TECHNICAL SPECIFICATIONS

SCCOE GLEN VIEW DAYCARE AND PLAYGROUND

600 W 8TH STREET,
GILROY, CA 95020

JUNE 29, 2022

SANTA CLARA COUNTY OFFICE OF EDUCATION

PREPARED BY:
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PROJECT # 06461
DSA APPLICATION # 01-120058

SIGNATURE SHEET

IDENTIFICATION STAMP
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APP: 01-120058 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 08/04/2022

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DIVISION OF THE STATE ARCHITECT

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Landscape Architect

DOCUMENT 00 01 10

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SECTION 01 56 39 - TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Furnish all labor, materials, equipment, facilities, transportation and services to complete tree protection and related work as shown on the drawings and/or specified herein.

B. Description of Work:

1. Protection of existing trees and vegetation to remain.
2. Trimming of existing trees.
3. Maintenance of existing trees and vegetation during construction.
4. Removal of existing trees and other vegetation.
5. Contractor shall retain the services of a certified arborist to perform routine visits and oversee the protection of the existing trees within the project area during demolition, construction and maintenance and to especially review and recommend treatment when roots are encountered and to perform routine maintenance during the construction phase.

C. Traffic:

1. Do not interfere with or close public ways without permission of the Owner’s Representative.
2. Do not interfere with adjacent private properties without permission of the Owner’s Representative.

D. Site Utilities:

1. Advise utility companies of excavation activities before starting excavations.
2. Locate and identify underground utilities passing through work area before starting work.
3. In event unidentified underground utilities are encountered during work, advise utility owner immediately before proceeding. Add any new utility information to project record drawings for actual location.
4. Protect all existing-to-remain utilities.
5. Do not interrupt existing utilities without advance notice to and approval from the District.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified arborist and tree service firm.

B. 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.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work and for removal and re-installation of existing trees.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain and/or relocate, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.4 QUALITY ASSURANCE

A. Contractor shall be liable for the loss in value to damaged trees and for all repair costs resulting as determined by the Owner's Representative. Due to the irreplaceable nature of many existing trees, the liability to the General Contractor shall be set at $500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture must be used to compute the actual value.

B. Arborist Qualifications: Certified Arborist as certified by the International Society of Arboriculture (ISA) and having performed similar services for a minimum of five (5) years.

1. Contractor shall retain the services of a Certified Arborist when any of the following conditions occur for existing to remain tree(s) within the project construction area that are over six (6) inches in diameter measured three (3) feet above finish grade:
    a. Grading, excavation, trenching or any other similar work is required that may disturb roots of existing to remain trees.
    b. Pruning is required on branches more than two (2) inches in diameter..

1.5 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.

1.6 SUBMITTALS

A. In the event work is required within the dripline of existing to remain trees and vegetation, Contractor shall retain the services of a Certified Arborist for the preservation of the tree(s) and submit written recommendations from Arborist to Owner's Representative for review prior to implementation. Contractor shall follow recommendations of Arborist and contact Arborist for further review and recommendations if the tree(s) begin to decline in health.

1.7 Definitions

A. Caliper: Caliper on young trees are taken six (6) inches above the soil level and measured by a diameter across the tree trunk. For a tree exceeding a four (4) inch caliper, the diameter measurement is then taken at twelve (12) inches above the soil level. For a mature tree, the caliper is taken at chest height, generally 4-1/2 to 5 feet above the soil level. The measurement is taken using a tree caliper, a utensil in the shape of an "F" with an adjustable cross arm to slide and rest up against the trunk to measure the precise distance of the trunk width.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, unless indicated otherwise on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius equal to the diameter of the drip line unless indicated otherwise on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

PART 2 - PRODUCTS

2.1 TREE PROTECTION PROTECTIVE FENCE

A. Existing vegetation and/or trees to remain on the site shall be protected with a five (5) feet high orange plastic snow fence. Fence shall be mounted on wooden lodgepole posts driven into the ground every six (6) feet to a depth of at least two (2) feet. Fence shall be erected and installed around the perimeter dripline (area directly under the outer circumference of the branches) of each shrub, tree or groups of shrubs or trees to remain.

B. Snow Fence: Orange, UV resistance, .3 inch thickness, 60 inches in width, oval mesh, extruded thermal plastic polymer, Tenax or equal, fence fabric.

C. During planting and irrigation operations, protective fencing is not required beneath existing to remain trees and shrubs that fall within the newly landscaped and/or irrigation area.

2.2 ORGANIC MULCH

A. Refer to Specification Section 32 90 00 "Planting" and match organic mulch material to use in non-bio-retention planting areas.

B. If Specification Section 32 90 00 “Planting” is not issued as part of this project, organic mulch to be Pro-Chip decorative mulch, mahogany in color and available from Pacific Landscape Supply (209) 593-1199, www.pacificlandscapesupply.com.

2.3 LODGEPOLE FENCE POSTS

A. Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated Douglas Fir or lodgepole pine, free of knots, holes, cross grain, and other defects, two (2) inches in diameter by length required, and pointed at one end.

PART 3 – EXECUTION

3.1 EXAMINATION

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. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.1 PREPARATION

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

B. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.

C. 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.

D. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas if indicated within Drawings.

1. Apply 3-inch minimum thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.2 PROTECTIVE FENCE INSTALLATION

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin. Install fencing in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Plastic Protection Zone Fencing: Neatly install protection zone plastic fabric by securing to posts with plastic bands or steel wires, a minimum of two per post, additionally if required to withstand typical construction activity.

2. Posts: Set or drive posts into ground at least two (2) feet without concrete footings and no more than six (6) feet on center spacing. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Owner's Representative.
3. Access Gates: Install as necessary; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Owner's Representative. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than two signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. 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 the Owner's Representative.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Owner's Representative and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.
3. Temporary access is permitted for landscape irrigation and planting operations.

3.3 ARBORIST SUPERVISION

A. For construction within ten (10) horizontal feet of a tree and/or shrub to remain, with a trunk diameter of twelve (12) inches or larger measured three (3) feet above original finish grade, Contractor shall retain the services of a reputable Arborist certified by the International Society of Arboriculture (ISA) to review the tree(s) and/or shrubs(s), the work to be performed and provide written recommendations to minimize the impact on existing trees and/or shrubs to remain. Submit recommendations to Owner's Representative for review.

B. Contractor shall implement Arborist recommendations.

C. Contractor shall consult Arborist for further recommendations if tree(s) and/or shrub(s) appear in failing health until final completion and acceptance of landscape work.

3.4 EXCAVATION

A. General: Excavation and trenching shall be performed at a minimum, in accordance with these specifications and per Drawings and Details and in accordance with recommendations from project Arborist retained by Contractor.

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 as required for root pruning.

C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 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. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. 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.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil

3.6 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. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible.

B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Avoid cutting trenches within shrub and/or tree protection zone. If trenching is unavoidable, cut trenches with an air spade tool to expose roots without cutting them. Roots encountered smaller than two (2) inches in diameter may be cut, not torn for removal. Cleanly cut roots as close as possible to excavation. Roots larger than two (2) inches in diameter shall remain.

3.7 CANOPY PRUNING

A. General Pruning Procedures:

1. Prune trees according to ANSI A300 (Part 1)**.**
2. Cut branches with sharp pruning instruments; do not break or chop.
3. Do not apply pruning paint to wounds.

B. Pruning Goals (Prune as follows and under the direction of Certified Arborist):

1. Prune trees to remain to compensate for root loss caused by construction damage. Provide subsequent maintenance during landscape irrigation and planting maintenance period and until “final completion” as recommended by Certified Arborist.
2. Prune to remove dead wood, promote proper structure, thin and open canopy, and for general health for the specific tree species.
3. Prune for clearance from structures, pathways and driveways and streets and for a balanced canopy.

C. Cleaning: Chip removed branches and dispose of off-site.

3.8 IRRIGATION

A. Irrigate existing vegetation and/or trees to remain and those relocated during hot and/or dry periods and as required to maintain material in a healthy, vigorous condition.

3.9 REMOVE AND RE-INSTALL EXISTING TREES

A. Plant material noted on Drawing to be transplanted shall be carefully removed from planting area and planted in new location indicated on Planting Plan. Removal shall consist of digging around the dripline of each plant to be transplanted and to the depth where roots are present. Plant and rootball shall be carefully moved to new planting pit.

B. Re-install transplanted plant material to location indicated on Drawing as follows:

1. Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Excavate approximately planting pit sizes twice the width of the planting pot and equal to the depth of the planting pot.
2. Carefully install root ball without damaging root ball or plant.
3. Set rootball onto compacted native soil so the rootball sits one (1) inch above adjacent finish grade.

4. Amend backfill soil per tree planting detail and landscape planting specifications.
5. Place planting soil around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil.
6. Stake tree(s) per tree planting detail.

3.10 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 the Owner's Representative.
   1. Submit details of proposed root cutting and tree and shrub repairs.
   2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
   3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
   4. Perform repairs within 24 hours.
   5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by the Owner's Representative.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the maintenance period or are damaged during construction operations that the Owner's Representative determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size and species as those being replaced for each tree that measures three (3) inches or smaller in caliper size.
   2. Provide new trees of 48" box size and species as those being replaced for each tree that measures greater than three (3) inches. In addition, the liability to the General Contractor shall be set at $500.00 minimum per tree. The Trunk Formula method for Northern California established by the International Society of Arboriculture must be used to compute the actual value.
   3. Plant and maintain new trees as specified in Section 32 90 00 "Planting."

C. Soil Aeration: Where directed by the Owner's Representative, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill two (2) inch diameter holes a minimum of 12 inches (300 mm) deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.11 REMOVAL OF EXISTING TREES:

A. Contractor shall remove and demolish from the site trees and vegetation indicated on the Drawings. Additonal trees and vegetation conflicting with work require written approval by Owner's Representative.

B. Tree removal shall include branches, leaves, roots, stumps and stump grindings to a minimum depth of 18" below proposed subgrade. Exact depth shall be determined in

accordance with and as required for building and hardscape work included under this contract.

C. Contractor shall fill depressions caused by tree removal with topsoil or site soil.

D. Properly dispose of any vegetation debris in a legal and acceptable manner off project/site property.

END OF SECTION

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SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART I – GENERAL

1.1 Description of Work

A. Work under this Section includes the furnishings and installing of all concrete work, complete, with all related accessories, items and incidentals required.

B. Coordinate installation of all inserts and embedded items required or indicated.

1.2 Applicable Standards (latest editions apply)

A. ACI- American Concrete Institute:

1. 301, Specifications for Structural Concrete for Buildings.

2. 305, Recommended Practice for Cold Weather Concreting.

3. 306, Recommended Practice for Hot Weather Concreting.

4. 318, Building Code Requirements for Reinforced Concrete.

B. ASTM- American Society of Testing and Materials, Referenced Standards.

C. ICC- International Code Council:

1. CBC - 2019 California Building Code (California Code of Regulations, Title 24, Part 2)

1.3 Submittals

A. Mix Design and Tests:

1. Submit mix designs and compressive strength test reports from previous applications for specified types of concrete.

2. One copy of all test reports shall be forwarded to DSA, the Architect, the Structural Engineer, the Inspector of Record within fourteen days of the test. Test reports shall comply with all requirements of CCR Title 24, Part 1, Section 4-335.

3. The concrete mixes shall be based on designs of a professional testing laboratory, verified by test, also in accordance with ACI 318, Sections 5.3 and 5.4 and CBC section 1905A.

PART II – PRODUCTS

2.1 Materials

A. General: Materials for cast-in-place concrete shall be set as forth in ACI 301 except as modified herein and as otherwise indicated in project documents.

B. Portland Cement: ASTM C150 Type II modified, with maximum alkali content of 0.6 percent (from only one source). Comply with Title 24, Section 1903A. Test cement per Title 24, Section 1910A.1

C. Aggregates: ASTM C33, (from source as approved by the Testing Agency). Comply with Title 24, Sections 1903A.5, 1905A and ACI 318 Section 26.4.1.2

D. Water: clean, potable, free of injurious materials.

E. Admixtures: Only brand products documented to have had not less than five years of satisfactory performance shall be used. Admixtures containing chlorides shall not be used. Comply with ACI-318, Section 26.4.1.4.

1. Air Entraining: ASTM C260

F. Grout: Manufactured pre-mixed. Non-ferrous, non-staining, flowable grout which will not shrink as it cures, 5000 psi @ 7 days.

G. Fly Ash: Shall conform to ASTM C618

2.2 Concrete Mix

A. Ready-Mix Concrete: ASTM C94.

2.3 Proportion and Mixture

A. Proportioning mixtures and production of concrete shall be in accordance with ACI 301, ACI 214R and CBC section 1905A and shall be in accordance with mix designs submitted by Laboratory and approved by the Owner's Testing Agency. All concrete shall have at least 5 sacks of cement per cubic yard of mix.

B. Concrete shall have 3% +/- 1%, air entrainment when approved by Testing Agency.

C. Water reducing admixtures may be used in concrete when approved by Testing Agency. Such admixtures shall not interfere with or reduce required air content dosage of air-entrained concrete.

D. Use a minimum of 5 sacks of cement per cubic yard for all concrete.

E. Concrete Mix Requirements: The following table presents a schedule of elements of concrete, compressive strength in psi after 28-days when tested in accordance with ASTM C39, maximum aggregate and maximum slump, which shall be as follows:

Concrete Element	*Strength*	*Max. Size Aggregate (Inch)*	*Max. Slump (Inch)*
All Concrete	per drawings	per drawings	per drawings

PART III – EXECUTION

3.1 Inspection

A. Areas in which concrete is to be placed shall be inspected by Contractor for defects which would prohibit satisfactory placement of concrete or related miscellaneous items. Such defects shall be corrected prior to commencement of work.

B. Concrete shall not be deposited or placed until all forms, reinforcing steel and construction joints have been inspected by Owner's Testing Agency and accepted in advance within the entire extent of the pour. Architect shall be notified 48 hours prior to first pour.

3.2 Field Quality Control

A. The Owner's Testing Agency will:

1. Review concrete mix designs.

2. Perform testing in accordance with ACI 318 and CBC Sections: 1903A and 1905A and 1910A.

3. Continuously monitor concrete temperature and inspect concrete placement.

4. Test concrete to control slumps according to ATSM C31 and ASTM C172.

5. Test concrete for required compressive strength in accordance with ACI 318, Section 26.12 and CBC Section 1905A and 1910A.

a. Make and cure three specimen cylinders according to ATSM C31 for each 50 cubic yards per ACI 318, Section 26.12.1.1 and CBC section 1905A, or fraction thereof, of each class poured at site each day.

b. Retain one cylinder for 7-day test and two for the 28-day test.

c. Number each cylinder 1A, 1B, 1C, 2A, 2B, 2C, etc; date each set; and keep accurate record of pour each set represents.

d. Transport specimen cylinders from job to laboratory after cylinders have cured for 24-hours on site. Cylinders shall be covered and kept at air temperatures between 60 and 80 degrees Fahrenheit.

e. Test specimen cylinders at age 7-days and age 28-days for specified strength according to ASTM C39.

f. Base strength value on average of two cylinders taken for 28-day test.

B. The Contractor shall:

1. Submit ticket for each batch of concrete delivered to job site. Ticket shall bear the following information:

a. Design mix number.

b. Signature or initials of ready mix representative.

C. Comply with Title 24, ACI 318, Chapter 26 and CBC Section 1905A

3.3 Workmanship

A. All concrete shall be placed, finished and cured, and all other pertinent construction practices shall be in accordance with the Specifications for Structural Concrete for Buildings (ACI 301) hereby made a part of these specifications.

B. In addition to the requirements of ACI 301, the following shall prevail:

1. Concrete shall be placed so that a uniform appearance of surface will be obtained.

2. The concrete shall be free of all rock pockets, honeycombs and voids.

3. Concrete shall be deposited as nearly as practical in its final position.

4. The sub-grade shall be slightly moist when the concrete is placed for floor slabs to prevent excessive loss of water from the concrete mix.

5. Place concrete within 90 minutes of mixing.

C. Vibrators and Vibrating:

1. Employ as many vibrators and tampers as necessary to secure the desired results. Minimum: one per each 20 cubic yards of concrete placed per hour.

2. Eliminate the following applications:

a. Pushing of concrete with vibrator.

b. External vibration of forms.

c. Allowing vibrator to vibrate against reinforcing steel where steel projects into green concrete.

d. Allowing vibrator to vibrate contact faces of forms.

3. Vibrators shall function at a minimum frequency of 3600 cycles per minute when submerged in concrete.

4. Supplement vibration by forking and spading along the surfaces of the forms and between reinforcing whenever flow is restricted.

D. Curing:

1. General: Freshly deposited concrete shall be protected from premature drying and excessively hot or cold temperatures and shall be maintained with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete. Also comply with ACI 318, Section 26.5.3 and CBC Section 1905A.

2. Initial Curing: Initial curing shall immediately follow the finishing operation. Concrete shall be kept continuously moist at least over night. One of the following materials or methods shall be used:

   a. Ponding or continuous sprinkling.

   b. Absorptive mat or fabric kept continuously wet.

3. Final Curing: Immediately following the initial curing and before the concrete has dried, additional curing shall be accomplished by one of the following materials or methods:

   a. Continuing the method used in initial curing.

   b. Slabs to receive finish flooring materials to be continuously wet cured for 7 days.

   c. Waterproof paper conforming to “Specifications for Waterproof Paper for Curing Concrete” (ASTM C171).

   d. Curing compounds conforming to “Specifications for Liquid Membrane-Forming Compounds for Curing Concrete” (ASTM C309). Such compounds shall be applied in accordance with the recommendations of the manufacturer and shall not be used on any surfaces against which additional concrete or other cementitious finishing materials (such as ceramic tile) are to be bonded, nor on surfaces on which such curing is prohibited by the project specifications.

   e. Other moisture-retaining coverings as approved.

4. Duration of Curing: The final curing continue until the cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of the air in contact with the concrete is above 50 degrees F., has totaled 7 days.

5. Formed Surfaces: Steel forms heated by the sun and all wood forms in contact with the concrete during the final curing period shall be kept wet. If forms are to be removed during the curing period, one of the above curing materials or methods shall be employed immediately. Such curing shall be continued for the remainder of the curing period.

E. Construction Joints

1. Joints not shown on the drawing shall be so made and located as to least impair the strength of the structural element and shall be approved by the Owner and Structural Engineer.

2. The surfaces of all concrete at all joints shall be thoroughly cleaned and all laitance removed by sandblasting.

3. Concrete surfaces at designated joints shall be roughened to ¼" relief with roto hammer or similar method.

4. Moisten all joints immediately prior to placement of concrete.

F. Embedded Items:

1. All sleeves, inserts, anchors and embedded items required for adjoining work or for its support shall be placed prior to concreting. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts and anchor bolt slots shall be filled temporarily with a readily removable material to prevent entry of concrete into the voids.

G. Grouting Column Bases:

1. The grout shall be mixed and placed in strict accordance with manufacturer's instructions.

2. Care shall be taken in the grouting to insure that there is full bearing between the base plates and the grout.

3.4 Defective Work: Work considered to be defective may be ordered to be replaced, in which case the Contractor shall remove the defective work at his expense. Work considered to be defective shall include, but not be limited to, the following:

A. Concrete in which defective or inadequate reinforcing steel has been placed.

B. Concrete incorrectly formed, or not conforming to details and dimensions on the drawings or with the intent of these documents, or concrete the surfaces of which are out of plumb or level.

C. Concrete below specified strength.

D. Concrete containing wood, cloth or other foreign matter, rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings.

3.5 Correction of Defective Work

A. The Contractor shall, at his expense, make all such corrections as directed by the engineer and approved by DSA.

B. Concrete work containing rock pockets, voids, honeycombs, cracks or cold joints not scheduled or indicated on the drawings shall be chipped out until all unconsolidated material is removed.

