been avoided by proper investigation on the part of the Contractor, will be back-charged as necessary and shall not be borne by the Owner.

1.08 RECORD DRAWINGS

- A. The contractor shall arrange and pay for one set of white prints of the HVAC drawings, which he shall alter in red to show all changes made to the original layout. These drawings shall be kept current.
- B. The contractor shall deliver these completed to the Owner when the job is finished and accepted prior to final payment.

1.09 OPERATION AND MAINTENANCE DATA

- A. Submit two sets prior to final inspection, bound in 8-1/2" x 11" text pages, binders with durable plastic covers. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", and title of project. Internally subdivide the binder contents with permanent page dividers, logically organized with tab titling clearly printed under reinforced laminated plastic tabs.
- B. Contents: Prepare a Table of Contents with each product or system description identified.
 - 1. Part 1: Directory listing names, addresses, and telephone numbers of Owner, Contractor, Subcontractors, and major equipment suppliers.

- 2. Part 2: Operation and maintenance instructions, arranged by system, identifying: significant design criteria; list of equipment; parts list for each component; operating instructions; maintenance instructions for equipment and systems; maintenance instructions for special finishes.
- C. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after final inspection, with Owner comments. Revise content as required prior to final submittal.
- D. Submit final volumes (revised) within ten days after final inspection.

1.10 WARRANTY

- A. The Contractor, in accepting this contract, binds himself to replace or repair at his own expense any defect in workmanship or material which may appear within a period of one year from the date of the final acceptance of the building, and to pay for all resulting damage which shall appear within the said period; provided the Contractor shall not be liable for anything attributable to acts of the agents of the Owner, or for ordinary wear.
- B. The Contractor guarantees that all piping as provided in this specification will be free from all obstructions, and that all piping will be tight and drip free.
- C. Equipment-Specific Warranty Periods (from date of Substantial Completion):
 - 1. Refrigerant Compressors: Five (5) years.
 - 2. Gas Furnace Heat Exchangers: Five (5) years.
 - 3. Solid-State Ignition Modules: Three (3) years.
 - 4. Control Boards: Three (3) years.
 - 5. All Other Parts: One (1) year.
 - 6. Labor: One (1) year.

1.11 LOCAL CONDITIONS

- A. The Contractor and trades submitting tenders on this work shall visit and will be deemed to have visited the site to ensure that they are familiar with all conditions relating to the work. Failure to visit the site will in no way relieve the successful Contractor of the necessity of furnishing any material or performing any work that may be required to complete the work without additional cost to the Owner.

1.12 RULES, REGULATIONS AND CODES

- A. All work and materials shall be in full accordance with the latest California Mechanical Code, California Plumbing Code, California Building Code, California Energy Code, California Electrical Code, California Fire Code, and local rules and regulations; State Fire Marshal regulations; the safety orders of the Division of Industrial Safety; the National Electric Code; the standards of the National Fire Protection Association; American Gas Association; OSHA; ANSI; ASME; ASTM; SMACNA; and other applicable laws, codes, or regulations. Nothing in these specifications shall be construed to permit work not conforming to these codes.
- B. Electrical Work: Motors, electrical apparatus, and wiring specified in this section shall conform to NEMA standards and the National Electric Code and bear the Underwriter's label of approval.
- C. The Contractor shall furnish, without extra charge, any additional material and labor when and where required to comply with these rules and regulations, though the

work be not mentioned in these Specifications or shown on the Drawings. When these Specifications or Drawings call for materials or construction of a better quality or larger sizes than required by codes, the provisions of these specifications and accompanying drawings shall take precedence.

1.13 FEES AND PERMITS

- A. The Contractor must obtain and pay all fees for permits, licenses, inspections, etc., which are required by any legally constituted authority. Coordinate exact requirements with the Owner prior to bid.

1.14 COORDINATION

- A. Following the general arrangement indicated on the Drawings as closely as possible, the Contractor shall coordinate with the architectural, structural, plumbing, electrical, and all other trades prior to installation of the materials and equipment to verify adequate space available for installation. The Owner shall be immediately notified if an area of conflict occurs between trades.
- B. The Contractor shall bear all costs incurred for work that must be relocated due to conflicts between trades.
- C. The Mechanical Contractor shall coordinate all requirements for all points of connection with the General Contractor and other trades prior to bid.
- D. Coordinate sizes and locations of concrete bases, roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.15 SEISMIC REQUIREMENTS

- A. Structural Performance: All HVAC duct hangers, supports, equipment supports, and piping supports shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards – Metal and Flexible," SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems," and ASCE/SEI 7.
- B. Provide seismic bracing for all ductwork, piping, and equipment as required by the California Building Code and ASCE/SEI 7.
- C. Install accessories in accordance with manufacturer's instructions and to meet the provisions of SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems," latest edition.
- D. Seismic-restraint device manufacturers: Cooper B-Line, Hilti, Mason Industries, Unistrut, or equal.

1.16 DRAWINGS

- A. The work shall be installed as indicated on Drawings; however, changes to accommodate installation with other work, or in order to meet architectural or structural conditions, shall be made without additional cost to the Owner.
- B. For the purpose of clarity and legibility, the Drawings are essentially diagrammatic to the extent that many offsets, bends, unions, special fittings, and exact locations are not indicated. The Contractor shall make use of all data in all of the Contract Documents, and shall verify this information at the site.