3.6 Slab Finish

A. Covered interior slabs shall receive a smooth, steel troweled finish. Tolerance shall be 1/8” in 10’-0”.

B. Slabs under ceramic tile shall receive a roughened finish.

C. Exposed interior & exterior slabs receive a broom finish as directed. Edges shall be smooth troweled. See drawings for specifics.

END OF SECTION 03 30 00

SECTION 06 10 53 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. If there is a conflict between City of Mountain View General and Special Provisions and Division 1, the City of Mountain View General and Special Provisions shall govern.

B. Rough Carpentry work includes walls and roofs.

C. Provide all labor, materials, equipment and service necessary for completion of the rough carpentry work shown on the drawings.

1.2 QUALITY ASSURANCE

A. Lumber shall conform to the following grading rules:

1. Douglas Fir Lumber: Standard Grading and Dressing Rules, latest edition, of the West Coast Lumber Inspection Bureau.

2. Redwood Lumber: Standard Specifications for Grades of California Redwood Lumber of the Redwood Inspection Service.

3. Plywood: Product Standard PS 1-83.

B. All lumber and plywood shall have the grade mark of the governing association.

C. All work shall conform to the 2019 California Building Code, Title 24, Part 2.

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather or cover with waterproof covering.

B. Store materials a minimum of six (6) inches above ground on blocking.

C. Protect all materials from corner breakage and surface damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All framing lumber shall be Coast Region Douglas Fir.

B. Conform to the following grades, unless noted otherwise:

Member	Grade
2x4 Studs, Plates, Bridging & Blocking:	Construction Grade
2x6 Studs and Blocking:	No.2
3x & 4x, 6” & deeper Beams, Headers, Ledgers:	No.1
6x & wider Beams & Headers:	No.1
Posts:	No.1
Sole plates on concrete:	No.2 pressure treated

C. All solid sawn lumber shall have a moisture content of not greater than 19% at the time of installation.

D. Plywood sheathing shall be APA rated Sheathing with exterior glue.

1. Wall sheathing shall be 15/32" thick with a span rating of 24/0.

E. Building paper shall be Asphalt-saturated asbestos felt conforming to ASTM D250, 15 lbs., non-perforated.

F. Timber connectors, bolts, lag screws, nails and staples shall conform to the building code.

G. Bolts set against wood shall have cut washers.

1. Anchor bolts for wall sole plates shall have 2”x2”x3/16” plate washers at top of sole plate.

2. Hot-dip galvanized or stainless steel for exterior use.

3. Hot-dip galvanized or stainless steel for use in preservative treated wood.

H. Nails shall be Common type.

1. Hot-dip galvanized or stainless steel for exterior use.

2. Hot-dip galvanized or stainless steel for use in preservative treated wood.

3. Box nails shall not be used without specific approval of the Engineer.

I. Joist hangers, post caps, holdowns, etc. as manufactured by the Simpson Company or approved equal. Any request for substitution shall be submitted to the Engineer with current ICC-ES approval report.

1. Hot-dip galvanized or stainless steel for exterior use.

2. Hot-dip galvanized or stainless steel for use in contact with preservative treated wood..

J. Powder driven fasteners shall be Hilti, size shown on drawings, installed per manufacturer's recommendations. Any request for substitution shall be submitted to the Engineer with current ICC-ES approval report.

K. Expansion anchors shall be Wedge Anchors for concrete or masonry anchorage, size as per drawings, unless specifically shown otherwise on the drawings.

1. Hot-dip galvanized or stainless steel for exterior use.

2. Hot-dip galvanized or stainless steel for use in preservative treated wood..

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sole Plates:

1. Set level to 1/16 in. in 6 ft.

2. Anchor bolt holes shall be not more than 1/8" larger than anchor bolt size.

B. Stud wall framing:

1. 2 in. thick studs @ 16" o.c. unless noted otherwise.

2. Provide studs in continuous lengths without splices.

3. Provide triple studs at corners and intersections so that no wall material can extend from one room to another, unless shown otherwise.

4. Firestop blocking shall be 2" material installed in accordance with CBC Section 708.

5. Openings shall be framed with headers where more than one stud is cut.

6. Locate blocking for backing for other trades, i.e., finishing materials, fixtures, specialty items and trim.

C. Horizontal framing:

1. Install with crown edge up.

2. Support ends of each member with a minimum of 1-1/2" of bearing on support.

3. Notch (birdsmouth) rafters to fit wall plates.

4. Place rafters directly opposite each other at ridges.

5. At hips and valleys bevel ends of rafters for full bearing against hip & valley members.

6. Provide solid blocking, at 8'-0" intervals, between all floor joist, and roof joist 8" and deeper.

D. Cutting, notching or boring of members shall not be done except as shown on the drawings.

E. Decking:

1. Install random length pieces continuous over three spans with end joints in adjacent rows a minimum of 24" apart.

2. Drive decking members tight using short block, do not hammer tongue.

3. Nail each member at support with one 20d blind nail and one 20d face nail for 2x decking; one 30d blind nail and one 30d face nail for 3x decking.

4. Toe nail grove to tongue at 45 degrees, 1-1/4" from edge, with 8d nails at 30" o.c.

F. Plywood Sheathing:

1. Allow a minimum of 1/16" between edge joints and 1/8" between end joints.

2. Floor sheathing shall be glued using 1/4" bead of B.F. Goodrich PL-400 adhesive at all supports and grooved edges. Nail immediately after gluing each piece.

3. Install floor plywood with face grain perpendicular to supports; roof plywood as shown on the drawings and wall plywood with face grain parallel to studs.

4. Plywood short nails may be used if the following penetration into the supporting member is maintained:

Nail Size	Penetration
6d	1-1/4"
8d	1-1/2"
10d	1-5/8"

5. Where gun nailing is used, care shall be taken not to overdrive nails. Where face ply is broken, renailing is required. Any nails that miss the supporting members shall be removed and renailed.

G. Wall Sheathing Board:

1. Apply sheathing with long dimension parallel to the studs.

2. Allow 1/8" space between sheets.

3. Attach sheathing using staples a minimum of 1-3/8" long spaced at 3" o.c. at edges and 6" o.c. at intermediate supports; or 6d nails spaced at 4" o.c. at edges and 8" o.c. at intermediate supports.

H. Connectors:

1. Minimum nail spacing shall be 1/2 their length, minimum edge distance shall be 1/4 their length. Pre-drill holes for nails wherever necessary to prevent splitting.

2. Wood screws and lag screws shall be turned into place, not driven. Drill holes in the same depth and diameter as the shank and the diameter of the thread base for the threaded portion.

3. Bolt holes shall be drilled 1/16" larger than the bolt diameter.

4. Joist hangers, tie straps, etc., shall have the number and size of connectors recommended by the manufacturer.

END OF SECTION 06 10 53

SECTION 06 41 16 – PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

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

B. Related Requirements:

1. Section 06 10 53 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
3. Apply WI Certified Compliance Program label to Shop Drawings.

C. Samples for Initial Selection:

1. Plastic laminates.
2. PVC edge material.
3. Thermoset decorative panels.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with sample applied to core material and specified edge material applied to one edge.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For each type of product.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a licensee of WI's Certified Compliance Program.

B. Installer Qualifications: Licensee of WI's Certified Compliance Program.

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

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

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. The Contract Documents may contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

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

      a. Formica Corporation.
      b. Nevamar; A Div, of Panolam Industries International, Inc.
      c. Wilsonart International; Div. of Premark International, Inc.

F. Laminate Cladding for Exposed Surfaces:

   1. Horizontal Surfaces: Grade HGS.

   2. Horizontal Surfaces in STEM and Prep Room: Chemical Resistant
   3. Postformed Surfaces: Grade HGP.
   4. Vertical Surfaces: Grade HGS.
   5. Edges: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
   6. Pattern Direction: Vertically for doors and fixed panels, horizontally for drawer fronts.

G. Materials for Semi-exposed Surfaces:

   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch (3 mm) thick, matching laminate in color, pattern, and finish.
b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Solid-hardwood lumber.
3. Drawer Bottoms: Hardwood plywood.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As selected by Architect from laminate manufacturer's full range of colors and patterns.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 4 to 9 percent.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Composite Wood and Agrifiber Products: Products shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
2. Medium-Density Fiberboard: ANSI A208.2, Grade 130, made with binder containing no urea formaldehyde.
3. Particleboard: ANSI A208.1, .Grade M-2, made with binder containing no urea formaldehyde.
4. Softwood Plywood: DOC PS 1, medium-density overlay.
5. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
6. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

A. Butt Hinges: 2-3/4-inch (70-mm), five-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

1. Semiconcealed Hinges for Overlay Doors: BHMA A156.9, B01521.

B. Back-Mounted Pulls: BHMA A156.9, B02011.

C. Wire Pulls: Back mounted, solid stainless steel, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141.

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.

F. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

G. Drawer Slides: BHMA A156.9.

1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
2. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1HD-100.
3. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-200.

H. Door Locks: BHMA A156.11, E07121.

I. Drawer Locks: BHMA A156.11, E07041.

J. Door and Drawer Silencers: BHMA A156.16, L03011.

K. Tempered Float Glass for Cabinet Doors: ASTM C 1048, Kind FT, Condition A, Type I, Class 1 (clear), Quality-Q3, 6 mm thick unless otherwise indicated.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
2. Satin Stainless Steel: BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate cabinets to dimensions, profiles, and details indicated.

C. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

E. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual." For glass in wood frames, secure glass with removable stops.

PART 3 - EXECUTION

3.1 PREPARATION

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

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends as indicated in Drawings.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16

SECTION 06 64 00 – PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plastic sheet paneling.
    a. Fiber reinforced laminates
    b. Glass fiber reinforced plastic

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 QUALITY ASSURANCE

A. Testing Agency: Acceptable to authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Fiber-Reinforced Laminates:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product as follows:

   a. Fiber Reinforced Laminates, Panolam Industries International, Inv.

   b. Or equal.

2. Low-Emitting Materials: Paneling shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84: Class A .Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 200 or less.
   b. Smoke-Developed Index: 450 or less.

4. Nominal Thickness: Not less than 0.075 inch.
5. Surface Finish: Textured finish with low gloss
6. Color: As selected by Architect from manufacturer’s full range
7. Wear resistance: NEMA 3.13: 3500
8. Flexural strength ASTM D790: 20148psi

B. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Marlite.
   b. Nudo Products, Inc.

2. Low-Emitting Materials: Paneling shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

4. Nominal Thickness: Not less than 0.12 inch (3.0 mm).
5. Surface Finish: Molded pebble texture.
6. Color: As selected by Architect from manufacturer's full range.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard vinyl and aluminum extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.

1. Color:
   a. FRL: Aluminum finish
   b. FRP: Match panels

B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.

C. Adhesive: As recommended by plastic paneling manufacturer and that complies with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."

1. Sealant shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines for accurate installation.
2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install trim accessories with adhesive.

D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

F. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

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

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Polypropylene-Scrim-Kraft Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).

D. Reinforced-Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

E. Foil-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame-propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

2.2 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; TACTOO Insul-Hangers.
b. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030-inch thick by 2-inches square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105-inch in diameter; length to suit depth of insulation indicated.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2-inches square or in diameter.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; RC150, SC150.
b. Gemco; Dome-Cap, R-150, S-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

a. Crawl spaces.
b. Ceiling plenums.
c. Attic spaces.

C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 2-inches between face of insulation and substrate to which anchor is attached.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; Clutch Clip.
b. Gemco; Clutch Clip.

D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Gemco; Tuff Bond Hanger Adhesive.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For metal-framed wall cavities where cavity heights exceed 96-inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
6. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:

    a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

7. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

    a. Exterior Walls: Set units with facing placed toward interior of construction.
    b. Interior Walls: Set units with facing placed toward areas of high humidity.

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

a. Glass-Fiber Insulation: Compact to approximately 40% of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.5 INSULATION SCHEDULE

A. Insulation Type: Unfaced, glass-fiber blanket insulation.

1. Use at all interior walls for sound insulation.
2. R-Value: R-21

B. Insulation Type: Foil-faced, glass-fiber blanket insulation.

1. Use at all exterior walls and roof for thermal insulation.
2. R-Value:
   a. Exterior Wall(s): R-21.
   b. Roof(s): R-30.

END OF SECTION 07 21 00

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed wall sheet metal fabrications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

2.2 SHEET METALS

A. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G60 coating designation.

1. Surface: Smooth, flat and mill phosphatized for field painting.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

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

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Solder:

1. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead with maximum lead content of 0.2 percent.

D. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with interlocking counterflashing on exterior face, of same metal as reglet.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Corporation; STX Stucco Reglet or a comparable product by one of the following:

a. Or equal.

2. Material: Galvanized steel, 24 gage thick.
3. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
4. Finish: Mill.

2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch-long sections. Furnish flat-stock gutter brackets and flat-stock gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard but with thickness not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Gutter Profile: Style B according to cited sheet metal standard.
2. Expansion Joints: Butted with expansion space and 6-inch-wide, concealed backup plate.
3. Accessories: Wire-ball downspout strainer.
4. Gutters with Girth up to 15 Inches: Fabricate from the following materials:

    a. Galvanized Steel: 24 gage thick.

B. Downspouts: Fabricate round downspouts from Schedule 40 pipe to dimensions indicated, complete with mitered and welded elbows.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop): Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates.

1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
2. Fabricate from the Following Materials:

    a. Galvanized Steel: 24 gage thick.

B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support

edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, solder or weld watertight.

1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
2. Fabricate from the Following Materials:

    a. Galvanized Steel: 20 gage thick.

C. Roof, Roof-to-Wall Transition, and Roof-to-Roof Edge: Fabricate from the following materials:

1. Galvanized Steel: 22 gage thick.

D. Base Flashing, Counterflashing, and Roof-Penetration Flashing: Fabricate from the following materials:

1. Galvanized Steel: 24 gage thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:

1. Galvanized Steel: 24 gage thick.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets with solder to width of 1-1/2 inches; however, reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not use torches for soldering.
2. Heat surfaces to receive solder, and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
3. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
4. Install gutter with expansion joints at locations indicated, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts: Join sections with mitered and welded joints.

1. Provide supports with fasteners designed to hold downspouts securely to walls as shown on Drawings.
2. Provide elbows at base of downspout to direct water away from building, or, where shown, connect downspouts to underground drainage system.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Reglets: Install manufactured reglets and removable counterflashing according to manufacturer’s instructions and Drawings.

C. Opening Flashings in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches beyond wall openings.

3.6 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING AND PROTECTION

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.

1.4 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Sealants and sealant primers shall comply with the following:

1. Architectural sealants shall have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for nonporous substrates shall have a VOC content of 775 g/L or less.
4. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

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

a. Dow Corning Corporation; Dow Corning® 795 Silicone Building Sealant.
b. Sika Corporation; Joint Sealants; Sikasil WS-295.
c. Tremco Incorporated; Spectrem 2.
d. Or equal.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

a. BASF Corporation; Construction Systems; MasterSeal NP 1 (Pre-2014: Sonolastic NP1).
b. Sika Corporation; Joint Sealants; Sikaflex Textured Sealant.
c. Tremco Incorporated; Dymonic.

d. Or equal.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

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

a. Dow Corning Corporation; DOW CORNING® 786 SILICONE SEALANT -.
b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
c. Tremco Incorporated; Tremsil 200.
d. Or equal.

2.5 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

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

a. May National Associates, Inc.; a subsidiary of Sika Corporation; Bondaflex 600.
b. Sherwin-Williams Company (The); 850A Siliconized Acrylic Latex Caulk.
c. Tremco Incorporated; Tremflex 834.
d. Or equal.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.3 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.4 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage

or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.5 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between metal panels.
c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
e. Control and expansion joints in ceilings and other overhead surfaces.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Vertical joints on exposed surfaces of concrete.

2. Joint Sealant: Urethane, S, NS, 25, NT.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

a. Control joints on exposed interior surfaces of exterior walls.
b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.

2. Joint Sealant: Acrylic latex.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.

END OF SECTION 07 92 00

SECTION 08 11 13 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:

1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

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

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Amweld International, LLC.
2. Ceco Door Products; an Assa Abloy Group company.
3. Curries Company; an Assa Abloy Group company.
4. Custom Metal Products.
5. Steelcraft; an Ingersoll-Rand company.
6. Stiles Custom Metal, Inc.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

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

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 INTERIOR FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.

2. Frames:

   a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Maximum-Duty Doors and Frames: SDI A250.8, Level 4.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm.)
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
   d. Edge Construction: Model 1, Full Flush.
   e. Core: Vertical steel stiffener.

3. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.067 inch (1.7 mm), with minimum A40 (ZF120) coating.
   b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2

inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-(9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.
3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors]of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.

2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.

b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

1) Three anchors per jamb up to 60 inches (1524 mm) high.
2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

c. Post-installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.9 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch- (0.5-mm-) thick, cold-rolled steel sheet set into 0.032-inch- (0.8-mm-) thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Install door silencers in frames before grouting.
    c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    d. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    e. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
6. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    c. At Bottom of Door: 5/8 inch (15.8 mm)]plus or minus 1/32 inch (0.8 mm).
    d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

SECTION 08 31 13 – ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings:

1. Include plans, elevations, sections, details, and attachments to other work.
2. Detail fabrication and installation of access doors and frames for each type of substrate.

C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Basis-of-Design Product: Subject to compliance with requirements, provide:

1. Milcor Inc.
2. Or approved equal.

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges:

1. Basis-of-Design Product: Milcor Model M.
2. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
3. Locations: Wall and ceiling.
4. Door Size: As needed.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage.
    a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

D. Exterior Flush Access Doors:

1. Basis-of-Design Product: Milcor Model K.
2. Assembly Description: Fabricate door to be weatherproof and fit flush to frame. Provide manufacturer's standard 2-inch- (50-mm-) thick fiberglass insulation and extruded door gaskets. Provide manufacturer's standard-width frame for surface mounting, proportional to door size.
3. Locations: Wall.
4. Door Size: As needed.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage.
    a. Finish: Factory prime.
6. Frame Material: Same material, thickness, and finish as door.
7. Hinges: Manufacturer's standard.
8. Hardware: Lock.

E. Hardware:
1. Lock: Cylinder.

2.3 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

C. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

E. Frame Anchors: Same type as door face.

F. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.
3. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder locks, furnish two keys per lock and key all locks alike.

2.5 FINISHES

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

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

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:

1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 31 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:

a. Swinging doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware and keying schedule.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedule.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that

are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC A117.1 and California Building Code.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

    a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

2.4 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch-thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

2.5 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
3. Deadbolts: Minimum 1-inch bolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on Drawings.
2. Levers: Cast.
3. Escutcheons (Roses): Cast.
4. Dummy Trim: Match lever lock trim and escutcheons.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

2.6 AUXILIARY LOCKS

A. Bored Auxiliary Locks: BHMA A156.36: Grade 1; with strike that suits frame.

2.7 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.

2.8 SURFACE BOLTS

A. Surface Bolts: BHMA A156.16.

2.9 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

2.10 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.

2.11 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.

1. Core Type: Interchangeable.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.12 OPERATING TRIM

A. Operating Trim: BHMA A156.6; aluminum unless otherwise indicated.

2.13 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.14 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

2.15 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

2.16 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

2.17 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of 0.3-inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. m/s per m) of door opening.

2.18 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

2.19 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick aluminum; with manufacturer's standard machine or self-tapping screw fasteners.

2.20 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

2.21 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

2.22 FABRICATION

A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

   a. Wood or Machine Screws: For the following:

      1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
      2) Strike plates to frames.
      3) Closers to doors and frames.

   b. Steel Through Bolts: For the following unless door blocking is provided:

      1) Surface hinges to doors.
      2) Closers to doors and frames.
      3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.23 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Operable parts of door hardware shall be within 34”-44” A.F.F.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Furnish permanent cores to Owner for installation.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

NOTE: All locks shall be lever activated for immediate egress.