1.17 INSPECTION

- A. The Contractor shall not allow or cause any of his work to be covered up or closed in until it has been inspected, tested, approved by all authorities having jurisdiction, and until Project Record drawings have been properly annotated.
- B. Should any work be covered up before such inspection, he shall, at his own expense, uncover the work to the satisfaction of the inspection party. All related repair work cost shall be borne by the Contractor.

1.18 DELIVERY, STORAGE AND PROTECTION

- A. Place orders for all equipment in time to prevent any delay in construction schedule. If materials or equipment are not ordered in time, additional charges made by equipment manufacturers together with any special handling charges shall be borne by the contractor.
- B. Materials shall be delivered in ample quantities for the uninterrupted progress of the work. They shall be stored as to cause the least obstruction and distributed so as to prevent overloading any portion of the structure.
- C. All work, equipment, and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his own workmen. He shall close all pipe and duct openings with caps or plugs during installation. He shall protect all equipment and materials against dirt, water, chemical, and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

1.19 DAMAGE BY LEAKS

- A. The Contractor shall be responsible for all damage to any part of the premises or work of other Contractors, caused by leaks or breaks in the piping or equipment furnished and/or installed under this section, during the construction and warranty period.

1.20 ACCESS TO EQUIPMENT FOR MAINTENANCE

- A. Install all equipment, piping, etc. to permit access for normal maintenance. Maintain easy access to filters, motors, etc. Perform any relocation required to permit access at request of Owner at no additional cost.
- B. Furnish and install access doors or panels in walls, floors, and ceilings to permit access to equipment, dampers, and all other items requiring service. Coordinate location of access doors with other trades as required.
- C. Size access panels to allow inspection and removal of all items served.
- D. Use Milcor style as required for material in which door is installed. Where door is installed in fire-rated construction, provide door bearing UL label required for condition.

PART 2- PRODUCTS

2.01 GENERAL

- A. All materials and equipment shall be new and of the best of their respective grades, free from all defects and of the make, brand, or quality herein specified or as accepted by the Owner.
- B. All materials and equipment shall be identified by manufacturer's name or nameplate data. Unidentified material or equipment shall be removed from the site.

- C. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in the catalog as standard with the equipment. Optional or additional accessories shall be furnished as specified.
- D. Where no specific make of material or equipment is mentioned, any first-class product of a reputable manufacturer may be used, provided it conforms to the requirements of the system and meets with the approval of the Owner.
- E. Equipment and materials damaged during transportation, installation, or operation shall be considered as "totally damaged" and shall be replaced with new. Any variance requires written approval of the Owner.
- F. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- G. Airstream Surfaces: All surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

2.02 PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

- A. Manufacturers:
 - 1. Carrier.
 - 2. Trane.
 - 3. Subject to compliance with requirements, provide products by other manufacturers providing equivalent performance.
- B. General:
 - 1. Provide roof-mounted units, electrically controlled heating and cooling utilizing scroll hermetic compressors with crankcase heaters for cooling duty and induced draft gas combustion for heating duty.
 - 2. Units shall be of ultra-high cooling efficiency and utilize R-454B refrigerant.
 - 3. Unit shall be a factory assembled, single-piece heating and cooling unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, refrigerant charge (R-454B), and special features required prior to field start-up.
 - 4. Minimum efficiency shall comply with California Energy Code (Title 24, Part 6), current edition.
- C. Quality Assurance:
 - 1. Units shall be rated in accordance with AHRI 210/240 and AHRI 340/360 for performance. Units shall be rated per AHRI 270 and 370 for sound.
 - 2. Unit shall be designed to conform to ASHRAE 15.
 - 3. Unit shall be UL and UL Canada tested and certified per ANSI Z21.47 and UL 1995 as a total package.
 - 4. Unit shall be manufactured in a facility registered to ISO 9001.
 - 5. Each unit shall be subjected to completely automated run testing on the assembly line.
 - 6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
 - 7. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).

D. Unit Cabinet:

1. Constructed of galvanized steel, bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
2. Structural members shall be minimum 18 gauge, with access doors or removable panels of minimum 20 gauge.
3. All airstream interior surfaces shall be insulated with a minimum 1/2-inch thick, 1 lb density foil-faced cleanable insulation. Insulation shall be bonded with a thermosetting resin and coated with an acrylic or other material that meets NFPA 90A flame retardance requirements and has an R-Value of 3.70.
4. Cabinet panels shall be hinged with stainless steel hinges. Hinged access panels for the filter, compressors, evaporator fan, control box, and heat section areas. Each panel shall use multiple quarter-turn latches and handles. Each major external hinged access panel shall be double-wall construction and permanently attached to the rooftop unit. Panels shall also include tiebacks.
5. Return air filters shall be accessible through a hinged access panel and be on a slide-out track using standard size filters.
6. Holes shall be provided in the base rails (minimum 16 gauge) for rigging shackles and level travel during overhead rigging operations.
7. Fork lift slots shall be available from multiple sides of the unit.
8. Unit shall have a factory-installed internally sloped condensate drain pan, providing a minimum 3/4-inch-14 NPT connection to prevent standing water from accumulating. Pan shall conform to ASHRAE 62.1 self-draining provisions with minimum one percent slope in at least two planes. An alternate vertical drain (3/4-inch NPT) connection shall also be available.

E. Fans:

1. Centrifugal supply air blower shall have rubber-isolated, pillow-block ball bearings and adjustable belt drive.
2. Fan wheel shall be made from steel with a corrosion resistant finish. It shall be a dynamically balanced, double-inlet type with forward-curved blades.
3. The indoor fan system (blower wheels, motors, belts, and both bearings) shall slide out for easy access.
4. Evaporator-fan motors shall be continuous operation, open drip-proof. Bearings shall be sealed, permanently lubricated ball-bearing type.
5. Condenser fans shall be of the direct-driven propeller type, with corrosion-resistant aluminum blades riveted to corrosion-resistant steel supports. They shall be dynamically balanced and discharge air upwards. Condenser fan motors shall be totally enclosed, thermally protected, and be of a shaft-down design.
6. Induced-draft blower shall be of the direct-driven, single inlet, forward-curved, centrifugal type. It shall be made from aluminized steel with a corrosion-resistant finish and shall be dynamically balanced.

7. Motor Efficiency: All motors shall comply with current DOE minimum efficiency standards. Motors 1 HP and larger shall be NEMA Premium Efficiency per NEMA MG 1.
- F. Compressors:
1. Fully hermetic, scroll type with crankcase heaters, internal high-pressure and temperature protection.
 2. Factory mounted on rubber grommets and internally spring mounted for vibration isolation.
 3. On dual electrically and mechanically independent refrigerant circuits.
 4. Provide five-year manufacturer's warranty on compressors.
- G. Coils:
1. Standard evaporator coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
 2. Dual circuit models shall have face-split type evaporator coil.
 3. Condenser coils shall be continuous slab design to facilitate easy coil cleaning.
 4. Coils shall be leak tested at 170 psig and pressure tested at 1875 psig.
- H. Heating Section:
1. Induced-draft combustion type with energy saving direct-spark ignition system and redundant main gas valve with 2-stage capability on all 3-phase units.
 2. Heat Exchanger: Stainless steel tubular-section type, constructed of a minimum of 20-gage type 409 stainless steel, including stainless steel tubes, vestibule plate, and collector box.
 3. Burners shall be of the in-shot type constructed of aluminum-coated steel.
 4. All gas piping shall enter the unit at a single location. All factory-installed orifices are for operation up to 2,000 feet of altitude.
 5. The integrated gas controller (IGC) board shall include gas heat operation fault notification using an LED. LED shall be visible without removal of control box access panel.
 6. Unit shall be equipped with anti-cycle protection. The IGC board shall contain algorithms that modify evaporator-fan operation to prevent future cycling on high-temperature limit switch.
 7. Gas burner tray, when disconnected, shall easily slide out for maintenance.
- I. Refrigerant Components:
1. Each refrigerant circuit shall include: thermostatic expansion valve (TXV) with removable power element; solid core refrigerant filter driers; gage port connections on suction, discharge, and liquid lines.
- J. Filter Section:
1. Standard filter section shall consist of factory-installed 2-inch thick MERV-13 pleated filters and shall be on a dedicated slide-out track.

2. Filter section shall use standard size filters and be of common sizes within cabinet sizes.
- K. Controls and Safeties:
1. Unit shall incorporate a solid-state compressor lockout which provides optional reset capability at the space thermostat, should any safety device trip.
 2. Compressor lockout protection provided for internal or external overload, low-pressure protection, freeze protection (evaporator coil), high-pressure protection, compressor reverse rotation protection, and loss of charge protection.
 3. Supply-air sensor shall be located in the unit and detect both heating and cooling operation.
 4. Induced draft heating section shall be provided with: high-temperature limit switch, induced-draft motor speed sensor, flame rollout switch, flame proving controls, and redundant gas valve.
- L. Special Features:
1. Economizer (See schedule):
 - a. Tilt-out economizer furnished and installed complete with outside air dampers and controls.
 - b. Low-leakage, opposing, gear-driven dampers with UL approved gears, capable of introducing up to 100% outdoor air for minimum ventilation and free cooling.
 - c. Damper actuator shall be electronic 4 to 20 mA/2 to 10 VDC fully modulating design.
 - d. Economizer shall be available for either field or factory installation.
 2. Economizer Fault Detection and Diagnostics (FDD): Controller shall provide economizer FDD as required by California Energy Code, current edition. Controller must be approved and listed on California Energy Commission (CEC) Certified Economizer FDD list. Provide a copy of the CEC listing during the submittal process.
 3. Non-Fused Disconnect Switch: Factory-installed, internally mounted, NEC and UL approved. Shall be accessible from outside the unit and shall provide power-off lockout capability.
 4. CO2 Sensor: Duct-mounted or wall-mounted CO2 sensor for demand control ventilation per California Energy Code requirements. The controller will use CO2 level information to modulate the economizer. Available as field or factory-installed.
 5. Fan Status: Pressure switch indicating indoor fan operation. Available as field or factory-installed.
 6. MERV-13 Pleated Return Air Filters: 2-inch pleated filters, MERV-13 efficient.
 7. Roof Curb: Galvanized steel conforming to NRCA Standards with gaskets, nailer strips. Provide 2-inch isolation curb for all units greater than 5 tons

cooling capacity or where noted on plans. Coordinate curb height with roof insulation and required flashing prior to ordering.

2.03 SPLIT-SYSTEM AIR-CONDITIONERS AND HEAT PUMPS

A. Manufacturers:

1. Carrier.
2. Trane.
3. Mitsubishi Electric.
4. Subject to compliance with requirements, provide products by other manufacturers providing equivalent performance.