Hardware Group No. 01 – Outdoor Entrance

1	EA	HINGE	BB1279 4.5X4.5 NRP	630	HAG
1	EA	DOOR LEVER/ CYLINDER	ND95PD RHODES	626	SCH
2	EA	PERMANENT CORE	BY OWNER AT LATER TIME		
1	EA	SURFACE CLOSER	4040XP MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR PEDESTAL STOP/HOLDER	FS40-43 AS REQ.	626	IVE
1	SET	SILENCER	1229		TMC
1	EA	DOOR SWEEP	153A	A	ZER
1	EA	THRESHOLD	PEMKO 2748A 1/4" X 8″ X36 OR EQUAL	A	PEM
1	EA	WEATHERSTRIPPING	36″X84″ 3340	PA	PEM

Hardware Group No. 02 - Washroom

1	EA	HINGE	BB1279 4.5X4.5	630	HAG
1	EA	DOOR LEVER/ CYLINDER	ND80PD RHODES	626	SCH
1	EA	PERMANENT CORE	BY OWNER AT LATER TIME		
1	EA	SURFACE CLOSER	4040XP MC	689	LCN
1	EA	SILENCER	1229		TMC
1	EA	FLOOR PEDESTAL STOP/HOLDER	FS40-43 AS REQ.	626	IVE
1	EA	THRESHOLD	PER DETAIL		

Hardware Group No. 03 – Interior Classroom

3	EA	HINGE	BB1279 4.5X4.5	630	HAG
1	EA	DOOR LEVER/ CYLINDER	ND95PD RHODES	626	SCH
2	EA	PERMANENT CORE	BY OWNER AT LATER TIME		
1	EA	SURFACE CLOSER	4040XP MC	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR PEDESTAL STOP/HOLDER	FS40-43 AS REQ	626	IVE
1	SET	SILENCER	1229	AA	TMC
1	EA	DOOR BOTTOM	355AA	AA	ZER
1	EA	THRESHOLD	PER DETAIL		

Hardware Group No. 04 – Staff Restroom

3	EA	HINGE	1279 4.5X4.5	630	HAG
1	EA	DOOR LEVER/ CYLINDER	ND40S RHODES	626	SCH
2	EA	PERMANENT CORE	BY OWNER AT LATER TIME	626	
1	EA	SURFACE CLOSER	4040XP MC	689	LCN
1	EA	THRESHOLD	PER DETAIL		
1	SET	SILENCER	1229	AA	TMC

Hardware Group No. 05 – Toddler Restroom, Heating Kitchen

1	EA	CONT. HINGE	700	628	IVE
1	EA	DOOR LEVER/ CYLINDER	ND10 RHODES	626	SCH
2	EA	PERMANENT CORE	BY OWNER AT LATER TIME	626	
1	EA	THRESHOLD	PER DETAIL		
1	SET	SILENCER	1229	AA	TMC

Lock shall be lever-actuated for immediate egress, typ.

Abbreviations:

1. BO – Bommer Industries
2. MK – McKinney Products
3. PE – Pemko Products
4. SU – Securitron
5. BU – Burns Manufacturing
6. DC – Door Controls International
7. RO – Rockwood Products
8. RU – Corbin Russwin Hardware
9. SA – Sergeant Manufacturing
10. NO – Norton Door Controls
11. HU – Hiawatha, Inc.
12. RF – Rixson Door Controls

RE – Reese Enterprises

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Window

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

Minimum Glazing requirement shall comply with CBC Chapter 34, Table 2403.2.1.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

B. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

C. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.

3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

B. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

1. Basis-of-Design Product: Subject to compliance with requirements, provide PPG Industries, Inc., “Solarban 70XL” or comparable product by one of the following:

   a. Or equal.

2. Tint Color: Clear.

2.3 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

1. EPDM complying with ASTM C 864.
2. Silicone complying with ASTM C 1115.
3. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.5 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Sealants used inside the weatherproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.6 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

2.9 GLASS SCHEDULE

A. Exterior Windows: Low-e-coated, insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 1/4 inch.
3. Outdoor Lite: Tinted fully tempered float glass.
4. Interspace Content: Air.
5. Indoor Lite: Clear fully tempered float glass.
6. Low-E Coating: Sputtered on second surface, PPG Industries Solarban 70XL (Clear) or equal.
7. Visible Light Transmittance: 35 percent minimum.
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Summer Daytime U-Factor: 0.27 maximum.
10. Solar Heat Gain Coefficient: 0.27 maximum.
11. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and

installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.
b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Low-Emitting Materials: For ceiling and wall assemblies, provide materials and construction identical to those tested in assembly and complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. Lafarge North America Inc.
5. National Gypsum Company.
6. PABCO Gypsum.
7. Temple-Inland.
8. USG Corporation.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead.
b. Bullnose bead.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long flange receives joint compound.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (control) joint.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
b. Grabber Construction Products; Acoustical Sealant GSC.
c. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
d. USG Corporation; SHEETROCK Acoustical Sealant.

2. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

G. Vapor Retarder: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: Vertical surfaces unless otherwise indicated.
2. Ceiling Type: Ceiling surfaces.
3. Moisture- and Mold-Resistant Type: Restrooms (above tile).
4. Cementitious Backer Units: Restrooms (behind tile).

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. L-Bead: Use where indicated.
3. U-Bead: Use at exposed panel edges.
4. Curved-Edge Cornerbead: Use at curved openings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 4: At all panel surfaces.
      a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13- ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for ceilings.

B. Related Requirements:
   1. None.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

   1. Acoustical Panel: Set of 12-inch- (300-mm-) square samples of each type, color, pattern, and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Size and location of initial access modules for acoustical panels.
   4. Items penetrating finished ceiling including the following:

      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.

   5. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of typical ceiling area shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and

ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and modifications by California Building Code 2016. Shall comply with DSA IR 25-2.13 Metal Suspension Systems for Lay In Panel Ceilings 2016 CBC.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

2.2 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2.3 METAL SUSPENSION SYSTEM

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Prelude XL (ICC ESR 1308) or comparable product by one of the following:

1. CertainTeed Corp.

2. Chicago Metallic Corporation.

3. USG Interiors, Inc.; Subsidiary of USG Corporation.

4. Or equal.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. Main Runner: 7301 (144 in x 15/16 in x 1-11/16 in, 6 in slot spacing)
3. Cross Runners: XL7341 (48 in x 15/16 in x 1-11/16 in) and X7328 (24 in x 15/16 in x 1-3/8 in)
4. End Condition of Cross Runners: butt-edge type.
5. Face Design: Flat, flush.
6. Cap Material: Steel cold-rolled sheet.
7. Cap Finish: Painted white.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.5 ACOUSTICAL SEALANT

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

1. Acoustical Sealant for Exposed and Concealed Joints:

   a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

   b. USG Corporation; SHEETROCK Acoustical Sealant.

   c. Or equal.

2. Acoustical Sealant for Concealed Joints:

   a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.

   b. Pecora Corporation; AIS-919.

   c. Tremco, Inc.; Tremco Acoustical Sealant.

   d. Or equal.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
3. Acoustical sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 ACOUSTICAL PANELS, GENERAL

A. Low-Emitting Materials: Acoustical panel ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

2.7 ACOUSTICAL PANELS

A. Acoustical Tile (Suspended Ceilings)
1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ultima High NRC or comparable product by one of the following:
   a. CertainTeed Corp.
   b. USG Interiors, Inc.; Subsidiary of USG Corporation.
   c. Or equal.

2. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
   a. Type and Form: Type IV, mineral fiber base with DuraBrite; Form 2, water felted.
   b. Pattern: E

3. Color: White
4. LR: No less than 0.87
5. NRC: Not less than 0.80.
6. CAC: Not less than 35.
7. Edge/Joint Detail: Reveal sized to fit flange of exposed suspension-system members.
8. Thickness: 15/16 inch.
9. Modular Size: 24 by 48 inches.
10. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Do not begin installation until materials sufficient to complete an entire room are received and prepared for installation.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.

C. Supports to accept screws no greater than 24” on center. Supports to run perpendicular to panel direction.

D. Panel ends must fall over support. Panel ends are to be staggered.

E. Screw to supports, five screws per panel width for 47¾” panels.

F. Screw head to be flush with panel surface.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13 – RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

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, not less than 12 inches (300 mm) long.

C. Samples for Initial Selection: For each type of product indicated.

D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

E. Product Schedule: For resilient base and accessory products.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than [95 deg F (35 deg C).

B. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

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

1. Burke Mercer Flooring Products, Division of Burke Industries Inc.
2. Roppe Corporation, USA.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 6 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job formed.

G. Inside Corners: Job formed.

H. Colors: As selected by Architect from full range of industry colors.

2.2 VINYL MOLDING ACCESSORY

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

1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
3. Johnsonite; A Tarkett Company.
4. Roppe Corporation, USA.

B. Description: Vinyl carpet edge for glue-down applications, reducer strip for resilient flooring, joiner for tile and carpet and transition strips.

C. Locations: At all flooring transitions.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m)] in 24 hours.

b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 18 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 18 inches in length.

a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply five coat(s).

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Unbacked vinyl sheet flooring.
2. Vinyl sheet flooring with backing.
3. Rubber Floor Plank.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

C. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than **6-by-9-inch** sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than **9 inches** long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of **6-by-9-inch** Sample applied to a rigid backing and prepared by Installer for this Project.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

B. Warranties: Furnish a written warranty against defects in material or workmanship.

1. Rubber Floor Plank: Provide manufacturer’s standard limited warranty for wear, defect, bond, and conductivity

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials**, from the same product run,** that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Vinyl sheet flooring: Furnish not less than **10 linear feet** for every **500 linear feet** or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide resilient flooring manufactured by a firm with a minimum of 10 years' experience with resilient flooring of type equivalent to those specified.

B. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated. The manufacture firm should have a minimum of 10 years' experience with resilient flooring of type equivalent to those specified.

1. It is recommended to have a minimum of one installer per working party with the ability to provide proof of current credentials at request.

2. Has obtained and maintained current credentials from manufacturer's training program.

3. Installers shall be able to exhibit proficient skills with flash cove detailing, both hot and cold-welding techniques, adhesives, specialty adhesive systems and seam cutting.

4. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.

a. Size: Minimum 100 sq. ft. (9.3 sq. m) for each type, color, and pattern **in locations indicated**.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **70 deg F (21 deg C)** or more than **85 deg F (29 deg C)**, in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than **55 deg F (13 deg C)** or more than **95 deg F (35 deg C)**.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2. Flooring along the accessible route shall be stable, firm and slip-resistant, per CBC 11B-302.1

2.2 UNBACKED VINYL SHEET FLOORING

A. Commercial DecorArt Corlon by Armstrong Flooring Inc

Or Equal

B. Product Standard: ASTM F1303.

C. Thickness: **0.080 inch (2.0 mm)**.

D. Wearing Surface: **Smooth**.

E. Sheet Width: **As standard with manufacturer**.

F. Seamless-Installation Method: **Heat welded**.

G. Colors and Patterns: **Match Architect's samples**

2.3 RUBBER FLOOR PLANK

A. Noraplan Valua 2.0 mm with backing by Interface

Or Equal

B. Product Standard: ASTM F1344

C. Thickness: **0.08 inches (2.0 mm)**

D. Wearing Surface: **Striated Profile**

E. Sheet Width: **As standard with Manufacturer**

F. Colors and Patterns: **Match Architects samples**

2.4 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Colors: **Match flooring**.

D. Integral-Flash-Cove-Base Accessories:

1. Cove Strip: 1-inch (25-mm) radius provided or approved by resilient sheet flooring manufacturer.
2. Cap Strip: **Square metal cap** provided or approved by resilient sheet flooring manufacturer.
3. Corners: Metal inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.

E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches (152 mm) away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. A subfloor that meets the requirements of ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient .Flooring is required, or as detailed in the manufacturer Installation Instructions as appropriate.

J. D.An installation area that is fully enclosed, weather tight, and climate controlled between 63°F and 75° and 40% to 60% ambient relative humidity (RH) for at least 48-hours prior, during, and 72-hours after installation (do not use gas fueled blowers). If this is not possible, contact the manufacturer Technical Department.

K. Areas with direct prolonged exposure to sunlight should be protected with the use of Low E glass doors, windows or facades that reduce the UV transmissions to less than 1%.

L. Areas of the flooring subjected to direct sunlight, for example through doors or windows, must be covered using blind, curtains, cardboard, or similar materials for 24-hours before, during, and for a period of 72-hours after the installation to allow the “wet” adhesives to cure. Do not allow traffic when using wet set adhesives for a minimum of 12-hours and prohibit rolling loads for 72-hours. All flooring must be protected from damage during construction operations using Masonite, plywood, or a similar product. Before laying the panels, the flooring surface must be free of all debris. Lay panels so that they are edge to edge and tape the joints to prevent movement and debris entrapment. Inspect the flooring before covering and after removal for final acceptance.

M. Follow installation instructions for manufacturer.

N. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

O. Integral-Flash-Cove Base: Cove resilient sheet flooring **6 inches (152 mm)** up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.

1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply **three** coat(s).

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 65 16

SECTION 09 65 19 - RESILIENT TILE FLOORING

1. PART 1 – GENERAL

1.1. RELATED DOCUMENTS

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

1.2. SUMMARY

1.2.1. Section Includes:

1.2.1.1. Luxury Vinyl Tile Flooring (LVT)

1.3. ACTION SUBMITTALS

1.3.1. Product Data: For each type of product.

1.3.2. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1.3.2.1. Show details of special patterns.

1.3.3. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.4. INFORMATIONAL SUBMITTALS

1.4.1. Qualification Data: For Installer.

1.5. CLOSEOUT SUBMITTALS

1.5.1. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6. MAINTENANCE MATERIAL SUBMITTALS

1.6.1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.6.1.1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7. QUALITY ASSURANCE

1.7.1. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.8. DELIVERY, STORAGE, AND HANDLING

1.8.1. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9. FIELD CONDITIONS

1.9.1. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:

1.9.1.1. 48 hours before installation.

1.9.1.2. During installation.

1.9.1.3. 48 hours after installation.

1.9.2. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

1.9.3. Close spaces to traffic during floor tile installation.

1.9.4. Close spaces to traffic for 48 hours after floor tile installation.

1.9.5. Install floor tile after other finishing operations, including painting, have been completed.

2. PART 2 - PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

2.1.1. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

2.1.1.1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.1.2. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2. LUXURY VINYL TILE (LVT)

2.2.1. Basis-of-Design Product: Subject to compliance with requirements, provide Mannington Commercial - Walkway

2.2.2. Tile Standard: ASTM F 1700-96 Class III Type B

2.2.3. Wear Layer Thickness: 20 mil

2.2.4. Size: 5.8” x 37” and 9” x 48”

2.2.5. Colors and Patterns: See Finish Schedule on Architectural Drawings.

2.3. INSTALLATION MATERIALS

2.3.1. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

2.3.2. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

2.3.2.1. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3.2.2. Provide manufacturer’s standard high moisture adhesive for use over concrete slabs with high internal relative humidity if RH test results are greater than 90% or as required by manufacturer.

2.3.3. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

3. PART 3 - EXECUTION

3.1. EXAMINATION

3.1.1. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

3.1.1.1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

3.1.2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

3.2.1. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

3.2.2. Concrete Substrates: Prepare according to ASTM F 710.

3.2.2.1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

3.2.2.2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.

3.2.2.3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

3.2.2.4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:

3.2.2.4.1. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours. And of 5 lb of water/1000 sq. ft. in 24 hours for LVT.

3.2.2.4.2. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level for VCT, maximum 85 percent relative humidity level for LVT,

3.2.3. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

3.2.4. Do not install floor tiles until they are the same temperature as the space where they are to be installed.

3.2.4.1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

3.2.5. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3. FLOOR TILE INSTALLATION

3.3.1. Comply with manufacturer's written instructions for installing floor tile.

3.3.2. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

3.3.3. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

3.3.4. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

3.3.5. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

3.3.6. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

3.3.7. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

3.3.8. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4. CLEANING AND PROTECTION

3.4.1. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

3.4.2. Perform the following operations immediately after completing floor tile installation:

3.4.2.1. Remove adhesive and other blemishes from exposed surfaces.

3.4.2.2. Sweep and vacuum surfaces thoroughly.

3.4.2.3. Damp-mop surfaces to remove marks and soil.

3.4.3. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

3.4.3.1. Not used.

3.4.4. Not used.

3.4.5. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Vinyl Wall Covering.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

B. Warranties: Furnish a written warranty against defects in material or workmanship for (5) years from date of shipment.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to [**5**] <**Insert number**> percent of amount installed.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

D. Product Delivery Storage and Handling. Deliver vinyl wallcovering and adhesive to the job site unbroken or undamaged containers and clearly marked with the supplier's identification label. Store vinyl wallcoverings in a flat position to avoid damage to roll ends. Store materials in a clean, dry storage area with temperature maintained above 55 degrees Fahrenheit with normal humidity, Do not cross stack the material.

PART 2 - PRODUCTS

2.1 MANUFACTURES

A. Source Limitations: Obtain tack paneling and trim accessories from single manufacturer

2.2 VINYL WALL COVERING

A. Tackboard Wall Cover:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product as follows:

a. Koroseal Spellbound Wall covering

2.3 PERFORMANCE REQUIREMENTS

A. Vinyl Wallcovering: Shall meet federal specification CCC-W408A and the CFFA-W 101-D, Quality standard for vinyl Coasted Fabric Wallcovering. The wallcovering type 1, type II or type III desired shall be specified. The vinyl wall covering shall contain mildew inhibitors.

B. Vinyl Wallcovering (Protected film): Shall meet the requirements as listed in 2.01 and in addition have a 0.37 thick protective film factory-applied to the wallcovering surface.

C. Protective Coating: The vinyl wallcovering shall have a protective coating applied to its surface to minimize migration of stains into the vinyl and, therefore, offer stain protection from a variety of staining agents and provide greater ease of cleanability.

D. Fire-Test-Response Characteristics: the manufacturer shall certify at the time of shipment that the materials furnished meet the published flame spread and smoke development fire hazard classification rating(s) of those products when tested according to astm-E84 Tunnel test.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 65
b. Smoke-Developed Index: 135

E. UL Label: All products shall be UL labeled assuring complete compliance with all specifications and requirements through continuous inspection by UL inspectors.

F. Fire detection Characteristics: The vinyl wallcovering shall contain the Early Warning Effect formulation which provides early warning to potential fire conditions. The vinyl wallcovering shall contain thermoparticulating ingredients which, when heated to approximately 300 °F, emit a colorless, odorless vapor that activates ionization smoke detectors when installed according to manufacturer's specifications. Evidence of the Early Warning Effect shall be based on the ASTM E603 standard guide for room fire experiments.

2.4 ACCESSORIES

A. Adhesive: The adhesive used must be manufacture's recommended adhesive and must contain mildew inhibitors

B. Primer: The primer used must be manufacture's recommended primer

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer shall inspect all areas and conditions under which vinyl wallcoverings are to be installed. Installer shall notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation; work will proceed only when conditions have been corrected and accepted by the installer.

B. Substrate shall be checked with a suitable "Moisture Meter". Moisture shall not exceed 4%

3.2 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Wall surfaces shall be free from defects and imperfections that could show through the finished covered surface. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

C. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

D. Sand-finished plaster shall be smoothed, cinder or cement blocks shall be plastered, or otherwise rendered smooth, and old wallcoverings shall be removed.

E. For new drywall construction, manufacturer’s recommended primer should be used before application of wallcovering for ease of future removal when redecorating.