B. Concealed Evaporator-Fan Components (Indoor Units):

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with AHRI 210/240.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors: Multitapped, multispeed with internal thermal protection and permanent lubrication. Wiring Terminations: Connect motor to chassis wiring with plug connection.
6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Disposable, MERV-13 minimum.
8. Mixing box with economizer where indicated on Drawings.
9. Condensate Drain Pans: Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and to direct water toward drain connection. Extend drain pan downstream from leaving face to comply with ASHRAE 62.1. Minimum 2 inches deep. Single-wall, galvanized-steel sheet. Drain connection at lowest point, sized to prevent overflow, minimum NPS 1. Pan-top surface coating: asphaltic waterproofing compound.

C. Wall-Mounted Evaporator-Fan Components (where indicated):

1. Cabinet: Enameled steel with removable panels in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with AHRI 210/240.
3. Fan: Direct drive, centrifugal.
4. Fan Motors: Multitapped, multispeed with internal thermal protection and permanent lubrication. Enclosure Type: Totally enclosed, fan cooled where indicated.
5. Filters: Permanent, cleanable.

6. Condensate Drain Pans: Fabricated with one percent slope in at least two planes. Minimum 1 inch deep. Drain connection at lowest point, minimum NPS 1.
 - D. Air-Cooled Compressor-Condenser Components (Outdoor Units):
 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 2. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 3. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 4. Refrigerant Charge: R-454B.
 5. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with AHRI 210/240.
 6. Heat-Pump Components (where indicated): Reversing valve and low-temperature-air cutoff thermostat.
 7. Fan: Aluminum-propeller type, directly connected to motor. Motor permanently lubricated, with integral thermal-overload protection.
 8. Low Ambient Kit: Permits operation down to 45°F.
 9. Mounting Base: Polyethylene.
 - E. Warranty:
 1. Compressor: Five (5) years from date of Substantial Completion.
 2. Parts: One (1) year from date of Substantial Completion.
 3. Labor: One (1) year from date of Substantial Completion.
- 2.04 REFRIGERANT PIPING
- A. Comply with ASHRAE 15 for refrigeration system safety.
 - B. Comply with ASME B31.5 for refrigeration piping.
 - C. Comply with California Mechanical Code Chapter 11.
 - D. Materials:
 1. Copper Tube: ASTM B88, Type L.
 2. Wrought-Copper Fittings: ASME B16.22.
 3. Brazing Filler Metals: AWS A5.8.
 - E. Refrigerant: R-454B.
 - F. Line Test Pressures for R-454B:
 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 2. Hot-Gas and Liquid Lines: 535 psig.
 - G. Piping Applications:

1. Suction Lines: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.
 2. Hot-Gas and Liquid Lines: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed joints.
- H. Product Storage: Store piping in a clean and protected area with end caps in place to ensure piping interior and exterior are clean when installed.

2.05 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers:
1. Greenheck Fan Corporation.
 2. Loren Cook Company.
 3. Subject to compliance with requirements, provide products by other manufacturers providing equivalent performance.
- B. Quality Assurance:
1. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal. Certify performance ratings per AMCA 210 and sound-power level ratings per AMCA 301.
 2. UL Standards: Power ventilators shall comply with UL 705.
 3. Electrical Components: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.
- C. Performance Requirements:
1. Base fan-performance ratings on actual project site elevation.
 2. Operating Limits: Classify according to AMCA 99.
- D. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone. Upblast units: provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
- E. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- F. Belt Drives:
1. Resiliently mounted to housing.
 2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
 3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
 5. Fan and motor isolated from exhaust airstream.
- G. Accessories:
1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 2. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.

- 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - H. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Configuration: built-in cant and mounting flange. Overall Height: as required to maintain 12 inches above finish roof. Pitch Mounting: manufacture curb for roof slope. Metal Liner: galvanized steel. Sound Curb: curb with sound-absorbing insulation where indicated.
 - I. Motors:
 - 1. Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Enclosure Type: Totally enclosed, fan cooled.
 - J. Extra Materials: Furnish one set of belts for each belt-driven unit.
- 2.06 DIFFUSERS, REGISTERS, AND GRILLES
- A. Manufacturers:
 - 1. Price Industries.
 - 2. Titus.
 - 3. Subject to compliance with requirements, provide products by other manufacturers providing equivalent performance.
 - B. General: Fabricated of steel with steel or aluminum frame and baked enamel off-white finish. Provide necessary sheet metal cans with appropriate collar to attach to air distribution device. Color selected by architect.
 - C. Supply Registers (SR): Double deflection type, constructed of steel.
 - D. Exhaust or Return Grilles (EG-2/RG-2): Fixed bar-type, constructed of steel.
 - E. Perforated Ceiling Supply Diffusers (SD-1, or where indicated): Modular core, square type. Steel, baked enamel finish, color selected by Architect. T-bar mounted, flush face style, adjustable pattern.
 - F. Suspended Round Diffusers (SD-3). 4 Cone, Constructed of steel. White finish or Color selected by Architect.
 - G. Perforated Ceiling Return Diffusers (RG-1 or where indicated): Steel, baked enamel finish, color selected by Architect. T-bar mounted, flush face style.
- 2.07 DUCTWORK
- A. General:
 - 1. Non-combustible or conforming to requirements for Class 1 air duct materials, UL 181, NFPA 90A, and NFPA 90B.
 - 2. Comply with SMACNA's "HVAC Duct Construction Standards – Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.
 - 3. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Sheet Metal Materials:
1. Galvanized Sheet Steel: ASTM A653/A653M, galvanized coating designation G90. Lock-forming quality. Exposed-surface finish: mill phosphatized.
 2. Reinforcement Shapes and Plates: ASTM A36/A36M, galvanized steel.
 3. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.
- C. Round Duct: Spiral seam construction.
- D. Insulated Flexible Ducts: UL 181, Class 1. Polyethylene film supported by helically wound galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film. Maximum 0.23 K value at 75°F with metal connectors. Pressure rating: 10-inch wg positive and 1.0-inch wg negative. Maximum air velocity: 5500 fpm. Insulation R-value: comply with ASHRAE 90.1.
- E. Sealants and Gaskets:
1. Surface-burning characteristics: maximum flame-spread index 25, maximum smoke-developed index 50 per UL 723.
 2. Water-Based Joint and Seam Sealant: Brush-on application. Minimum 65 percent solids. Water resistant, mold and mildew resistant. Maximum VOC 75 g/L. Maximum static-pressure class: 10-inch wg.
 3. Flanged Joint Sealant: Comply with ASTM C920. Single-component, acid-curing, silicone elastomeric.
 4. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer.
 5. Round Duct Joint O-Ring Seals: EPDM O-ring. Maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg. Rated for 10-inch wg static-pressure class.
- F. Low Pressure Duct Fabrication:
1. Fabricate and support in accordance with current CMC, SMACNA HVAC Duct Construction Standards, and ASHRAE handbooks, except as indicated. Gages for galvanized steel ducts for low pressure systems where velocities do not exceed 2000 FPM shall be as follows:

RECTANGULAR DUCT	Gage	ROUND DUCT	Gage
Largest Side (L) inches		Diameter (D) inches	
$L \leq 12$	26	$D < 9$	26
$12 < L \leq 30$	24	$9 \leq D < 14$	24
$30 < L \leq 54$	22	$14 \leq D < 23$	22
$54 < L \leq 84$	20	$23 \leq D < 37$	20
$84 < L$	18	$37 \leq D < 51$	18
		$51 \leq D < 61$	16
		$61 \leq D < 84$	14

2. All joint and seam constructions as indicated in the CMC are acceptable. Exposed ductwork shall have clean joints.

3. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
4. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide turning vanes per SMACNA Figure 4-3 and 4-4.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
6. Use double nuts and lock washers on threaded rod supports.

G. Duct Sealing:

1. Seal ducts per SMACNA seal and leakage class requirements:
 - a. Outdoor, Supply-Air Ducts: Seal Class A.
 - b. Unconditioned Space, Supply-Air Ducts ≤ 2 -inch wg: Seal Class B.
 - c. Unconditioned Space, Supply-Air Ducts > 2 -inch wg: Seal Class A.
 - d. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - e. Conditioned Space, Supply-Air Ducts ≤ 2 -inch wg: Seal Class C.
 - f. Conditioned Space, Supply-Air Ducts > 2 -inch wg: Seal Class B.
 - g. All Exhaust Ducts: Seal Class C minimum.
2. SMACNA Leakage Class for Rectangular: 24. For Round and Flat Oval: 12.

H. Duct Liner:

1. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, and NAIMA AH124. Manufacturers: CertainTeed, Johns Manville, Knauf, or Owens Corning.
2. Water-Based Liner Adhesive: Comply with NFPA 90A and ASTM C916. VOC content 80 g/L or less.
3. Insulation Pins and Washers: Cupped-head, capacitor-discharge-weld pins, 0.106-inch-diameter shank, with integral 1-1/2-inch galvanized carbon-steel washer.

I. Volume Control Dampers:

1. Fabricate in accordance with SMACNA standards, and as indicated.
2. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
3. On insulated ducts mount quadrant regulators on stand-off mounting brackets.

J. Duct Test Holes: Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or twist-on metal caps.

2.08 AIR DUCT ACCESSORIES

A. Backdraft and Pressure Relief Dampers:

1. Manufacturers: Greenheck, Pottorff, or Ruskin.

2. Description: Gravity balanced. Maximum air velocity: 2500 fpm. Maximum system pressure: 2-inch wg.
 3. Frame: Hat-shaped, 18-gage galvanized sheet steel, with welded corners and mounting flange.
 4. Blades: Multiple single-piece, center pivoted, maximum 6-inch width, 0.025-inch thick, roll-formed aluminum with sealed edges. Parallel blade action. Extruded vinyl blade seals, mechanically locked.
 5. Bearings: Synthetic pivot bushings. Return spring: adjustable tension.
 6. Accessories: Adjustment device for varying differential static pressure, counterweights and spring-assist kits for vertical installations, bird screens (removable, galvanized steel), 90-degree stops.
- B. Barometric Relief Dampers:
1. Manufacturers: Greenheck, Pottorff, or Ruskin.
 2. Suitable for horizontal or vertical mounting. Maximum air velocity: 2000 fpm. Maximum system pressure: 2-inch wg.
 3. Frame: Hat-shaped, 16-gage galvanized sheet steel with welded corners and mounting flange.
 4. Blades: Multiple, 0.025-inch thick roll-formed aluminum, maximum 6-inch width, parallel action, gravity balanced, eccentrically pivoted.
 5. Bearings: Ball type. Return spring: adjustable tension. Rattle-free with 90-degree stop.
- C. Manual Volume Dampers:
1. Manufacturers: Nailor Industries, Pottorff, Ruskin, or Trox USA.
 2. Standard leakage rating. Suitable for horizontal or vertical applications.
 3. Frames: Hat-shaped, 20-gage, galvanized sheet steel. Mitered and welded corners. Flanges for wall-mounting and flangeless for in-duct.
 4. Blades: Multiple or single blade, parallel- or opposed-blade design, galvanized-steel 0.064-inch thick, stiffened for stability.
 5. Blade Axles: Plated steel. Bearings: Molded synthetic.
- D. Combination Fire and Smoke Dampers:
1. Manufacturers: Greenheck, Pottorff, or Ruskin.
 2. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
 3. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
 4. Fire Rating: 1-1/2 and 3 hours as required.
 5. Frame: Hat-shaped, 0.094-inch-thick galvanized sheet steel with welded or mechanically attached corners and mounting flange.
 6. Heat-Responsive Device: Electric resettable device and switch package, factory installed.
 7. Smoke Detector: Integral, factory wired for single-point connection.