F. Glossy surfaces shall either be sanded to dull surface, or a coat of manufacturer’s recommended primer applied prior to installation of wallcovering.

G. If there is any evidence of mildew, it must be removed, and the wall surface treated to inhibit further mildew growth.

H. All painted surfaces should be evaluated for the possibility of pigment bleed-through. If there is any possibility, a coat of sealer, recommended by the manufacturer, should be applied before application of the wallcovering.

I. Do not install vinyl wallcovering over oil-based wood stains as a bleed-through may occur.

3.4 INSTALLATION OF WALL LINER

A. Install wall liner, without gaps or overlaps. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.5 INSTALLATION OF WALL COVERING

A. Wallcovering shall be installed by experienced workers and contractors in strict accordance with the manufacturer’s printed instructions using vinyl wallcovering adhesive recommended by the manufacturer (WHEAT PASTE SHALL NOT BE USED). It is absolutely imperative that installer read the manufacturer’s instruction sheet in each roll before installing the vinyl wallcovering. Permanent building light shall be available for installation.

B. Installer, before cutting, shall examine pattern and color and determine that they are the correct pattern and color as specified. Installer shall install each roll in sequence starting with largest roll number and each strip in same sequence as cut from roll. If pattern is not random, examine for repeat design. Some patterns should be lined up, matched or reversed for best results. If necessary, trim selvage deep enough to assure color uniformity.

C. After application of three strips, an inspection should be made and if there are any variations in color or pattern which are felt to be excessive, the wallcovering distributor or manufacturer's representative should be notified for his inspection before any further wallcovering is installed.

D. Always bring material six (6) inches around inside and outside corners being sure to fit into corners to avoid bridging or spanning. The wallcovering should be smoothed to the hanging surface with a stiff bristled sweep brush or a flexible broad-knife to eliminate air bubbles. Avoid burnishing the face of the material.

E. Remove excess adhesive along finished seam immediately after each wallcovering strip is applied. Use of clean, warm water, a natural sponge, and clean towels are recommended for this use. It is very important to change water often to maintain cleanliness.

3.6 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Upon completion of work, remove surplus materials, rubbish and debris, resulting from the wallcovering installation. Leave areas in neat, clean and orderly condition.

END OF SECTION 09 72 00

SECTION 09 91 13 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on exterior substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products from Dunn-Edwards Paints for the paint category indicated, or a comparable product by one of the following:

1. Or equal.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.

C. Colors: Three color scheme as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Portland Cement Plaster: 12 percent.

C. Portland Cement Plaster Substrates: Verify that plaster is fully cured.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

1. SSPC-SP 2.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. The number of coats scheduled is the minimum number of coats required. Additional coats shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color, and to produce satisfactory finish results.

3. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
4. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
5. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
7. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards and switch gear.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Tanks that do not have factory-applied final finishes.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Primer, alkali resistant, water based, 247 ACRY-SHIELD, MPI#3.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, semi-gloss, 1250 ACRY-SHIELD (MPI Gloss Level 5), MPI #11, 163.

B. Steel and Iron Substrates:

1. Water-Based Architectural Coating System:

a. Prime Coat: Primer, rust inhibitive, water based, 1710 KEL-GUARD, MPI #107.
b. Intermediate Coat: Architectural coating, exterior, water based, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss, 1250 ACRY-SHIELD (MPI Gloss Level 5), MPI #11, 163.

C. Galvanized-Metal Substrates:

1. Latex System:

a. Prime Coat: Primer, galvanized, water based, 1440 DEVCRYL, MPI #134.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss, 1250 ACRY-SHIELD (MPI Gloss Level 5), MPI #11, 163.

D. Wood Substrates: Glued-laminated construction.

1. Latex System:

a. Prime Coat: Primer, latex for exterior wood, 255 ACRY-SHIELD, MPI #6.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss, 1250 ACRY-SHIELD (MPI Gloss Level 5), MPI #11, 163.

E. Portland Cement Plaster Substrates:

1. Latex System:

a. Prime Coat: Primer, alkali resistant, water based, 247 ACRY-SHIELD, MPI #3.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior semi-gloss, 1250 ACRY-SHIELD (MPI Gloss Level 5), MPI #11, 16

END OF SECTION 09 91 13

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior substrates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.4 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products from Dunn-Edwards Paints for the paint category indicated, or a comparable product by one of the following:

1. Or equal.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 100 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.

C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

1. Colors: Three color scheme as selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 2.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

H. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.

4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. The number of coats scheduled is the minimum number of coats required. Additional coats shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color, and to produce satisfactory finish results.
3. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
5. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
6. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
7. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in occupied spaces:

a. Equipment, including panelboards.
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Plastic conduit.
g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
h. Other items as directed by Architect.

2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, alkali resistant, water based, 247 ACRY-SHIELD.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54.

B. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, rust inhibitive, water based, 1711 KEL-GUARD, MPI #107.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54.

C. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, galvanized, water based, 1440 DEVACRYL, MPI #134.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54.

D. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, water based, 1440 DEVACRYL, MPI #134.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54.

E. Wood Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer, latex, for interior wood, 973 ACRY-PLEX, MPI #39.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54.

F. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:
a. Prime Coat: Primer sealer, latex, interior, 971 ACRY-PLEX, MPI #50.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, semi-gloss, 1520 ENVIRO-COAT, (MPI Gloss Level 5), MPI #54

END OF SECTION 09 91 23

SECTION 10 14 23 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Panel signs.
2. Room-identification signs.
3. Field-applied, vinyl-character signs.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.

1. Include representative Samples of available typestyles and graphic symbols.

D. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Panel Signs: Full-size Sample.
2. Room-Identification Signs: Full-size Sample.
3. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.

E. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

B. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs. 2019 CBC 11B-216 & 11B-703

2.2 ROOM IDENTIFICATION, RESTROOM IDENTIFICATION, INFORMATIONAL AND DIRECTIONAL SIGNS

A. Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide:

    a. Advance Corporation Braille-Tac magnesium sign systems.
    b. Or approved equal.

2. Signage Construction: Exterior rated Magnesium construction with painted finish.
3. Painted finish shall comply with the following performance requirements:

    a. Weatherability - When tested in accordance with ASTM G 53, after 500 hours in a Weatherometer (equivalent to 3 years of exterior exposure) gloss retention of not less than 88.0 determined in accordance with ASTM d 523 at a 60 degree angle.
    b. Color Fade Resistance - Color shall not change more than 1.68 units determined in accordance with ASTM D 2244 and measured with a Hunter colorometer, Model D25.
    c. Durability - Sign finish shall show no effect after requested use of cleaners such as Graffiti Remover #1120 manufactured by Fine Organics Corp., Lodi, NJ.

4. Thickness: 0.153 inch.
5. Size: As indicated on Drawings.
6. Edge Condition: As indicated on Drawings.
7. Corner Condition in Elevation: As indicated on Drawings.
8. Mounting: Surface mounted to wall with countersunk flathead through fasteners.
9. Text and Typeface: Accessible raised characters and Braille, typeface matching Architect's sample. Finish raised characters to contrast with background color, and finish Braille to match background color.
10. Flatness Tolerance: Sign panel shall remain flat or uniformly curved under installed conditions as indicated and within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.

2.3 FIELD-APPLIED, VINYL-CHARACTER SIGNS

A. Field-Applied, Vinyl-Character Sign: Pre-spaced characters die cut from 3- to 3.5-mil (0.076- to 0.089-mm) thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

1. Basis of Design Product: Subject to compliance with requirements, provide:

    a. 3M Premium Quality Pressure Sensitive Marking Film
    b. Or approved equal.

2. Size: As indicated.
3. Substrate: Glass.
4. Text and Font: As indicated.

2.4 ACCESSORIES

A. Fasteners and Anchors: Non-corrosive and compatible with each material joined, and complying with the following:

1. Counter-sunk, vandal-resistant, tamper-proof screws.

B. Adhesives: As recommended by sign manufacturer and with a VOC content of 70g/L or less for adhesives used inside the weatherproofing system and applied on-site when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.

2.6 GENERAL FINISH REQUIREMENTS

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

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 MAGNESIUM FINISH

A. Surface Preparation: Remove mill scale and rust, if present, and prepare for coating according to coating manufacturer's written instructions.

B. Baked Acrylic Polyeurethane Enamel: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish to a minimum dry film thickness of 2 mils (0.05 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Wall Surfaces: Anchor signs with counter-sunk, vandal-resistant, tamper-proof screws and silicone adhesive.

a. Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
b. Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive.
c. Paint heads of screws to match the plaque background color. Visible screw holes are not acceptable on plaques that do not require screws.

2. Glass Surfaces: Anchor signs with silicone adhesive.

a. Clean substrate surface. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in

position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

b. Provide opaque sheet matching sign material, size and finish onto opposite side of glass to conceal back of sign.

C. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23

SECTION 10 21 13 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Solid-color reinforced composite toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:

1. Division 10 Section "Toilet and Bath Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.
4. Show overhead support or bracing locations.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for units, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" for toilet compartments designated as accessible.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

C. Brass Castings: ASTM B 584.

D. Brass Extrusions: ASTM B 455.

E. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

F. Stainless-Steel Castings: ASTM A 743/A 743M.

G. Adhesives: Manufacturer's standard product that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the

Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 SOLID-COLOR REINFORCED COMPOSITE UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide:

1. Bobrick Washroom Equipment, Sierra Series

2. Or approved equal.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Wall Mounted

D. Door, Panel, Screen, and Pilaster Construction: Solid, solid-color reinforced composite panel material, not less than 3/4 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.

1. Color and Pattern: One color and pattern in each room as selected by Architect from manufacturer's full range.

E. Pilaster Shoes and Sleeves (Caps): Manufacturer's standard design; stainless steel.

F. Urinal-Screen: Manufacturer's standard flange bracket, 12” o.c.

G. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
   a. 18 gauge at toilet compartments
   b. Provide through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Through-bolted fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's standard continuous, 16 gauge, cam type that swings to a closed or partially open position.
   a. Attach to door and stile with theft-resistant, pin-in-head Torx stainless steel machine screws into factory installed, threaded brass inserts. Threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per insert.
3. Latch and Keeper: Manufacturer's standard surface-mounted sliding latch unit requiring less than 5-lb of force to operate.

a. Attach latch track to door with machine screws into factory installed threaded brass inserts. Threaded brass inserts shall be factory installed for door hinge and latch connections and shall withstand a direct pull exceeding 1,500 lbs. per insert.
b. Secure latch keeper to stile with through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners. Fasteners shall withstand direct pull force exceeding 1,500 lbs. per fastener.

4. Coat Hook: Secured to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Through-bolted fasteners shall withstand a direct pull force exceeding 1,500 lbs. per fastener.
5. Door Bumpers: Two 11-gauge (3mm) stainless steel door stop plates with attached rubber bumpers at each door.
6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Install below latch.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Unless otherwise noted, provide manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13

SECTION 10 28 00 - TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Warm-air dryers.
2. Public-use washroom accessories
3. Under lavatory guards

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Bobrick Washroom Equipment, Inc.
2. Or approved equal.

B. Toilet Tissue (Roll) Dispenser:

1. Product: Bobrick B-3888
2. Description: Double-roll dispenser.
3. Mounting: Recessed
4. Material and Finish: Stainless steel, No. 4 finish (satin).

1. Product: Bobrick B-685
2. Description: Sigle-roll dispenser.
3. Mounting: Surface mount
4. Material and Finish: Stainless steel, No. 4 finish (satin).

C. Grab Bar:

1. Product: Bobrick B-5806.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.

a. Finish: Smooth, No. 4 finish (satin).

4. Outside Diameter: [1-1/4 inches (32 mm)] [1-1/2 inches (38 mm)].

5. Configuration and Length: As indicated on Drawings.

D. Mirror Unit:

1. Product: Bobrick B-165 2436
2. Frame: Stainless-steel channel.

a. Corners: Mitered and mechanically interlocked.

3. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

a. Wall bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.

4. Size: 18 inches by 30 inches.

E. Liquid-Soap Dispenser:

1. Product: GOJO ADX-12 Dispenser Dimensions
2. Mounting: Vertically oriented, surface mounted.
3. Material and Finish: Factory

F. Combination Towel (Folded) Dispenser Receptacle

1. Product: Bobrick B-26212
2. Description: Combination unit for dispensing C-fold or multifold towels, with removable waste receptacle
3. Mounting: Surface
4. Material and Finish: Stainless steel, No. 4 finish (satin).

G. Sanitary-Napkin Disposal Unit

1. Product: Bobrick B270
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

H. Seat-Cover Dispenser:

1. Product: Bobrick B221
2. Mounting: Surface mounted.
3. Material and Finish: Stainless steel, No. 4 finish (satin).

2.2 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
1. Bobrick Washroom Equipment, Inc.

B. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick B-239.

2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Length: 36 inches (914 mm).
4. Hooks: Four.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
    b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.3 ER LAVATORY GUARDS

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

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

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

2.4 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Provide solid blocking behind both Contractor-furnished and Owner-furnished accessories.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10 28 00

SECTION 11 68 16 - PLAY STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The extent of work in this Section includes the provision and installation of the play structures with miscellaneous hardware, foundations and appurtenances required for installation.

B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:

1. Apex Climber.
2. Classic Stepping Columns.
3. Elephant Play Slide.
4. Mini City Play House with traffic light.
5. Play Panels.
6. Sensory Maze Small Tunnel.
7. Welcome Sign (risk management sign).

C. Related Sections include the following:

1. Specification Section 32 13 13.1 Concrete Work (Landscape).
2. Specification Section 32 18 13 Synthetic Grass Surfacing.
3. Specification Section 32 18 16.13 Playground Protective Surfacing.
4. Division 31 for Grading.

D. Prior to bidding:

1. Contractor shall review play components with manufacturer representative and include in their bid special delivery, delivery lead times and off-loading requirements (according to size, weight and proportions of play components), recommended rigging procedures, protection and security of play components prior to installation, manufacturer recommended footings and installation procedures.
2. Contractor shall review manufacturer’s installation manual and include recommended procedures in their bid.

1.03 REFERENCES AND STANDARDS

A. ASTM: American Society for Testing and Materials.

B. CPSC: Consumer Product Safety Commission.

C. IPEMA: International Playground Equipment Manufacturer's Association.

D. ADA: Americans with Disabilities Act.

E. ISO: International Organization for Standardization.

F. CPSI: Certified Playground Safety Inspector by the National Recreation and Park Association.

1.04 QUALITY ASSURANCE

A. All manufactured items shall be inspected and approved upon delivery by Contractor.

B. Unless otherwise specified, install all materials in accordance with manufacturer's recommendations.

C. Play structure manufacturer shall carry International Organization for Standardization (ISO) certification ISO 9001 for customer focused, emphasizing continuous improvement in quality and ISO 14001 for operating in a manner that is environmentally conscious.

D. Play structure manufacturer shall be a member in good standing with the International Play Equipment Manufacturers Association (IPEMA), and be Third Party Certified conforming to ASTM F1487-11, excluding sections 7.1.1, 10 and 12.6.1 Standard Consumer Safety Performance Specification for Playground Equipment for Public Use.

E. Play structure and installation methods shall conform to the U.S. Consumer Product Safety Commission (CPSC) "Public Playground Safety Handbook" (Publication No. 325 CPSC, www.cpsc.gov/PageFiles/122149/325.pdf).

F. Contractor installing play structure shall have installed at least 20 play structures of similar magnitude, size and complexity within the last 5 years on a DSA approved California school campus.

G. Play structure shall conform to regulations published in the Code of Federal Regulations (CFR) for the following:

1. 16 CFR 1303 Ban of Lead-containing paint and certain consumer products bearing lead-containing paint.
2. 16 CFR 1501 Method for identifying toys and other articles intended for use by children under 3 years of age which present choking, aspiration or ingestion hazards because of small parts.
3. 15 CFR 1500.48 Technical requirements for determining a sharp point in toys and other articles intended for use by children under 8 years of age.

H. Design and installation shall meet or exceed the Americans with Disabilities Act (ADA) "2010 ADA Standards for Accessible Design" and CBC 2019.

I. Play structure finishes shall conform to the following:

1. ASTM D 522 for flexibility.
2. ASTM D 4541 for adhesion.
3. ASTM D 2794 for impact resistance.

4. ASTM D 523 for gloss.
5. ASTM D 4060 for taber abrasion.
6. ASTM D 638 for tensile strength.
7. ASTM D 638 for % elongation.
8. ASTM D 2247 for humidity resistance.
9. ASTM B 117 for salt spray.
10. ASTM G 53 for QUV.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for play structure(s) conforming to requirements of Division 01, Section 01 33 00 “Submittal Procedures”. Submit the following:

1. Play structure manufacturer and manufacturer’s representative’s name(s) and address(es).
2. Plan view drawings with model numbers, descriptive labels (including component names), deck heights, and notations of compliance with CPSC, ASTM F1487 and ADA.
3. Detailed component list with model numbers and catalog descriptions.
4. Manufacturer’s Standard Color Chart.
5. Written material specifications for all components.
6. IPEMA certification certificate from the IPEMA website.
7. Copy of manufacturer’s warranty in certificate format.
8. Copy of manufacturer’s ISO 9001 Certification.

B. Spare or replacement parts, if provided, and/or maintenance care instructions shipped with components shall be delivered to Owner’s Representative prior to substantial completion.

C. Third Party Certified Playground Safety Inspector (CPSI): Identify third party safety inspector name, address and phone number Contractor shall retain for installation inspection.

1.06 WARRANTY/GUARANTEE

A. The structure manufacturer shall warrant material and workmanship against defects, from the date of manufacturer’s invoice, for the period of time as follows:

1. Limited Warranty for as long as you own the product against structural failure due to corrosion or defects in materials and workmanship on aluminum decks, steel deck posts, clamping/fastening and associated fastening hardware.
2. Limited fifteen (15) year warranty against structural failure due to corrosion or defects in materials and workmanship on steel support legs, steel components including railings, rungs and rigid climbers.

B. Contractor shall guarantee installation workmanship for a period of one year from the date of substantial completion of the project. The Contractor shall be responsible for coordi-

nating manufacturer material warranty items with the manufacturer/distributor and for the installation of replacement materials(s) at no additional cost to the owner.

1.07 DELIVERY, STORAGE AND HANDLING

A. Contractor shall schedule delivery and receive play structures specified within this Specification whether purchased as part of this project or purchased by Owner. Receiving process shall include offloading play structure and accompanying components, taking inventory, accepting delivery and follow-up in event parts are missing and/or damaged, to ensure all components required are delivered in good condition.

B. Contractor shall contact play structure supplier and/or delivery company and verify size and weight of items delivered and provide adequate equipment to facilitate safe and proper offloading procedures acceptable to the manufacturer.

C. Store and handle products so as not to impede work of others.

D. Protect products from damage and/or theft during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structure: See drawings and details for type, style, configuration, size and height of play structure(s) to be provided.

B. Colors: Shall be selected from manufacturer's standard colors.

C. Model and Manufacturer: Refer to Miracle Play Systems Quote #Q-03521 and Timberform Quote #033921

Description	Manufacturer	Model #	Local Rep
Play Panels:			
Bus Stop Panel	Miracle Play Systems	715-6B	Miracle Play Systems
Clock Panel	Miracle Play Systems	904	
Electronic Piano Panel	Miracle Play Systems	715-16	
Gear Panel	Miracle Play Systems	761-3	
Magical Music Panel	Miracle Play Systems	714-715-206	
Very Buried Panel	Miracle Play Systems	714-715-203	
Xylophone Panel	Miracle Play Systems	975-3	
1. Mini City Playhouse	Miracle Play Systems	MR0882	
2. Sensory Maze Small Tunnel	Miracle Play Systems	Arch and play panels per quote	
3. Welcome Sign	Miracle Play Systems	787-001	

Description	Manufacturer	Model #	Local Rep
1. Apex Climber	Timberform	1672-M	Ted Jonsson
2. Classic Stepping Columns	Timberform	4500-501	Ted Jonsson
3. Elephant Play Slide	Miracle Play Systems		Miracle Play Systems

Local Representative(s):	Phone	Website	Email
Jean Tyan	(650) 930-0459	www.miracleplaygroup.com	jean@miracleplaygroup.com
Ted Jonsson	(888) 460-7275	www.parkpacific.com	Sales@parkpacific.com

D. Contractor Owner shall purchase touch-up paint for each color of powder coated products for use as needed after installation. Deliver un-used touch-up paint to Owner prior to substantial completion.

PART 3 - EXECUTION

3.01 SEQUENCING AND SCHEDULING

A. Coordinate construction timing with installation of site furnishings in conformance with other pertinent Sections of the Specifications.

3.02 INSTALLATION

A. Contractor shall coordinate installation of play structure with installation of perimeter curbing, subsurface drainage, underground utilities, base installation and resilient surfacing installation.

B. Contractor shall lay out footing locations and obtain manufacturer approval on safety clearances in writing prior to installation of adjacent hardscape.

C. Resilient Surfacing:

1. Contractor shall review sub-base per safety requirements.
2. Contractor shall review resilient surfacing area prior to installation of play structure. Contractor shall verify fall attenuation is adequate for proposed play structure fall heights and verify Americans with Disabilities Act (ADA) access to points of entry and exit.

D. Concrete Footings: Install footings with top of concrete sloped to drain at 1%. Install where shown on drawings and as detailed and per manufacturer's instructions.

E. Installation instructions, detailed, printed installation instructions, written in English, shall be provided by the manufacturer which shall include detailed, scaled plan views, elevations and footing drawings and details when applicable, as well as sequential assembly instructions to assure proper installation of the playground structure(s).

F. Contractor shall install play structure according to manufacturer's installation instructions.

G. Contractor shall keep site clean. Tools, trash, debris and surplus installation materials shall be removed on a daily basis.

H. Materials may be stored on site during installation with appropriate protective measures for job site safety and to protect from theft.

3.03 FIELD QUALITY CONTROL

A. Contractor shall retain the services of a Certified Playground Safety Inspector (CPSI). The play structure shall be inspected after installation by a Certified Playground Safety Inspector (CPSI), not employed by the installer, and Contractor shall obtain sign-off ensuring play structure meets the current national standards set by the American Society for Testing and Materials (ASTM) and U.S. Consumer Product Safety Commission (CPSC), by said CPSI before the play structure is open for use.

B. In the event installation does not meet or exceed American Society for Testing and Materials (ASTM) and U. S. Consumer Product Safety Commission (CPSC) Guidelines upon inspection, installing Contractor shall correct deficiencies and reimburse Owner for re-inspection by Certified Playground Safety Inspector (CPSI) until deficiencies are correct and installation is certified by Certified Playground Safety Inspector (CPSI).

3.04 CLOSE-OUT

A. Contractor shall provide Owner's Representative with written certification of installation by Certified Playground Safety Inspector.

B. Contractor shall provide Owner's Representative with one (1) copy of complete manufacturer's installation instructions and maintenance kit, if provided.

C. Contractor shall deliver spare and/or replacement parts, if provided, to Owner's Representative prior to substantial completion.

D. Contractor shall purchase and deliver touch-up paint for each powder-coat color represented on play structure(s) to Owner's Representative.

END OF SECTION

SECTION 12 93 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.

1.2 SUMMARY

A. The extent of work in this Section includes the provision and installation of the site furnishing equipment and structures with all miscellaneous hardware, foundations and appurtenances required for installation.

B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:

1. Hand Pump.
2. Tree Gate.

C. Related Sections include the following:

1. Specification section 32 13 13.1 “Concrete Work (Landscape)” for concrete footings and bases.

1.3 QUALITY ASSURANCE

A. All manufactured items shall be inspected and approved upon delivery.

B. Unless otherwise specified, install all materials in accordance with manufacturer’s recommendations.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for site furnishings conforming to requirements of Front-End Specifications.

B. Product Warranty, spare or replacement parts, and/or care instructions shipped with components shall be delivered to Owner prior to substantial completion.

1.5 DELIVERY, STORAGE AND HANDLING:

A. Store and handle products so as not to impede work of others.

B. Protect products from damage or theft during delivery, handling, storage and installation.

C. Contractor shall schedule delivery and receive site furnishings contained within this Specification whether purchased as part of this project or purchased by Owner as part of this project. This shall include unloading site furnishings, taking inventory and accepting delivery.

PART 2 - PRODUCTS

2.1 MATERIALS

Description	Manufacturer	Model
Hand Pump	Goric Marketing Group	55700480
Tree Grate	Neenah Foundry	R-8710 48” square

Manufacturer	**Local Representative**	**Phone**	**Website**
Goric Marketing Group		(617) 744-0772	www.Goric.com
Neenah Foundry	Chris Orme chris.orme@neenahenterprises.com	(626) 277-5013	www.groupnei.com

PART 3 - EXECUTION

3.1 SEQUENCING AND SCHEDULING:

A. Coordinate construction timing with installation of site furnishings in conformance with other pertinent Sections of the Specifications.

3.2 INSTALLATION

A. Site Furnishings: Install where shown on drawings, as detailed and per manufacturer instructions. All site furnishings shall be secured in a vandal resistant manner acceptable to the Architect.

B. Sports Equipment: Install where shown on drawings, as detailed and per manufacturer instructions.

C. Concrete Footings: Install footings with top of concrete sloped to drain at 1%. Install where shown on drawings and as detailed and per manufacturer's instructions.

D. Sleeves: Install site furnishings, standards and posts into sleeves embedded into concrete bases for removal and replacement where indicated or detailed on drawings.

END OF SECTION

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SECTION 22 00 00 - PLUMBING GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. Paint all exposed piping and supports.

B. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

D. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

E. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

F. Pipes which pitch have right-of-way over those which do not pitch. For example, condensate drains and waste normally have right-of-way.

G. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to be installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

B. Provide materials and equipment bearing the label of, or listed by, the Underwriter’s Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

C. Furnish all materials and equipment of the same type by the same manufacturer.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

E. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.

2. Make Corrections Noted. No Resubmittal Required.

3. Revise and Resubmit.

4. Rejected.

5. Not Reviewed.

F. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.

2. Date.

3. Name and address of Architect and Engineer.

4. Name of Owner.

5. Name, address and contact information of Contractor.

6. Names and contact information of sub-contractor, manufacturer, and supplier.

7. Name of entity that prepared submittal.

8. Category and type of submittal.

9. Specification Section number and title.

10. Drawing number and detail references, as appropriate.

11. Transmittal number, numbered consecutively, and revision number clearly identified.

12. Each item submitted labeled or identified the same as on the drawings.

G. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

H. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

I. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

J. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of piping and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of piping. Field verify all dimensions.

B. The exact locations of equipment and piping shall be ascertained from the Architect or the Owner's representative in the field. The Architect reserves the right to make minor changes in the location of piping and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Pipe size and routing.
4. Dimensional changes to drawings.
5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

F. Do not operate water systems until piping has been cleaned, disinfected and start-up strainers are in place.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 FURRING AND PIPE SPACES

A. Spaces provided in the design of the building shall be utilized and the work shall be kept within the furring lines established on the Drawings.

B. Ensure necessary clearances on trim plates at exposed penetrations of walls and floors. If sufficient room is not available above suspended ceiling or vertical shafts obtain clarification from Architect before work is started.

3.9 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of piping or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

D. Provide sleeves for all piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1” clearance all around between sleeve and piping. When piping is insulated, insulation shall pass continuously through sleeve with 1” clearance between insulation and sleeve or hole in existing construction.

3.10 ACCESS

A. Indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24” x 24” unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.11 SEISMIC RESTRAINTS

A. All equipment, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

B. Piping shall be braced as follows:

1. Brace all gas piping that is 1" nominal diameter and larger.

2. Brace all piping located in mechanical equipment rooms that is 1 1/4" nominal diameter and larger.

3. Brace all piping that is 2 1/2" nominal diameter and larger.

4. Transverse bracings at 40'-0" on center maximum (minimum of one brace per direction of run).

5. Longitudinal bracings at 80'-0" on center maximum (minimum of one brace per direction of run).

6. Transverse bracing shall be 20'-0" on center maximum and longitudinal bracing at 40'-0" on center maximum for gas piping and piping in mechanical rooms.

7. Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe section connected perpendicular to it, if the bracing is installed within 24" of the elbow or tee and is connected to the largest pipe.

8. Do not use branch lines to brace main lines.

9. Provide flexibility in joints where pipes pass through building seismic or expansion joints or where rigidly supported pipes connect to equipment with vibration isolators.

10. At vertical pipe risers, support the weight of the riser at a point or points above the center of gravity of the riser wherever possible. Provide lateral guides at the top and bottom of the riser and at intermediate points not to exceed 30'-0" on center.

11. No bracing is required if the top of single pipe is suspended 12" or less from the connection point at the supporting structural member.

3.12 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.13 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping or equipment within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.14 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.15 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.

C. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.16 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.17 TESTING

A. Test all equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.18 OPENINGS

A. Locating and sizing of all openings for piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.19 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner’s premises shall be left clean, and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

3.20 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner’s operating and maintenance personnel.

B. Instruct the Owner’s operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.21 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.

2. Identifying equipment manufacturer, product name, and model number.

3. Locations.

4. Wiring Diagrams.

5. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.

6. Assembly and disassembly instructions.

7. Startup procedures.

8. Routine and normal operating instructions.

9. Normal and emergency shutdown instructions.

10. Troubleshooting diagnostic instructions.

11. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION 220000

SECTION 22 05 00 - PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 22 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete plumbing and piping systems which shall include, but not limited to fixtures, equipment, piping, valves, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Plumbing fixtures and trim.
2. Water Heaters.
3. Piping and fittings.
4. Insulation.
5. Pipe hangers and supports.
6. Valves.
7. Drains and cleanouts.
8. Trap primers and water hammer arrestors.
9. Coordination Drawings: plans and details, drawn to scale, on which piping is shown and coordinated with other installations, using input from installers of the items involved.
10. Welding certificates.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

1.4 QUALITY ASSURANCE

A. Steel support welding qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel."

B. Pipe welding qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Each length of pipe, fitting, trap, fixture, or device used in any piping system shall be stamped or indelibly marked with type, weight, quality, and manufacturer's name or mark.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pipes shall be shipped so as not to bend, dent, or otherwise damage the pipe during transport. Contractor shall take all necessary precautions to prevent damage to pipe and fittings during delivery and unloading. Any pipe found to have been damaged due to improper handling shall be removed from the jobsite at Contractor's expense.

B. Handling flammable liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

C. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

D. Store and handle pipes and tubes having factory-applies protective coatings to avoid damaging coating, and to protect from direct sunlight.

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES, TRIM AND ACCESSORIES

A. See Schedules on Drawings for plumbing fixtures. Furnish and install all fixtures in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

B. Fixture locations and heights as shown on Architectural Drawings.

C. Comply with applicable provisions and recommendations of CALGreen for water conservation measures.

D. Provide fixtures complete with all trim and materials, fittings, supports, fastening devices, faucets, valves, traps, and appurtenances required.

E. Lavatories and sinks shall be provided with required number of holes by faucet only, unless otherwise specified or required.

F. Install fixtures level, plumb and set at right angles to wall, floor, or both unless otherwise indicated.

G. Make connections between fixtures and waste pipe gastight and watertight with neoprene type gaskets or bowl wax.

H. Where fittings, trim, and accessories are exposed or semi-exposed, provide chrome plated 17 gauge seamless brass.

I. Where fixture supplies and drains penetrate walls, provide chrome plated brass escutcheons with setscrews.

J. Vitreous china: unmarked, true, clear, smooth and bright. Color shall be white unless otherwise indicated.

K. Porcelain lined ware: constructed of smooth, sound iron castings, properly finished, and provided with first quality, high temperature enamel.

2.2 ELECTRIC WATER HEATERS

A. Refer to schedule on Drawings for capacities, recovery rates and electrical characteristics.

B. Acceptable manufacturers: A.O. Smith, Bradford White, or approved equal.

C. Heater shall be ETL or UL listed and shall bear the UL or ETL label.

D. Heater shall meet the energy efficiency requirements of California Title 24.

E. Internal surfaces exposed to water shall be glasslined with an alkaline borosilicate composition fused to steel at 1600°F.

F. Heating elements shall be medium watt density. Each heating element shall be controlled by an individually mounted thermostat and high temperature cutoff switch.

G. Heater shall be provided with anodic protection.

H. Insulation: Factory installed foam insulation with heat loss not to exceed ASHRAE Standard 90.1 and California Title 24. With steel cover with factory backed enamel finish.

I. Provide a minimum two (2) year manufacturer’s commercial installation warranty for the entire unit.

J. Water heater shall be seismically braced in accordance with California Plumbing Code.

2.3 WATER PIPING AND FITTING MATERIALS

A. All water piping shall comply with NSF/ANSI Standard 372 for low lead requirements.

B. Above Grade: ASTM B88, Type L copper tubing, hard temper with wrought copper fittings.

C. Below Grade: ASTM B88, Type K copper tubing, hard temper with wrought copper fittings.

D. Joints: 1/2" to 1-1/2” pipe sizes soldered using ASTM B32, lead-free alloys. Include water-flushable flux according to ASTM B813. 100 percent lead free, 95 percent tin and 5 percent antimony composition, silver bearing solders unless otherwise indicated.

E. Joints: 2” and larger pipe sizes brazed using AWS A5.8/A5.8M, AWS BCuP Series copper-phosphorous alloys.

F. Water Hammer Arrestors: Provide at quick closing valves such as flush valves, etc. Certified under Plumbing and Drainage Institute Standard WH201 and by ASSE Standard 1010.

G. Select and size water hammer arrestors in accordance with Plumbing and Drainage Institute Standard WH201. Install above ceilings or behind wall access door at each plumbing fixture, or where plumbing fixtures are installed in groups, at each group of fixtures.

H. Insulation: Insulate outdoor piping with 1” Glass Fiber Insulation and 0.016 aluminum jacket.

2.4 HOT WATER PIPING INSULATION

A. Acceptable manufacturers: Johns Manville, Owens Corning, Knauf.

B. Glass Fiber: Conforming to ASTM C547, rigid molded, non-combustible.

1. Installed thermal conductivity: 0.23 btu-inch per hour-ft^2-°F at 75°F.

2. 1” thickness.

3. Owens-Corning SSLII with ASJ max or other equal.

C. All insulated piping installed indoors shall be protected with PVC jacketing.

D. All insulated piping installed outdoors or in exposed locations shall be in protected with 0.016 inch thick aluminum jacketing.

E. All insulation shall be installed in accordance with California Energy Code.

2.5 WATER PIPING VALVES

A. All valves shall be the product of a single manufacturer. Milwaukee, NIBCO, Stockham, Crane, or approved equal. 125 PSIG steam service rated and 300 PSIG air and water rated. All valves shall be low lead type per NSF/ANSI Standard 372.

B. Provide valves with screwed or flanged ends as required by the piping system in which they are installed.

C. Shut-off valves 2 inches and smaller: Ball Valve. Bronze body, two piece, full port, extended handle that allows operation of valve without disturbing the insulation.

D. Shut-off valves 2 1/2 inches and larger: Gate Valve. Iron body, resilient wedge, outside screw and yoke.

E. Check valves: Bronze body, swing check, screwed. Provide non-slam check on pumped equipment or quick closing fixtures.

F. Relief valves: Bronze body, spring and diaphragm combination pressure and temperature relief valves with test lever and automatically resetting type thermostatic element. Tested under ANSI Z21.22 and rated relief capacities greater than water heater's input rating.

2.6 WASTE AND VENT PIPING AND FITTING MATERIALS

A. Above Grade Waste: Hubless cast iron soil pipe and fittings, service weight per ASTM A888 and Cast-Iron Soil Pipe Institute Standard (CISPI) 301. Couplings conforming to ASTM and CISPI 310; stainless steel covered neoprene gasket sleeve and stainless steel clamps.

B. Below Grade Waste and Vent: ABS-DWV (SDR-35) per ASTM D2751 and IAPMO approved with solvent weld socket fittings.

C. Above Grade Vent: ABS-DWV Schedule 40 per ASTM D2661 and IAPMO approved with solvent weld socket fittings.

D. Waste piping below grade at floor sinks or floor drain in mechanical/custodial rooms shall be Schedule 40 CPVC-DWV and IAPMO approved with solvent weld socket fittings.

E. Traps: Provide traps at all fixtures connected to waste systems, except for fixtures having integral traps. Type of trap(s) shall be approved by local codes and be of same material as piping system. Exposed traps for fixtures shall be chrome plated 17 gauge brass.

F. Trap Primers: Pressure drop activated brass trap seal primer with view holes and removable filter screen and requires no adjustments or air pre-charge. Select appropriate model for number of drains being served. Precision Plumbing Products, MIFAB, or approved equal.

G. Drains: Size of drain outlets shall be same as connecting pipe and as indicated on Drawings. Provide trap primer connections on all drains. Drain outlet as required for connection to piping.

H. Temperature and Pressure Relief Drain: Material shall be rated at not less than the operating temperature of the system and approved for such use or shall comply with ASME A 112.4.1.

I. Cleanouts: Install cleanouts of same diameter as pipe (4 inch maximum) where indicated or required by code. Cleanouts shall be installed at all points of change in direction and in horizontal waste lines over 50 feet inside building and 100 feet outside building. Locate minimum 18 inches away from building construction to allow sufficient space for rodding.

1. Provide cleanouts in waste drop from each sink and urinal. Provide one wrench for each size and type of cleanout used.

2. Floor Cleanouts: ZURN Z1400 series, or approved equal. Nickel-bronze, round top, with vandal proof screws.

3. Wall Cleanouts: ZURN Z1446 series, or approved equal with stainless steel cover and vandal proof screws.

4. Unfinished Areas: Zurn Z1440, or approved equal. Cast iron cleanout.

5. Grass or Planting Area: Zurn Z1449, or approved equal. Locate in concrete box and cover.

2.7 CONDENSATE DRAIN PIPING

A. Condensate drain piping shall be type DWV copper with wrought copper fittings.

B. Condensate drain between condensing gas fired equipment and neutralization kit shall be schedule 40 PVC with solvent weld fittings per ASTM D1785.

C. Condensate drain piping inside building shall be insulated with 1” thick closed cell elastomeric foam insulation. Armaflex, Aeroflex, or approved equal.

2.8 UNIONS AND FLANGES

A. Install Watts, Epco, Nibco, or equal, dielectric unions or flanges at points of connection between copper or brass piping or material and steel or cast iron pipe or material except in drain, waste, or vent piping. Dielectric unions installed in potable water systems shall conform to lead free requirements.

B. Install unions in piping 2” and smaller and flanges in piping 2 1/2" and larger at each connection to all equipment, tanks, and automatic valves.

C. Locate unions for easy removal of equipment, tank, or valve.

2.9 PIPE HANGERS AND SUPPORTS

A. Provide adequate supports, hangers, guides, thrusters, etc. as necessary to allow for proper movement of the piping at the building seismic joints and at the thermal expansion loops and flexible connectors, taking into account the pipe size, flex connection type, required seismic movement and system operating temperature and pressure.