8. Blades: Roll-formed, horizontal, interlocking, 16-gage galvanized sheet steel.
 9. Leakage: Class II.
 10. Mounting Sleeve: Factory-installed, 0.039-inch-thick galvanized sheet steel; length to suit wall or floor application.
 11. Damper Motors: Two-position action. Spring-return motors with integral spiral-spring mechanism where indicated.
 12. Accessories: Test and reset switches, remote mounted.
- E. Turning Vanes:
1. Manufacturers: Ductmate Industries, Duro Dyne, or SEMCO.
 2. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 3. Comply with SMACNA Figures 4-3 and 4-4.
 4. Vane Construction: Double wall.
- F. Duct-Mounted Access Doors:
1. Manufacturers: Ductmate Industries, Greenheck, or Pottorff.
 2. Fabricate per SMACNA Figures 7-2 and 7-3.
 3. Door: Double wall, rectangular, galvanized sheet metal with insulation fill. Vision panel. Hinges and latches: 1-by-1-inch butt or piano hinge and cam latches. Fabricate airtight and suitable for duct pressure class.
 4. Frame: Galvanized sheet steel with bend-over tabs and foam gaskets.
 5. Minimum 8" x 8" for hand access, 18" x 18" for shoulder access, and as indicated.
- G. Flexible Connectors:
1. Manufacturers: Ductmate Industries, Duro Dyne, or Ward Industries.
 2. Materials: Flame-retardant or noncombustible fabrics. Coatings and adhesives: Comply with UL 181, Class 1.
 3. Metal-Edged Connectors: Factory fabricated with fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide galvanized sheet steel.
 4. Indoor System Fabric: Glass fabric double coated with neoprene. Minimum weight 26 oz./sq. yd. Service temperature: minus 40 to plus 200°F.
 5. Outdoor System Fabric: Glass fabric double coated with weatherproof synthetic rubber resistant to UV rays and ozone. Minimum weight 24 oz./sq. yd. Service temperature: minus 50 to plus 250°F.
- H. Flexible Ducts:
1. UL 181, Class 1. Insulated: polyethylene film supported by helically wound galvanized-steel wire; fibrous-glass insulation; aluminized vapor-barrier film. Pressure rating: 10-inch wg positive and 1.0-inch wg negative. Maximum air velocity: 5500 fpm.

2. Maximum length shall not exceed 5 feet unless indicated otherwise on Drawings. Flexible duct shall be fully extended when installed—no excess length or kinks.
3. Connectors: Stainless-steel band clamps with worm-gear action, or adhesive plus sheet metal screws.

2.09 DUCT INSULATION

- A. All insulation shall have composite (insulation, jacket or facing, and adhesive) fire-smoke hazard ratings as tested by ASTM E84, NFPA 255, and UL 723 not exceeding: Flame Spread: 25; Smoke Developed: 50.
- B. All products or their shipping cartons shall bear a label indicating compliance. The Contractor shall certify that all products used meet these criteria.
- C. Insulation values shown are a minimum. If the requirements of Title 24, Part 6 exceed these values, the amount and/or type must be increased to meet Title 24 requirements.
- D. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Owens Corning; SOFTR All-Service Duct Wrap.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglas 700 Series.
- G. Glass Fiber Duct Liner, Rigid:
 1. Insulation: ASTM C612; semi-rigid, noncombustible. K value: ASTM C518, 0.24 at 75°F. Maximum service temperature: 250°F. Density: 1.5 to 3.0 lb/ft³. Maximum velocity on coated air side: 4,000 ft/min.

2. Adhesive: Waterproof (fire-retardant) type.

2.10 HVAC PIPING INSULATION

- A. Insulate the following piping systems: refrigerant suction piping, chilled-water piping (where present), and heating hot-water piping (where present), indoors and outdoors, as indicated on Drawings and as required by Title 24, Part 6.
- B. Surface-Burning Characteristics per ASTM E84: Indoor: Flame-spread index 25 or less, smoke-developed index 50 or less. Outdoor: Flame-spread index 75 or less, smoke-developed index 150 or less.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products in contact with stainless steel shall have leachable chloride content less than 50 ppm per ASTM C871.
- E. Flexible Elastomeric Insulation (for refrigerant suction piping): Closed-cell, sponge or expanded rubber. Thermal conductivity: 0.27 Btu·in/(h·ft²·°F) at 75°F. Water vapor permeance: 0.10 perm-inch maximum.
- F. Mineral Fiber Pipe Insulation (for hot-water piping): ASTM C547. Thickness per Title 24, Part 6 insulation tables.
- G. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

2.11 INSTRUMENTATION AND CONTROL FOR HVAC

- A. Control equipment and sequence of operation shall be as indicated on the Drawings.
- B. The controls contractor shall provide a complete operational BACnet-based Energy Management System (EMS) per Mechanical Drawings.
- C. All economizer controllers shall be listed on the California Energy Commission (CEC) Certified Economizer Fault Detection and Diagnostics (FDD) list.
- D. Provide BACnet or LonWorks compatible interface for central HVAC control workstation with the ability to adjust set points, monitor fan operation, inquire damper position and air temperatures, and monitor occupied/unoccupied operations.