B. Acceptable manufacturers: B-line, Tolco, Superstrut, Unistrut, or approved equal.

C. Plumbers tape or sheetmetal straps shall not be used for hanging or supporting of pipes.

D. Support horizontal piping in accordance with the following schedule:

Pipe Size (inches)	Maximum Hanger Spacing (feet)						Hanger Rod Diameter (inches)		
	Steel	Cast Iron	Copper	Plastic			Steel / Cast Iron	Copper	Plastic
				CPVC	PVC	PP			
Up to 1	7	-	5	3.5	3	2.75	3/8	3/8	3/8

Pipe Size (inches)	Maximum Hanger Spacing (feet)						Hanger Rod Diameter (inches)		
	Steel	Cast Iron	Copper	Plastic			Steel / Cast Iron	Copper	Plastic
				CPVC	PVC	PP			
1 1/4	9	-	7	3.5	3	2.75	3/8	3/8	3/8
1 1/2 & 2	9	5	8	3.5	3.5	2.75	3/8	3/8	3/8
2 1/2	12	5	9	3.5	3.5	3.5	1/2	1/2	1/2
3	12	5	10	3.5	3.5	3.5	1/2	1/2	1/2
3 1/2	-	5	11	-	-	-	5/8	1/2	-
4	12	5	12	4	4	4	5/8	5/8	5/8
5	12	5	13	4	4	4	5/8	5/8	5/8
6	12	5	14	4	4	4	3/4	3/4	3/4
8 to 12	12	5	14	4	4	4	7/8	3/4	7/8

E. Provide hangers at each change in direction and both sides of valves 4-inch and larger. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

F. Support piping on the roof in accordance with the following schedule:

Nominal Pipe Size (inches)	Spacing of Supports (feet)
1/2	6
3/4 or 1	8
1 1/4 or larger	10
1 1/4 or larger (Vertical)	Every floor level

PART 3 – EXECUTION

3.1 PIPE SIZES TO EQUIPMENT

A. Pipe sizes indicated, including required valving, shall be carried full size to equipment served. Any change of size to match equipment connection shall be made within 1’-0” of equipment.

3.2 PIPING GENERAL INSTALLATION

A. Thoroughly clean all pipe and maintain in clean condition during construction temporarily capping or plugging ends of pipe when not being worked on.

B. Cut pipes accurately to measurements established at the site and work into place without springing or undue forcing and out of the way of openings, ductwork, and equipment; ream ends of screwed pipes and tubing to original bore before connecting together.

C. Protect all piping located over switchboards, electrical machinery, or equipment against condensation. Insulate piping and install sheetmetal pan underneath piping running above electrical equipment and panels.

D. Where changes in pipe size occur, use only reducing fittings.

E. Provide screwed unions or flanges in locations required for disconnecting and connecting of all equipment.

F. Pipe runs in masonry and concrete floors shall be sleeved for protection.

G. Chase or sleeve all lines rising in footings and where running concealed through walls.

H. Caulk space between pipes and sleeves in exterior walls and in concrete slabs with graphite packing and waterproof plastic compound; caulk with Dow Corning #3 6548 Silicone RTV Foam per manufacturer's recommendations at fire walls.

I. Place escutcheons, stamped with #16 gauge steel and chromium plated, on pipes passing through sleeves in walls, floors or ceiling where exposed to view within a finished area. Grout in all other lines.

J. Support piping where necessary at sufficiently close intervals (and 24" from each fitting and change of direction) to keep it in alignment and to prevent sagging.

K. Anchor vertical risers with hooks, brackets, or clamps to make rigid.

L. All changes of direction of piping shall be made with fittings. Do not bend pipe.

M. Flash roof vent piping through roof with 24 gauge or heavier galvanized flashing. Make watertight with black fibrous mastic. Extend flashing into roofing felt 12” from pipes.

3.3 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.

2. Cut threads full and clean using sharp dies.

3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.

4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.

2. Bevel plain ends of steel pipe.

3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints:

1. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints:

1. Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints:

1. Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.4 WASTE, VENT AND CONDENSATE DRAIN PIPING INSTALLATION

A. Lay piping in straight lines at a minimum slope of 2 percent in direction of flow of drainage system, unless otherwise noted on the Drawings.

B. Keep stopper in mouth of pipe when pipe when pipe laying is not in process.

C. Make changes in direction with long sweep or bends. Do not change direction of flow more than 90 degrees.

D. Reducing size of drainage piping in direction of flow is prohibited.

E. Make connections of branches to mains with “Y” fittings and 1/8 or 1/16 bends.

F. Install traps and fresh air inlets where required by code regulations.

G. Install traps with offset drain where required to meet ADA clearances.

H. Install trap primers discharge piping appropriate for trap primers installed. Coordinate discharge piping routing and method of connection to inlet side of floor drain and ensure discharge piping has positive drainage towards connection point floor drain. Slope piping at 1/8” per foot.

I. Install cleanouts at ends of horizontal runs in excess of 5’-0” and every 100’-0” of horizontal run.

J. Makeup cleanout plugs with graphite and oil to facilitate easy removal.

K. Extend vents through roof. Vents may be combined in accordance with California Plumbing Code. Arrange piping passing through roofs to be a minimum of 12 inches from walls or other obstructions so as to permit proper flashing.

L. Do not terminate vent outlet less than ten (10) feet from air intakes.

M. Deliver to the owner at completion of work two (2) suitable wrenches for each type of cleanout installed.

N. Take necessary precautions to protect cleanouts during course of construction.

O. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.5 WATER PIPING INSTALLATION

A. Extend piping for hot and cold water, including mains, risers, and supplies to fixtures and indicated equipment. Carry headers for groups of fixtures full size throughout their length.

B. All domestic water piping shall be arranged to drain to low points and to provide for air elimination at high points.

C. All ferrous to non-ferrous pipe connections shall be made with accepted dielectric pipe or flange union isolating joints to prevent any electrolytic action between dissimilar metals.

D. Insulate all domestic hot and hot water return piping and fittings.

E. Make changes in pipe sizes with reducing tees or reducer fittings.

F. Install a shut off valve at domestic water line to each fixture group so that each group can be shut off without shutting down the other parts of the system.

G. Provide shut off valves for all plumbing equipment, fixtures, and fixture trim which do not have supply stop or integral isolation valves included.

H. Arrange and orientate valves, trap primers, water hammer arrestors, etc. in manner accessible for maintenance and/or removal.

I. No water piping will be permitted below slab on grade unless shown on Drawings.

J. Contractor to inquire from Owner the time to make tie-in to existing systems.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure. Comply with OSHPD Preapproval of Manufacturer’s Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

C. Install lateral bracing with pipe hangers and supports to prevent swaying.

D. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

E. Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.

F. Adjust hangers to distribute loads equally on attachments.

G. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

3.7 PAINTING

A. Paint exposed piping, valves, service regulators, and piping specialties per architect's directions.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

C. Refer to Division 09 for additional painting requirements.

3.8 TESTING, ADJUSTING, AND CLEANING

A. Provide testing of all installed domestic water, drainage and vent systems during progress of work. Such tests shall be done in the presence of the Owner's representative, and all Authorities Having Jurisdiction. The inspection authority having jurisdiction and the Engineer shall be notified a minimum of 48 hours prior to performance of all tests so that they may be witnessed.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. Contractor shall provide all apparatus, temporary work, or any other requirements necessary for such tests. Take all due precautions to prevent damage to the building or its contents that may be incurred by such tests as the Contractor will be required to repair and make good, at own expense, any damage caused.

D. Any defects or deficiencies discovered as result of tests shall be immediately repaired and tests shall be repeated until all test requirements are fully met. No caulking of pipe joints to remedy leaks shall be permitted.

E. Waste and Condensate Drain Piping: All waste and condensate drain systems shall be tested hydraulically by filling to the highest vent point with water. Piping may be tested in sections. Each section of drainage piping tested shall have all openings tightly closed with screw plugs, or equal device, and stand without loss of level for a period of 4 hours when filled with water which produces at least a 10-foot head at the highest point of the section tested.

F. Water Piping: All water piping shall be tested to 100 psig with potable water and held for 8 hours without drop in pressure before it is covered and concealed. Equipment and personnel shall be protected from this test pressure. After fixtures are connected, test system for 2 hours at 75 psig or prevailing water pressure, whichever is higher.

G. Adjust and regulate all faucets, valves, water heating equipment, etc. and turn over to the Owner in perfect working order.

H. Upon completion of work, clean all equipment and piping installed under this Section.

3.9 DISINFECTION

A. Upon completion of all tests and necessary replacements, all domestic water piping shall be disinfected. Chlorination shall be accomplished by personnel in direct employ of a firm licensed to do this type of work. After work has been accomplished, provide the Owner and Architect with a statement from the laboratory indicating the water is suitable for human consumption.

B. Prior to testing, flush piping with clean water until clean water free of silt or grit is observed for at least one minute.

C. Comply with local requirements where local code requirements are more stringent. Provide necessary labor, equipment, material, and test kits for chlorine application and tests. Make all arrangements with jurisdictional water authority for witnessing chlorination tests and tests of proper disinfection.

D. Sterilize all parts of building water system with water solution containing 50 ppm of available chlorine for at least a 24 hour contact period. After contact period, flush all parts of system with clear water until system tests at no more than 0.2 ppm residual chlorine.

E. Flush thoroughly and submit bacteriological samples to a certified laboratory which shall certify in writing that the water is suitable for drinking.

3.10 TRAINING AND O&MS

A. Refer to Section 22 00 00 Plumbing General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION 220500

SECTION 23 00 00 - MECHANICAL GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Supplementary Conditions, and Division 01 General Requirements.

1.2 SCOPE OF WORK

A. Provide all labor, apparatus, and materials that are required to provide a complete installation as indicated on the drawings and in the specifications, including that reasonably inferred for proper execution of this Division.

B. Consult all other Sections to determine the extent of this work specified elsewhere.

C. Coordinate all utility requirements for equipment furnished under this Division. Rough-in required systems and make final connections.

1.3 REGULATIONS AND STANDARDS

A. Install all work to meet or exceed requirements prescribed by governmental bodies having jurisdiction and in accordance with all federal, state, and local codes and ordinances, and all OSHA requirements. These codes include, but are not limited to the latest applicable edition of the following:

1. California Building Code
2. California Electrical Code
3. California Plumbing Code
4. California Mechanical Code
5. California Energy Code
6. California Green Buildings Standard
7. California Fire Code

1.4 QUALITY ASSURANCE

A. Comply with current governing codes, ordinance and regulations of the Authority Having Jurisdiction and the regulations and requirements of the Owner’s insurance underwriter.

B. Where requirements differ between drawings, specifications, codes and standards, apply the more stringent.

C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Architect prior to submitting bid.

D. After contract is awarded, if minor changes or additions are required by the aforementioned authorities, even though such work is not shown on drawings or overtly covered in the specifications, they shall be included at the Contractor's expense.

E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, skillful and well-executed manner by competent workers. Provide a competent, experienced full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

F. The Architect or Architect's Representative may conduct unannounced field reviews of any work completed or in progress. A report will be issued for all items that are found to be inconsistent with the contract documents. All items in the report shall be addressed in writing by the Contractor within two (2) weeks.

1.5 SAFETY

A. Contractors must conduct a weekly safety meeting with their employees and maintain documentation of attendance and topics of discussion. Contractor shall comply with all OSHA regulations. Contractor is required to obtain and pay for insurance required to cover all activities withing Contractor's scope of work.

1.6 PERMITS, FEES, AND UTILITIES

A. Secure and pay for all permits, licenses, inspections, and fees required.

B. Coordinate with other Sections and schedule sequence of accomplishing the work in such a manner as not to interrupt existing services and utilities at a time that will inconvenience the Owner. Provide Owner a minimum 48 hour notice when utilities will be interrupted.

1.7 PAINTING

A. See Division 09 for painting.

1.8 COORDINATION

A. Coordinate with work performed by other Sections in order to ensure adequate space and proper location of all necessary work on this project whether or not work is under this Section. Coordination shall be done prior to order or manufacture of any systems or components.

B. At a minimum, coordinate location of each piece of equipment, requirements for access panels, space required for supports, power requirements for each piece of equipment, and control requirements for each piece of equipment.

C. Prepare complete set of construction coordination shop drawings indicating equipment actually purchased and exact routing of all piping and ductwork. Requirement for coordination shop drawings shall not be construed as authorization for contractor to make unauthorized changes to Contract Documents. Prior to final acceptance, contractor shall submit the coordination shop drawings as part of the record drawings.

D. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. At completion, include a set of these drawings with the record drawings.

E. Install the work in cooperation with other trades. Before installation, make proper provisions to avoid interferences.

F. No additional costs will be considered for work which has to be relocated due to conflicts with other trades or for additional equipment/parts that need to installed due to a lack of coordination prior to, or during, construction.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND MATERIALS

B. Provide products and materials that are new, clean, free of defects, damage and corrosion. Inspect all materials and remove defective materials from the site.

C. Provide materials and equipment bearing the label of, or listed by, the Underwriter's Laboratories (UL), unless the material or equipment is of a type for which label or listing service is not provided.

D. Furnish all materials and equipment of the same type by the same manufacturer.

E. Statically and dynamically balance rotating equipment for minimum vibration and lowest operating noise level.

2.2 ALTERNATE EQUIPMENT AND MATERIALS

A. No substitute materials or equipment may be installed without the written approval of the Architect.

B. Contract documents are based on materials specified and equipment manufacturers indicated. Acceptance of alternative equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the quality and performance stated or implied in the contract documents.

C. All submittals for substitution must include comparison to show equal with scheduled equipment. Submit proposals to supply alternate materials or equipment, in writing, with sufficient lead time for review prior to the date equipment must be ordered to maintain project schedule.

D. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

2.3 SUBMITTALS

A. Submit shop drawings, manufacturer's data, samples and test reports as specified.

B. The review of submittals is for general compliance with the design concept and contract documents. Comments or absence of comments does not relieve the Contractor/Vendor/Manufacturer from compliance with the contract documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.

C. No part of the work shall be ordered, procured, or installed until that work has been submitted, reviewed, and returned without comment.

D. A minimum period of ten (10) working days will be required in the Engineer's office each time a submittal is sent for review. Contractor shall prioritize submittal reviews where multiple submittals are sent for review. This time period must be considered by the Contractor in the scheduling of the work.

E. Submittals will be returned to indicate appropriate action taken as follows:

1. No Exceptions Taken.
2. Make Corrections Noted. No Resubmittal Required.
3. Revise and Resubmit.
4. Rejected.
5. Not Reviewed.

F. Use electronic form acceptable to Architect for electronic submittals, containing the following information:

1. Project name.
2. Date.
3. Name and address of Architect and Engineer.
4. Name of Owner.
5. Name, address and contact information of Contractor.
6. Names and contact information of sub-contractor, manufacturer, and supplier.
7. Name of entity that prepared submittal.

8. Category and type of submittal.

9. Specification Section number and title.

10. Drawing number and detail references, as appropriate.

11. Transmittal number, numbered consecutively and revision number clearly identified.

12. Each item submitted labeled or identified the same as on the drawings.

G. Identify each sheet of submittal pages (using arrows, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information.

H. Organize submittals to keep all related items together; break submittal into sections and provide appropriate identifying tags on submittal pages to indicate item being submitted.

I. Inadequate or incomplete submittals will not be reviewed and will be returned to the Contractor for resubmittal.

J. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. No additional costs will be considered for any special handling charges or expedited processing required for materials or equipment not ordered in time.

PART 3 – EXECUTION

3.1 EXAMINATION OF SITE

A. The Contract Documents do not make representations regarding the character or the extent of the subsoils, water levels, existing structural, mechanical, plumbing, and electrical installations, above or below grade, or other sub-surface conditions which may be encountered during the work.

B. Evaluate existing conditions that may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.2 DRAWINGS

A. Drawings show general arrangement and location of ductwork, piping, and equipment. Drawings are diagrammatic and intended to show approximate location and routing. Dimensions on drawings shall take precedence over scaled dimensions on drawings. Allow for supports, expansion, and pitch of ducts and piping. Field verify all dimensions.

B. The exact locations of equipment, ducts, piping, and registers shall be ascertained from the Architect or the Owner’s representative in the field. The Architect reserves the right to make minor changes in the location of ducts, registers, piping, and equipment up to the time of installation without additional cost.

C. Furnish and install any incidental work not shown or specified which can reasonably be inferred as part of the work and necessary to provide a complete and workable system.

D. Execute any work or apparatus shown on the Drawings and not specifically mentioned in the Specifications, or vice versa. Omission from Drawings or Specifications of any minor details of construction, installation, materials, or essential specialties does not relieve Contractor from furnishing complete workable system.

3.3 RECORD DRAWINGS

A. Contractor shall maintain a complete set of documents on site that are marked up during the construction process indicating all changes that have been made. Record drawings shall be maintained up to date throughout construction. Indicate clearly all work installed differently from that shown.

B. Upon completion of work, certify all record drawings with a stamp including the date and name of Contractor. Submit one (1) complete, bookmarked, set of electronic record drawings to the Architect for final review.

C. Record drawings must include the following as a minimum:

1. Actual equipment locations.
2. Revisions or substitutions to equipment schedules.
3. Duct/pipe size and routing.
4. Dimensional changes to drawings.
5. Revisions to details shown on drawings.
6. Changes made by RFIs, Addenda, or Change Orders.
7. Locations of access panels and shut-off valves.
8. Locations and depths of underground utilities.
9. Controls sequence of operations.

3.4 PROTECTION OF BUILDING

A. Protect new and existing building structures and adjacent finished surfaces during construction. Patch, repair, and refinish existing work damaged by work under this Division to match adjacent undisturbed areas.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Include all drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery of equipment to the project as required by the construction schedule.

B. Provide proper protection and storage of all items and tools required.

C. If equipment is not delivered or installed at the project site in a timely manner as required by the construction schedule, the Contractor shall be responsible for disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workers of this trade, and correct damage caused without additional cost to the Owner.

B. The Contractor shall be responsible for all work, materials, and equipment until finally inspected, tested, and accepted. Protect work against theft, injury, or damage. Carefully store material and equipment received on site that is not immediately installed.

C. Cover open ends of work with temporary covers or plugs during construction to prevent entry of dust, dirt, water or other obstructing material. Cover and protect equipment and materials from damage due to water, humidity, paint, spray-on fireproofing, construction debris, etc. Store equipment subject to moisture damage, such as insulation or electrical components in dry, heated spaces.

D. Provide adequate means for fully protecting finished parts of the materials and equipment against damage from whatever cause during the process of the work until final acceptance.

E. Do not install damaged items. Take immediate steps to obtain replacement or repair. Replace all wet or damp insulation or acoustic lining.

3.7 QUALITY OF WORK

A. The quality of work shall be of a standard generally accepted in the respective trade. Use only experienced, competent, and properly equipped workers. Replace work falling below this standard as directed by the Architect.

B. Systems shall be worked into a complete and integrated arrangement with like elements arranged neatly with adequate head room and passageway free from obstructions.

3.8 CUTTING AND PATCHING

A. Do not cut, channel or drill unfinished masonry, tile, etc. unless written permission is obtained from the Architect. Perform this work in a manner acceptable to the Architect. Cutting of structural members or footings is prohibited without the prior written consent of the Structural Engineer.

B. Where cutting, channeling or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary from the proper installation, support or anchorage of ductwork, piping, or equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or finishes using skilled tradesmen for all required work.

C. Provide slots, chases, openings and recesses through floors, walls, ceilings and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations.

D. Provide sleeves for all ductwork and piping passing through new floors, walls, partitions, and any other building construction, of adequate diameter to allow minimum of 1" clearance all around between sleeve and ductwork or piping. When ductwork or piping is insulated, insulation shall pass continuously through sleeve with 1" clearance between insulation and sleeve or hole in existing construction.

3.9 ACCESS

A. Damper operators, filters, and indicating equipment or specialties requiring reading, adjusting, inspection, repairing, removal, or replacement shall be conveniently and accessibly located with reference to finished building.

B. No dampers, controls, or equipment shall be placed in a location that will be inaccessible after the system is complete. Access panels or doors shall be provided where required whether shown on Drawings or not.

C. Access panels shall be 24" x 24" unless otherwise directed, style as selected by the Architect. Panels shall have the same acoustic barrier or rating as the construction in which panel is installed.