PART 3- EXECUTION

3.01 GENERAL

- A. Install all equipment in locations indicated on the Drawings. Contractor will be responsible to verify with the Owner if suitability is doubted. Contractor shall notify the Owner before installation into any apparent improper locations or interference with other work.

3.02 INSTALLATION

- A. Ductwork and Accessories:
 - 1. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing, complete with metal can with spring device or screw to ensure against air leakage.
 - 2. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

3. Provide balancing dampers at points on low-pressure supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Use splitter dampers only where indicated.
4. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.
5. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, at each change in direction and at maximum 50-foot spacing, and elsewhere as indicated.
6. Provide duct test holes where indicated and required for testing and balancing purposes.
7. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
8. Install diffusers to ductwork with airtight connection. Provide balancing dampers on duct take-off to diffusers and registers, regardless of whether dampers are specified as part of the diffuser or register assembly.
9. Paint ductwork visible behind air outlets and inlets matte black.
10. Install fire and smoke dampers according to UL listing. Install access doors at each fire/smoke damper location.
11. Set all dampers to fully open position before testing, adjusting, and balancing.
12. Install flexible ducts with maximum 60-inch length to connect diffusers. Fully extend without kinks. Connect with draw bands.
13. Protect duct interiors from moisture, construction debris, and other foreign materials. Comply with SMACNA's "IAD Guidelines for Occupied Buildings Under Construction."

B. Refrigerant Piping:

1. Install refrigerant piping according to ASHRAE 15 and ASME B31.5.
2. Install piping in concealed locations unless otherwise indicated, except in equipment rooms and service areas.
3. Install exposed piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.
4. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
5. Slope refrigerant piping to ensure proper oil return to compressor.
6. Refrigerant piping shown on Drawings is schematic only. Size piping and design actual layout including oil traps, double risers, specialties, and sizes to accommodate equipment, elevation differences, and piping length to ensure proper operation and compliance with equipment warranties.

C. Split-System Air-Conditioning Units:

1. Install units level and plumb.
2. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3. Install ground-mounted compressor-condenser components on cast-in-place concrete equipment bases.
 4. Install roof-mounted compressor-condenser components on equipment supports. Anchor units with removable, cadmium-plated fasteners.
 5. Comply with seismic control requirements per ASCE/SEI 7.
 6. Connect supply and return ducts with flexible duct connectors.
 7. Install and connect precharged refrigerant tubing to component's quick-connect fittings where applicable. Install tubing to allow access to unit.
- D. Rooftop Units:
1. Install on roof curbs, level and secure, per NRCA standards. Coordinate roof penetrations and flashing with roof construction.
 2. Secure RTUs to upper curb rail and secure curb base to roof framing with anchor bolts.
 3. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, designed for loads at Project site.
 4. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or area drain.
 5. Gas Piping: Connect to burner full size of gas train inlet with union and shutoff valve with sufficient clearance for burner removal and service.
 6. Install ducts to termination at top of roof curb. Remove roof decking only as required for passage of ducts. Connect supply ducts with flexible duct connectors.
- E. Insulation:
1. Unless specifically indicated, Contractor may line or wrap ductwork to meet insulation requirements.
 2. Fiberglass ductwrap: Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
 5. Duct Liner Application: Adhere insulation with adhesive for minimum 90 percent coverage. Secure with mechanical liner fasteners per SMACNA standards, 4 inches from corners and at intervals not exceeding 12 inches transversely; 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally. Seal and smooth joints. Seal liner surface penetrations with adhesive.
 6. Duct dimensions indicated are net inside dimensions for airflow. Increase duct size to allow for insulation thickness.

7. Secure transversely oriented liner edges facing the airstream with metal nosings (channel or Z profiles) at fan discharges, intervals of lined duct preceding unlined duct, and upstream edges of transverse joints where air velocities exceed 2500 fpm.

3.03 FIELD QUALITY CONTROL

A. Split-System Units:

1. Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Rooftop Units:

1. Engage a factory-authorized service representative to perform startup service.
2. Complete installation and startup checks according to manufacturer's written instructions, including: inspect for visible damage to casing, combustion chamber, compressor, coils, and fans; verify labels, clearances, controls, and filters; clean condenser coil and furnace flue; connect and purge gas line; verify lubrication; inspect fan-wheel rotation; adjust belts; start unit per manufacturer's instructions.
3. Test and adjust controls and safeties including: high-temperature limits, low-discharge-temperature safety, outdoor-air damper stroke and interlock, economizer operation, smoke and firestat alarms.
4. After startup and testing, replace existing filters with new filters.