D. Doors shall be Milcor, Newman or equal, with concealed hinges, screwdriver locks, prime coated with rust inhibitive paint, finish painted in field to match adjacent surface. Provide key locks where required by Architect/Owner. All access doors shall be keyed the same. Doors in walls of toilet rooms shall be stainless steel.

E. Continuously check installation manuals for clearance and accessibility of equipment. No allowance of any kind will be made for negligence on part of Contractor to foresee means of installing equipment in proper position.

3.10 SEISMIC RESTRAINTS

A. All equipment, ductwork, piping, and materials shall be fastened and securely anchored to building structure as required by the Drawings, Specifications, OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

3.11 MANUFACTURER'S DIRECTIONS

A. Materials and equipment shall be installed in accordance with manufacturer's application and recommendations, requirements, and instructions, and in accordance with Contract Documents.

B. Conflicts between manufacturer's instructions and Contract Documents shall be brought to the Architect's attention for resolution prior to installation.

C. Where requirements indicated in Contract Documents exceed manufacturer's requirements, Contract Documents shall govern.

3.12 BELT DRIVES

A. Belt drives for fans and equipment shall consist of "V" belts and sheaves.

B. Drives that require not more than two belts shall be provided with variable pitch, driving sheaves to provide some speed adjustment above and below the normal required operating speed; the adjustments to be as near equal as practicable.

C. Belts shall be furnished in matching sets.

D. Fan drives for blower-type fans shall be selected for the proper fan speeds required for the air volumes specified or shown on the Drawings at the static pressures indicated. The static pressures indicated show estimated conditions, which may vary under actual operating conditions. Should it be necessary to adjust the fan speeds to obtain the proper air volume, the Contractor shall make the necessary changes to the drives without additional cost the Owner.

3.13 ELECTRICAL MOTORS FOR HVAC EQUIPMENT

A. Provide electric motors for driving the mechanical equipment. Motors shall be of proper power, construction and speed to suit the specified equipment.

B. Motors and motor control equipment shall conform to NEMA standards and shall be UL listed.

C. Coordinate the NEMA type of each motor with the torque and inertia load of the equipment served, and the in-rush current characteristics of the motor with the motor starter selection, so that all items furnished constitute a complete motor control and protection package. Motor shall not operate in the 15% service factor range.

D. Motors located in ducted air streams or subject to outside air elements shall be totally enclosed fan cooled; others shall be open drip-proof design.

E. Motors used with variable frequency drives shall be designed specifically for use on AC inverter power and adjustable speed applications.

F. Each motor shall be factory-wired to a junction box mounted on the motor or on the driven piece of equipment to facilitate single point of field power connection under Division 26.

G. Motors 1/2 HP and smaller shall be rated 120 VAC – single phase – 60 hertz and shall be provided with integral thermal overload protection, unless otherwise indicated.

H. Motors 3/4 HP and larger shall be rated for 208 VAC or 460 VAC – 3 phase – 60 hertz, unless otherwise indicated.

3.14 COORDINATION WITH ELECTRICAL CONTRACTOR

A. Coordinate with the Electrical Contractor on furnishing and installing of controls, motors, starters, etc. Provide copies of submittal and installation data to Electrical Contractor for all items requiring electrical connection.

B. Furnish and install all line voltage and low-voltage temperature control wiring in the Mechanical work, including all interlock wiring between motor starter coils, interlock relays, and temperature control equipment. Conduit for temperature control wiring shall be responsibility of Mechanical Contractor and shall be of type specified in Division 26.

C. Electrical Contractor shall furnish disconnect switches, motor starters, conduit and wiring for line voltage power to the equipment. See Division 26 and Drawings.

3.15 ELECTRICAL EQUIPMENT AND ELECTRICAL ROOM PRECAUTIONS

A. Do not install piping, equipment, or ductwork, plumbing, or any piping systems not included as part of the electrical work in the following rooms: switchgear, transformer, generator, elevator equipment, telephone, fire command, security, dimmer or electrical equipment rooms.

B. Do not install piping, equipment, or ductwork within the code required service space for switchboards, disconnects, panelboards, dimmers, control panels, VFDs, individual motor controllers, electronics, etc.

3.16 LUBRICATION

A. Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a metallic lubrication tube with suitable fitting to an accessible location and identify it with permanent laminated plastic nameplates. Identify this location in the maintenance manual.

B. After installation, properly lubricate all parts requiring lubrication and keep them adequately lubricated with a lubricant recommended by the equipment manufacturer until Owner acceptance.

3.17 EQUIPMENT GUARDS

A. Provide easily (without tools) removable expanded metal guards for all hot surfaces, belts, couplings, exposed fan inlets and outlets, and other moving parts or machinery. Provide access openings for greasing, oiling, adjusting, etc. All guards shall comply with OSHA requirements and applicable codes.

3.18 CATHODIC PROTECTION

A. Install dielectric unions at points in piping where dissimilar metal pipes are connected together.

3.19 PIPING AND EQUIPMENT IDENTIFICATION

A. Furnish and install engraved nameplates with 1/4" minimum lettering at panel mounted control devices, manual control stations, power disconnects, motor starters, and pieces of equipment. Nameplates shall be white lettering on black background. For outdoor locations, provide brass engraved nameplates or plastic rated for outdoor use.

B. Label each thermostat and switch with equipment connected to the thermostat or switch with black lettering on white background.

C. Each piping system installed under this work shall be identified and the direction of flow indicated. Markings shall be applied after all painting, priming, and cleaning of the piping and insulation is completed. Labels shall be black lettering on colored backgrounds. Lettering shall be easily readable from the floor and background colors easily discernible. Furnish labels in every room and every 20' of pipe length.

D. Tag all valves with 2" diameter brass tags noting the valve number and contents in the pipe. At the completion of the project, provide Owner with a valve listing for all valves installed in the project. Valve listing shall note valve tag number, contents in the pipe and the areas (room numbers, etc.) that are impacted by valve.

3.20 GUARANTEE

A. The Contractor shall guarantee the quality of all work and the quality of the equipment and materials in accordance with the provisions of the General Conditions and Special Conditions. Should any defects occur during this period, the Contractor shall promptly repair or replace defective items as directed by the Architect, without cost to the Owner.

B. Contractor shall be responsible for damage to any part of premises during guaranteed period caused by leaks or breaks in work furnished and/or installed under this Section.

3.21 TESTING

A. Test all ductwork, equipment, piping, and systems as called for in the Specifications. Notify Architect and inspection authorities prior to testing so that they may be witnessed. Protect all personnel and equipment during testing.

3.22 OPENINGS

A. Locating and sizing of all openings for ductwork and piping through walls, roof, etc. shall be done under this Division. Framing of openings shall be done by the respective trades in whose work the opening is made.

3.23 CLEAN-UP

A. During the course of work under this Division, all rubbish, debris, surplus materials, tools, etc. resulting from this work shall be removed from work area and shall be disposed of off-site at the end of each working day. The Owner's premises shall be left clean and in a condition acceptable to the Architect.

B. Clean all work installed under this Contract to satisfaction of Owner.

C. Remove debris and trash from ductwork, fan units, and all air handling equipment. Vacuum clean fan housing, coils, and ducts in vicinity of openings before grilles and registers are installed. Replace construction filters with new filters prior to project completion.

3.24 ACCEPTANCE TESTING

A. Equipment and systems requiring acceptance testing certification for Code Compliance shall have Certificate of Acceptance completed and submitted to enforcement agency. See Drawings for equipment and systems requiring acceptance certification. Tests shall be performed by Certified Mechanical Acceptance Test Technician. Contractor shall be responsible for procuring the required test forms from the California Energy Commission website.

3.25 OPERATING INSTRUCTIONS AND OPERATOR TRAINING

A. Provide the services of factory-trained specialists to supervise the operation of all equipment and train the Owner's operating and maintenance personnel.

B. Instruct the Owner's operating personnel in the basis of design, the available documentation, the proper starting sequences, operation, shut-down, minor adjustments, troubleshooting, recommended spare parts, and regular maintenance procedures.

C. Submit training agenda, schedule and list of representatives to the Owner for review ten (10) days prior to training. Confirm attendance at training by sign-in sheet. At a minimum, the training agenda shall cover all items required to be provided in the operating and maintenance manuals.

3.26 OPERATING AND MAINTENANCE MANUALS

A. Provide operating instructions and maintenance manuals for all equipment and material furnished under this Division.

B. Provide the following equipment and maintenance information where applicable:

1. Systems and Equipment Controls – describe sequence of operation and diagram controls as required.

2. Identifying equipment manufacturer, product name, and model number.

3. Locations.

4. Wiring Diagrams.

5. Lubrication Charts.

6. Manufacturer's recommended operating and maintenance instructions, with all non-applicable information deleted.

7. Assembly and disassembly instructions.

8. Startup procedures.

9. Routine and normal operating instructions.

10. Normal and emergency shutdown instructions.

11. Troubleshooting diagnostic instructions.

12. Parts list and recommended spare parts including name and address of source of supply.

C. Contractor must start compiling above data immediately upon approval of submittals for equipment and materials.

D. Submit one (1) electronic copy of operating and maintenance manuals, indexed and bookmarked, for review by Architect/Engineer.

E. Submit three (3) complete sets of bound hard copies of operating and maintenance manuals, and one (1) electronic copy to Owner within thirty (30) days of issuance of final occupancy permit.

END OF SECTION 230000

SECTION 23 05 00 - HEATING, VENTILATING, AIR CONDITIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, and Division 23 Sections apply to this Section.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, and services to furnish and install complete mechanical systems which shall include, but not limited to equipment, ductwork, piping, accessories, insulation, and supports.

1.3 SUBMITTALS

A. Submit for review, within fifteen (15) days after signing Contract, the required number of copies of a complete list of materials proposed for use. This list includes:

1. Split Systems.
2. Fans.
3. Ductwork.
4. Duct Insulation and Lining.
5. Dampers and Duct Accessories.
6. Filters.
7. Diffusers, Registers, and Grilles.
8. Refrigerant Piping.
9. Mechanical Supports.
10. Controls.
11. Coordination Drawings: plans and details, drawn to scale, on which equipment and duct routing is shown and coordinated with other installations, using input from installers of the items involved.

B. No substitute materials or equipment shall be installed without the written approval of the Architect.

C. No increase in the contract price will be considered to accommodate the use of alternative equipment, including revisions required by other trades.

D. Submit test reports on all systems tested. Tests required by Authorities Having Jurisdiction over the work shall be submitted on appropriate forms to the satisfaction of such authorities.

PART 2 – PRODUCTS

2.1 HVAC EQUIPMENT

A. See Schedules on Drawings for equipment data. Furnish and install all equipment in accordance with Drawings, manufacturer's recommendations, and all applicable codes.

2.2 FILTERS

A. Filters shall be 2"-thick of size and number required for equipment and selected for 300 FPM velocity.

B. Filters shall be throwaway type, Class 2 UL listed.

C. Filters shall be minimum MERV 13 based on ASHRAE Standard 52.2 test method.

2.3 ROOF HOODS AND CAPS

A. Roof hoods shall be of size, type, and capacity noted on Drawings.

B. Roof caps for exhaust shall be of size required for duct dimensions noted on Drawings.

C. Roof hood and cap housing shall be constructed of heavy gauge galvanized steel and shall be fully weatherproof and painted with name. Cap and hood shall be reinforced to prevent oil canning and deflecting in high winds. Roof caps and hoods shall be complete with bird screen and roof curb. Distance of hood from roof shall be 18" unless otherwise noted on Drawings.

2.4 DUCTWORK

A. Comply with latest edition of SMACNA HVAC Duct Construction Standards, Metal and Flexible for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Comply with NFPA 90A when ducts traverse through smoke zones.

B. Comply with UL 181 and California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

C. Ducts shall be minimum 24 gauge thickness. Ducts shall be constructed for 2500 FPM maximum velocity and static pressure classes as follows:

1. Supply Ducts: +3 inch w.g.

2. Return Ducts: - 2 inch w.g.

3. Exhaust Ducts: -2 inch w.g.

D. Longitudinal seams: Groove and Pittsburgh lock seams and slip joints shall be used.

E. Duct Connections: Ductmate industries “Ductmate 35” and “Ductmate 45”. Ductmate “Spiralmate” for round duct. Ductmate “Ovalmate” for oval duct.

F. Duct sealing shall be DP 1010 water based duct sealant and SMACNA approved foil-backed pressure sensitive tape or Hardcast, Two Part II Duct Sealing System: DT-5400 tape with RTA-50 sealant.

G. Flexible ducts shall be UL 181 and Class I air duct in compliance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, and NFPA 90A and 90B.

H. Flexible ducts shall be two-ply vinyl film supported by helically wound spring-steel wire, R4.2 fiberglass insulation, exterior reinforced laminated vapor barrier film. Duct shall be rated for +2 inch w.g., -1 inch w.g., 4000 FPM maximum velocity, and -10°F to +160°F. Flame Spread less than 25, Smoke Developed less than 50.

2.5 DUCT INSULATION AND LINING

A. All duct insulation and lining shall comply with California Energy Code Section 120.4 requirements for air distribution ducts and plenums.

B. Insulation shall conform to NFPA 90A and 90B, and UL 181, Class I. Insulation shall have Flame Spread not over 25 and Smoke Developed of not over 50.

C. Wherever external duct insulation is specified and internal acoustic treatment of equivalent insulating effect is also required by the Drawings or Specification for the same location, the external insulation may be omitted.

D. Acceptable Manufacturers: Johns Manville, Owens Corning or approved equal.

E. Acoustic Duct Liner: 1” thick, R4.2 in directly conditioned space and 2” thick, R8.0 in unconditioned space or outdoors. Owens Corning Quiet R, or approved equal.

F. Duct Insulation: 3” thick, R8.3 in unconditioned space and 1 1/2” thick, R4.2 for indirectly conditioned space. Owens Corning SoftR Ductwrap FRK, or approved equal.

G. Duct Insulation Outdoor: 2” thick rigid board fiberglass, R8.7 with 0.016 inch thick sheet Aluminum jacket.

2.6 REGISTERS, DIFFUSERS AND GRILLES

A. Acceptable manufacturers: Titus, Krueger.

B. Registers, diffusers, and grilles shall be as indicated on Drawings. Drawings and schedules indicate specific requirements of air inlets and air outlets. Other manufacturers' products with equal quality, appearance, finish, and performance characteristics may be considered.

C. Registers shall have adjustable air pattern for setting in field to match field conditions. Redirect air pattern when required.

D. Refer to Architectural Drawings and Specifications for reflected ceiling plans, elevations, wall and ceiling type and construction. Coordinate frame and border types to accommodate the wall or ceiling specified or shown on the Architectural Drawings.

E. Registers, diffusers, and grilles in fire-rated ceilings or walls shall be all-steel construction.

2.7 DAMPERS AND DUCT ACCESSORIES

A. Acceptable manufacturers:

1. Dampers: Ruskin, Air Balance Inc, Pottorff, or approved equal.

2. Turning vanes: Ductmate industries, Duro Dyne, or approved equal.

3. Flexible connectors: Duro Dyne, Ventafabrics, or approved equal.

4. Duct access doors: Ductmate industries, Ward industries, or approved equal.

5. Backdraft dampers: Ruskin, Greenheck, Air Balance Inc, or approved equal.

B. Provide volume dampers as specified or shown on the Drawings for proper balancing and distribution of air. Provide single blade dampers in ducts 24 inches in width or less, or 12 inches in height or less. Provide multiple blade, opposed blade design, dampers for all other duct sizes. Coordinate with the balancing contractor and provide additional dampers required for proper air balance.

C. Dampers shall be galvanized steel construction and shall be minimum 2 gauges thicker than duct gauge. Damper shall be pivoted to turn easily, provided with operating handles and locking devices mounted on the outside of the duct in an accessible location. Dampers shall be reinforced for rigidity.

D. Damper actuators for control dampers shall be modulating, 24V power supply, 0-10V DC control input, weatherproof construction.

E. Turning vanes shall comply with SMACNA HVAC Duct Construction Standards, Metal and Flexible for vanes and vane runners. Vane runners shall automatically align vanes.

F. Manufactured Turning Vanes: Fabricate 1 1/2" wide, double vane, curved blades of galvanized steel construction set to 3/4" o.c. Support with bars perpendicular to blades set 2" o.c. and set into vane runners suitable for duct mounting.

G. Flexible duct connectors shall be flame retardant fabrics, coatings, and adhesives complying with UL 181, Class I. Where exposed to weather, fabric shall be double coated with weatherproof, synthetic rubber resistant to UV rays.

H. Duct access doors shall be airtight and suitable for duct pressure class, constructed of galvanized steel with insulation fill as integral part of appropriate thickness. Include cam latches, sash locks, and hinges such that doors can easily be opened without tools. Seal around frame with neoprene or foam rubber.

I. Backdraft dampers shall be multi blade, parallel action gravity balanced, or adjustable counter-balance weighted dampers. Dampers shall have center pivoted blades of maximum 6” width, with sealed edges, assembled in rattle free manner with 90-degree stop. Provide with adjustment device to permit setting for varying differential static pressure.

2.8 REFRIGERANT PIPING

A. Refrigerant line kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed. Factory insulated lines with flared fittings at both ends. Mueller Streamline Co., JMF Company, or approved equal.

B. Refrigerant pipe insulation shall be minimum 1” thick flexible closed cell elastomeric foam complying with ASTM C543 with UV retardant, and resistant to mold and mildew. Outdoor piping shall have insulation covered with .016 inch thick aluminum jacket.

C. Refrigerant pipe insulation shall meet requirements of California Energy Code Section 120.3.

2.9 HANGERS AND SUPPORTS

A. Subject to compliance with requirements, provide products by one of the following manufacturers or other approved equal:

1. B-Line.
2. Mason West.
3. Unistrut.
4. Power Strut.
5. Hilti.

B. Qualify welding processes and operators according to ASME Boiler and Pressure Vessel Code. Comply with AWS D1.1 procedures for field welding.

C. Duct attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

2.10 SLEEVES

A. Construct sleeves for pipes passing through walls, floors, partitions, hung or furred ceilings, etc. of minimum 18 gage galvanized steel, flanges on each side of wall, partition, hung or furred ceiling, etc.

B. Provide standard weight galvanized steel pipe sleeves with welded anchor flanges at foundation walls and reinforced concrete or masonry walls.

C. Provide 20 gage galvanized sheet metal sleeves for round ductwork passing through masonry or concrete construction. Rectangular ductwork shall be provided with framed openings through floor and wall construction.

D. Install escutcheons at exposed piping through floors, ceilings, walls and partitions in finished areas, within cabinets and millwork, and piping through all fire-rated separations.

2.11 CONTROLS

A. Furnish and install programmable thermostats where indicated. Coordinate exact locations with Architect.

B. If indicated on Drawings, provide thermostats by specified manufacturer.

C. Thermostats shall comply with latest edition of California Energy Code for demand responsive capabilities and occupancy monitoring if required.

D. Mount thermostats 48 inches above finished floor.

E. Control wiring shall be installed per manufacturer's instructions and wiring diagrams. Wiring in walls and exposed spaces shall be in conduit and in accordance with Division 26. Wiring above ceiling shall be plenum rated cable complying with NFPA 70.

2.12 PAINTING

A. See Division 09 for painting.

B. Prime and paint diffuser boot and duct interiors where visible through grilles with a matte black finish.

C. Prime and paint exposed ductwork, supports, and registers where required by the Architect.

D. Prime and paint louver or grille interiors where required by the Architect.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation clearances, tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. Equipment shall be installed level, on curbs or supports as required and/or indicated on Drawings and in accordance with manufacturer's instructions and recommendations.

B. Equipment shall be installed in locations shown and as complete assemblies with adequate service clearances for access and maintenance as required by codes and equipment installation manuals.