C. Power Ventilators:

1. Verify shipping, blocking, and bracing are removed. Verify unit is secure on mountings.
2. Disconnect fan drive from motor, verify proper motor rotation direction, verify fan wheel free rotation and smooth bearing operation. Reconnect, align and adjust belts, install belt guards.
3. Adjust damper linkages. Verify lubrication for bearings.
4. Energize motor and adjust fan to indicated RPM. Measure and record motor voltage and amperage.

D. Ductwork:

1. Leakage Tests: Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Test representative duct sections totaling no less than 25 percent of total installed duct area for pressure classes exceeding 3-inch wg. Test for leaks before applying external insulation. Conduct tests at static pressures equal to maximum design pressure. Give seven days' advance notice.

2. Duct System Cleanliness: Visually inspect to ensure no visible contaminants. Clean new duct systems before TAB. Use service openings for entry. Use HEPA filtration when venting vacuum system inside building.

3.04 AIR SYSTEM TEST AND BALANCE

- A. Perform all tests to the entire satisfaction of the Owner. Air balancing contractor shall notify Owner seven days prior to scheduling air balance at the site.
- B. TAB Contractor Qualifications:
 1. Engage a TAB entity certified by AABC.
 2. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC.
 3. TAB Technician: Employee of the TAB contractor and certified by AABC as a TAB technician.
- C. ASHRAE Compliance:
 1. Comply with ASHRAE 62.1, Section 7.2.2 – “Air Balancing.”
 2. Comply with ASHRAE 90.1, Section 6.7.2.3 – “System Balancing.”
 3. Instrumentation: Per ASHRAE 111, Section 5.
- D. Examination:
 1. Examine Contract Documents to become familiar with Project requirements and discover conditions that may preclude proper TAB.
 2. Examine systems for installed balancing devices (test ports, gage cocks, thermometer wells, flow-control devices, balancing valves, manual volume dampers). Verify accessible locations.
 3. Examine equipment performance data including fan curves. Calculate system-effect factors per AMCA 201 or SMACNA “HVAC Systems – Duct Design.”
 4. Verify that air duct system is sealed as specified.
 5. Examine HVAC equipment and filters; verify bearings are greased, belts aligned and tight, and equipment with functioning controls is ready for operation.
 6. Examine heat-transfer coils for correct piping connections and clean, straight fins.
 7. Examine operating safety interlocks and controls on HVAC equipment.
- E. Preparation:
 1. Prepare a TAB plan with strategies and step-by-step procedures.
 2. Verify: permanent electrical-power wiring complete; automatic temperature-control systems operational; equipment and duct access doors securely closed; balance, smoke, and fire dampers open; ceilings installed in critical areas.
- F. Testing Procedures:

1. Procedures shall conform to AABC's "National Standards for Total System Balance," ASHRAE 111, and SMACNA's "HVAC Systems – Testing, Adjusting, and Balancing."
 2. Test and adjust all supply, return, and exhaust blower RPM to design requirements.
 3. Test and record all motor full load amperes.
 4. Test and record system static pressures, suction and discharge. Measure static pressure across each component.
 5. Test and adjust system for design recirculated air CFM.
 6. Test and adjust system for design CFM outside air.
 7. Adjust all supply, return, and exhaust outlets to within 10% of design CFM.
 8. Adjust patterns of adjustable outlets for proper distribution without drafts.
 9. Do not make fan-speed adjustments that result in motor overload. Measure amperage in full-cooling, full-heating, economizer, and other operating modes.
- G. Motor Testing:
1. Motors 1/2 HP and larger: Test at final balanced conditions and record manufacturer's name, model, serial number, horsepower, RPM, efficiency rating, nameplate and measured voltage (each phase), nameplate and measured amperage (each phase), and starter thermal-protection-element rating.
- H. Tolerances:
1. Supply, Return, and Exhaust Fans: Plus or minus 10 percent.
 2. Air Outlets and Inlets: Plus or minus 10 percent.
- I. Certified TAB Reports:
1. Provide reports in PDF format, complete with index page. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, indicating thermostat locations.
 2. Review field data reports to validate accuracy and prepare certified TAB reports.
 3. Certify that the TAB team complied with the approved TAB plan.
 4. Submit instrument calibration reports including instrument type, make, serial number, application, dates of use, and dates of calibration.
 5. Include fan curves, manufacturers' test data, and system diagrams showing duct sizes, outlet/inlet sizes, and position of balancing devices.
- J. Inspections:
1. After TAB is complete, operate each system and randomly check measurements to verify system is operating according to final test and balance readings. Measure airflow of at least 10 percent of air outlets. Verify that balancing devices are marked with final balance position.
 2. If rechecks yield measurements that differ from documented measurements by more than specified tolerances, measurements shall be noted as

"FAILED." If failed measurements exceed 10 percent of total, TAB shall be considered incomplete and rejected.

K. Additional Tests:

1. Within 90 days of completing TAB, perform additional TAB to verify balanced conditions are maintained and to correct unusual conditions.
2. Seasonal Periods: If initial TAB was not performed during near-peak summer and winter conditions, perform additional TAB during near-peak conditions.

3.05 DEMONSTRATION AND TRAINING

- A. Engage factory-authorized service representatives to train Owner's maintenance personnel to adjust, operate, and maintain all HVAC units.
- B. Demonstrate complete operating system to Owner's representative.
- C. Provide certificate stating that control system has been tested and adjusted for proper operation.
- D. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits during other-than-normal occupancy hours.

END OF SECTION