3.3 DUCTWORK INSTALLATION

A. All ductwork gauges, joints, bracing, reinforcing, and other details shall be in accordance with latest edition of SMACNA manuals unless otherwise specified.

B. Duct dimensions are net, inside, clear dimensions. For internally lined ducts, add lining thickness to determine metal duct dimensions.

C. Provide minimum 24-gauge sheet metal construction for ducts. Construct ducts with NFPA 90A gauges when traversing smoke zones.

D. Construct ducts of galvanized sheet metal, except where otherwise indicated or specified.

E. Construct all ductwork to dimensions indicated, straight and smooth on the inside with neatly finished joints lapped in direction of travel.

F. Fabricate changes in direction, both horizontal and vertical, to permit easy airflow.

G. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons fastened to the duct only.

H. Duct Openings: Provide openings where required to accommodate thermometers, smoke detectors, controllers, wiring, conduit, tubing, etc. insert through air-tight rubber grommets.

I. Provide pitot tube openings where required for testing of systems. Include threaded metal cap, spring loaded cap or threaded plug to eliminate any air leakage. Coordinate locations of openings with balancing contractor.

J. Install ductwork to clear all obstructions, preserve headroom, and keep openings clear. Install exposed ducts as high as possible. Coordinate with other trades to maintain minimum 7'-6" clearance above finished floor, unless otherwise indicated.

K. Install ducts unless otherwise indicated, vertically or horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

L. Coordinate layout with suspended ceiling, lighting layouts, and similar finished work.

M. Install dampers in branch duct for all air inlets and outlets at accessible location. Dampers shall be capable of adjustments and of being locked into position.

N. Use radius elbows in rectangular ductwork unless otherwise indicated. Centerline radius shall be a minimum 150 percent of duct width. Where space does not permit duct radius, install square elbow with turning vanes.

O. Ends of ducts shall turn over 3/4” for airtight connections between ducts and grilles. The ducts and grilles shall have separate sets of screws. Register frames and ends of ducts shall be properly placed before finishing is begun.

P. All ducts shall be supported per SMACNA HVAC Duct Construction Standards. Supports and seismic bracing shall be in accordance with OSHPD Preapproval of Manufacturer’s Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

Q. Ducts exposed to weather shall be completely waterproof with outdoor vapor barrier mastic over tape at all joints and seams. Slope entire top of duct down towards sides and coordinate duct slope with roof slope. Arrange standing seam, joints, and flanges to prevent accumulation, ponding or pooling of water.

R. Seal joints and seams of ductwork airtight to SMACNA seal classifications.

S. Protect all ductwork and interiors of ducts shall be clean and free from foreign materials until building is enclosed.

T. All ductwork and sealing shall comply with California Energy Code Section 120.4 requirements for Air Distribution System Ducts and Plenums.

3.4 FLEXIBLE DUCTWORK INSTALLATION

A. Flexible ductwork shall be installed with no runs of more than 5’-0” in length and shall be used only at register connections.

B. Flexible duct shall be installed in fully extended condition, free of sags and kinks, using only minimum length required to make connection. Bends greater than 90° are not allowed.

C. Flexible duct shall be full size of branch. Any change in size to match terminal connection shall be made at terminal. Connect to duct collars, terminal unit connections and air inlets and outlets per manufacturer’s instructions.

D. All connections shall be sealed with high pressure duct sealer and secured with 3/8” nylon straps around inside liner of flexible duct.

E. Flexible ducts shall be supported at or near mid-length with 2” wide, 28 gauge steel hanger collar attached to the structure with an approved duct hanger. Installation shall minimize sharp radius turns or offsets.

3.5 DUCT INSULATION AND LINING INSTALLATION

A. Concealed ductwork shall be insulated with fiberglass ductwrap.

B. Provide acoustic lining where indicated on Drawings.

C. All supply and return ductwork shall be insulated, or acoustically lined on the inside when ductwork is exposed.

D. Exhaust duct need not be insulated. Outside air duct indoors need not be insulated. Outside air duct installed outdoors shall be insulated.

3.6 DUCT ACCESSORIES INSTALLATION

A. Flexible connections shall be installed on inlet and outlet duct connections of fans, air conditioning units, furnaces, and all other HVAC equipment. Fabric shall be of weight and strength for service required, properly fitted to render connection airtight. Fabric of sufficient width to provide minimum 4” between connected items.

B. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated. Install backdraft dampers at roof hoods or louvers connected to ductwork.

C. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units. Access doors shall be large enough for maintenance.

3.7 REGISTERS, DIFFUSERS, AND GRILLES INSTALLATION

A. Locations indicated on the Architectural Drawings shall take precedence. For lay-in ceiling panels, locate in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

B. Install with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

C. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

D. Install diffusers, registers, and grilles level and plumb, according to manufacturer’s written instructions.

E. All visible interior surfaces of registers, diffusers, and grilles shall be painted flat black.

F. All visible exterior surfaces of registers, diffusers, and grilles shall be factory off-white finish as standard. Where required by Architect, provide in a color as selected by Architect or provide prime-painted for field painting.

3.8 REFRIGERANT PIPING INSTALLATION

A. Refrigerant pipe installation shall comply with latest editions of ASHRAE 15 and ASME B31.5.

B. Install piping in accordance with manufacturer’s instructions and good practices.

C. Install piping adjacent to unit to allow access to unit for service and maintenance.

D. Where required, provide or install additional refrigerant charge per equipment manufacturer's requirements. After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

E. Install piping as short and direct as possible, with a minimum number of joints and fittings.

F. Route piping in orderly manner, parallel to building structure, and maintain gradient. Group piping whenever practical at common elevations and locations. Install piping to conserve space and avoid interference with use of space.

G. Slope piping one percent in direction of oil return. Provide suction traps at base of suction risers where required.

H. Piping shall be cut accurately to measurements established at job site and worked into place without springing or forcing, allowing for proper head room.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

K. Install insulation without and gaps or cracks and use contact adhesive recommended by manufacturer at joints and connections.

L. When the thickness of insulation is reduced, for example at support hangers, reinforce the reduced thickness with additional insulation.

M. Seal longitudinal seams and end joints of insulation with manufacturer's recommended adhesive to eliminate openings in insulation. Installation to maintain a continuous vapor barrier.

N. Where metal jackets are indicated for insulation, install with 2 inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches on center at end joints.

3.9 HANGERS AND SUPPORTS INSTALLATION

A. All equipment, plenums, registers, ductwork, and piping shall be securely anchored to building structure and seismically braced as required by the Drawings and Specifications. Comply with OSHPD Preapproval of Manufacturer's Certification OPM-0043-13 and OPM-0052-13, and the California Building Code.

B. Comply with SMACNA HVAC Duct Construction Standards – Metal and Flexible for hanger rod or sheet metal strap sizes and spacing for duct supports.

C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

D. Install lateral bracing with pipe hangers and supports to prevent swaying.

E. Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

F. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

G. Install hangers and supports to provide indicated pipe slopes.

H. Adjust hangers to distribute loads equally on attachments.

I. Trim excess length of continuous-thread hanger and support rods to 1 1/2 inches.

J. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding.

3.10 TESTING

A. Comply with more stringent of system manufacturer's requirements and requirement indicated herein.

B. Provide the Architect with certified copies of the test results in written format. At a minimum include the date of the test, witnesses present, sections tested, length of tests, starting and final pressures.

C. After completion of refrigerant piping installation, pressurize piping systems to a test pressure of not less than 600 psig using dry nitrogen.

D. Successful testing shall maintain the test pressure for a continuous and uninterrupted period of 24 hours.

E. After completion of pressure testing evacuate piping systems using a vacuum pump with a check valve. Maintain test pressure per manufacturer's requirements for a continuous and uninterrupted period of one (1) hour.

F. Prepare and submit test reports to the Architect for project record.

G. Charge the refrigerant piping system following system manufacturer's written instructions. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

3.11 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature setpoints. Adjust initial airflow settings and discharge airflow patterns.

C. Set field adjustable switches and circuit breaker trip ranges according to manufacturer's written instructions.

3.12 FIELD QUALITY CONTROL

A. Engage a factory authorized service representative to inspect field assembled components and equipment installation, including piping and electrical connections. Provide a written report of inspection to the Architect.

B. Engage a factory authorized service representative to perform startup service. Complete installation and startup checks according to manufacturer's written instructions. Provide completed startup sheets for each piece of equipment to the Architect.

3.13 TRAINING AND O&MS

A. Refer to Section 23 00 00 Mechanical General Requirements and Division 01 for Training requirements, Operating and Maintenance Manuals, and other Closeout procedures.

END OF SECTION 230500

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01, Division 22, and Division 23 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Test and balance air distribution systems.

1.3 QUALITY ASSURANCE

A. Work shall be performed by independent testing agency certified by AABC or NEBB. Work shall be performed by qualified technicians and trained personnel, using instruments certified accurate to its limits.

B. Use standard forms from AABC's National Standards for Testing, Adjusting and Balancing or NEBB's Procedural Standards for Testing, Adjusting and Balancing.

C. Calibrate instruments at least every twelve months or more frequently if required by the instrument manufacturer.

1.4 COORDINATION

A. Coordinate efforts of HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist with testing, adjusting, and balancing activities.

B. Check for and report defects or deficiencies that may affect balancing.

C. Mechanical Contractor shall advise Balancing Contractor of changes made to the system during construction.

D. Mechanical Contractor shall install test holes or wells complete with removable and replaceable plugs or caps, dampers as specified on Drawings and where required by Balancing Contractor to obtain final system balance.

E. Mechanical Contractor shall make any changes in the pulleys, belts, and dampers, or the addition of dampers for the correct balance as recommended by Balancing Contractor at no additional cost to the Owner.

F. Controls Contractor shall cooperate with and work with the Balancing Contractor when setting damper linkages, minimum outside air dampers, and other air volume devices, and shall be available for readjusting of dampers, devices or controls.

1.5 SUBMITTALS

A. Within 30 days of Contractor's Notice to Proceed, submit the following documents:

1. TAB agency and team member qualifications.

2. Strategies and procedures plan.

3. Sample report forms intended for use on this project.

4. Instrument calibration reports.

B. Submit final, completed balance report prior to request for final mechanical observation of the project.

PART 2 – PRODUCTS

2.1 INSTRUMENTS

A. Utilize test instruments and equipment of type, precision, and capacity as recommended in the AABC or NEBB standards.

B. Instruments for testing and balancing of air and hydronic systems shall have been calibrated within a period of 6 months and verified for accuracy prior to start of work.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to construction, examine the Contract Documents to become familiar with the project requirements and to discover conditions in the systems' designs that may preclude proper testing, adjusting and balancing of systems and equipment.

B. Examine system and equipment installations to verify that balancing devices are properly installed and accessible for effective balancing.

C. Recommend adjustments and/or corrections to mechanical equipment and air distribution systems that are necessary for proper balancing of systems.

3.2 GENERAL PROCEDURE

A. Perform testing and balancing procedures on each system according to procedures contained in AABC or NEBB standards.

B. Testing and balancing shall not begin until system has been completed and is in full working order.

C. Cut insulation, ducts, pipes, and equipment cabinets for installation or test probes to the minimum extent necessary for balancing procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this project.

D. Permanently mark settings on valves, splitters, dampers, and other adjustment devices.

E. Balance to a maximum measured flow deviation from specified values of plus or minus 10 percent at terminal devices and outlets, and plus or minus 5 percent at equipment.

F. At final inspection, recheck random selections of data recorded in report to verify balance has not been disrupted.

3.3 AIR SYSTEMS PROCEDURE

A. Execute air systems balancing for each air system in accordance with AABC or NEBB standards and as described herein.

B. Conduct tests with supply, return and exhaust systems operating and doors and windows closed or in their normal operating condition.

C. Construction filters shall be removed before testing and balancing. Tests shall be done with final filters installed. Allowances shall be made for air filter resistance at time of tests. The main air supplies shall be set with filter resistance midway between clean and dirty filters.

D. Test and adjust fan or blower speed to design requirements.

E. Test and record motor full load amps. Record each installed motor manufacturer and motor efficiency.

F. Traverse main supply air ducts, using a pitot tube and manometer.

G. Submit data in support of fan deliveries by the following methods:

1. By summation of the air quantity readings at inlets or outlets.

2. By duct traverse of main ducts.

H. Test and record required and measured system static pressures; filter differential, coil differential and fan total static pressure.

I. Test and adjust systems for design recirculated airflow rates.

J. Test and adjust system for outside airflow rates. Measure and adjust outside airflow rates for all fan speeds.

K. Test and record entering and leaving air temperatures.

L. Inspect and confirm all fire dampers are open, all smoke dampers and fire/smoke dampers are in the correct positions, all duct access doors are closed and fire damper fusible links are accessible.

M. Adjust zones to proper design supply, return, and exhaust flow rates.

N. Test and adjust each air inlet and air outlet and transfer duct to within 10 percent of design requirements.

O. Adjust diffusers, grilles and registers to minimize drafts, dumping, and to prevent short circuiting between supply and return outlets.

P. Vary total system airflow rates by adjustment of fan speeds. Vary branch air quantities by damper regulation.

Q. Record installed fan drive assemblies; fans sheaves, motor sheaves, belts and motors.

R. The final balanced condition of each area shall include testing and adjusting of pressure conditions. Test and record building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. For multi-story buildings, test pressure conditions at ground, intermediate and upper levels. Front doors, stair and vestibule doors, exits and elevator shafts shall be checked for airflow so that leakage does not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

S. Complete balancing to achieve positive building pressure unless otherwise instructed. A positive pressure relative to outside of 0.02 inch wg minimum and 0.05 inch wg maximum shall be achieved, measure with negligible outside wind velocity.

3.4 ACCEPTANCE

A. Mechanical systems shall not be considered ready for final inspection until balancing results acceptable to the Architect are obtained.

B. If it is found that specified airflows cannot be achieved on portions of the system, the actual conditions shall be reported to the Architect for consideration of corrective action.

3.5 BALANCE REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

B. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.

2. Name and address of the TAB firm and specialist.

3. Project name.

4. Project location.

5. Architect’s name and address.

6. Engineer’s name and address.

7. Contractor’s name and address.

8. Report date.

9. Signature of TAB supervisor who certifies the report.

10. Summary of contents including the following:
    a. Design versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

C. Report shall be indexed as follows:

1. Air
    a. Summary.
    b. Procedure.
    c. Instrumentation.
    d. Drawings.
    e. Equipment Summary.
    f. Fan Sheets.
    g. Fan Curves.
    h. Fan Profile Data.
    i. Static Data.
    j. Traverse Data and Schedule.
    k. Terminal Unit Summary.
    l. Outlet Data Summary and Schematics (per system).
    m. Building Pressurization Data.

END OF SECTION 230593

SECTION 26 05 00 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Electrical identification.
2. Utility company electricity-metering components.
3. Concrete equipment bases.
4. Electrical demolition.
5. Cutting and patching for electrical construction.

B. Refer to drawings for applicable codes.

C. Refer to Division 11 and Division 13 specifications for additional electrical work to be provided.

D. Refer to TR, TL, AV and FS drawings for additional electrical work to be provided.

1.2 SUBMITTALS

A. Product Data: For utility company electricity-metering components.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts and single-line diagram of electricity-metering component assemblies specific to this Project.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Devices for Utility Company Electricity Metering: Comply with utility company published standards.

C. Comply with NFPA 70.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings for electrical supports, raceways, and cable with general construction work.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment that requires positioning before closing in the building.

C. Coordinate electrical service connections to components furnished by utility companies.
1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for service entrances and electricity-metering components.

D.

E. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

F. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs. Strength rating to suit structural loading.

D. Slotted Channel Fittings and Accessories: Recommended by the manufacturer for use with the type and size of channel with which used.
1. Materials: Same as channels and angles, except metal items may be stainless steel.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 EL ECTRICAL IDENTIFICATION

A. Identification Device Colors: Use those prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

C. Tape Markers for Conductors: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

D. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

E. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape compounded for permanent direct-burial service, and with the following features:
1. Not less than 6 inches wide by 4 mils thick.
2. Embedded continuous metallic strip or core.
3. Printed legend that indicates type of underground line.

F. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

G. Warning and Caution Signs: Preprinted; comply with 29 CFR 1910.145, Chapter XVII. Colors, legend, and size appropriate to each application.
1. Interior Units: Aluminum, baked-enamel-finish, punched or drilled for mechanical fasteners.
2. Exterior Units: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate with 0.0396-inch, galvanized-steel backing. 1/4-inch grommets in corners for mounting.

H. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.3 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

A. Comply with requirements of electrical power utility company for all new service entrance equipment, raceways and structures.

2.4 CONCRETE BASES

A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, slotted channel system components.

B. Dry Locations: Steel materials.

C. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four with, 200-lb minimum design load for each support element.

3.3 SUPPORT INSTALLATION

A. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

B. Size supports for multiple raceway or cable runs so capacity can be increased by a 25 percent minimum in the future.

C. Support individual horizontal single raceways with separate, malleable-iron pipe hangers or clamps except use spring-steel fasteners for 1-1/2-inch and smaller single raceways above suspended ceilings and for fastening raceways to slotted channel and angle supports.

D. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

E. Secure electrical items and their supports to building structure, using the following methods unless other fastening methods are indicated:
   1. Wood: Wood screws or screw-type nails.

2. Gypsum Board: Toggle bolts. Seal around sleeves with joint compound, both sides of wall.
3. Masonry: Toggle bolts on hollow block and expansion bolts on solid block. Seal around sleeves with mortar, both sides of wall.
4. New Concrete: Concrete inserts with machine screws and bolts.
5. Existing Concrete: Expansion bolts.
6. Structural Steel: Spring-tension clamps.
   a. Comply with AWS D1.1 for field welding.
7. Light Steel Framing: Sheet metal screws.
8. Fasteners for Damp, Wet, or Weather-Exposed Locations: Stainless steel.
9. Light Steel: Sheet-metal screws.
10. Fasteners: Select so load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

E. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

F. Install warning, caution, and instruction signs where required to comply with 29 CFR 1910.145, Chapter XVII, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Indoors install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

G. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch- high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.5 ELECTRICITY-METERING EQUIPMENT

A. Install utility company metering equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.6 FIRESTOPPING

A. Apply firestopping to cable and raceway sleeves and other penetrations of fire-rated floor and wall assemblies to restore original undisturbed fire-resistance ratings of assemblies. Firestopping installation is specified in Division 7 Section "Through-Penetration Firestop Systems."

3.7 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.8 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.9 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair, refinish and touch up disturbed finish materials and other surfaces to match adjacent undisturbed surfaces.

END OF SECTION 260500

SECTION 26 05 13 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.2 SUBMITTALS

A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:
   1. American Insulated Wire Corp.; a Leviton Company.
   2. General Cable Corporation.
   3. Senator Wire & Cable Company.
   4. Southwire Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN or XHHW complying with NEMA WC 5 or 7

2.3 CONNECTORS AND SPLICES

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

I. Fire Alarm Circuits: Type THHN-THWN, in raceway.

J. Class 1 Control Circuits: Type THHN-THWN, in raceway.

K. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 16 Section "Basic Electrical Materials and Methods."

F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 16 Section "Basic Electrical Materials and Methods."

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION 260513

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Requirements specified in this Section may be supplemented by requirements of other Sections.

1.2 SUBMITTALS

A. Product Data: For ground rods.

B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled under UL 467 as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ground Rods:
   a) Weaver
   b) Thomas & Betts
   c) Talley
2. Grounding Connectors:
   a) Burndy Hyground Compression Systems
   b) Erico/Cadweld
   c) Amp Ampact Grounding System.
3. Pipe Grounding Clamps:
   a) Burndy GAR Series
   b) O-Z Gedney
   c) Thomas & Betts
4. Telecommunication Grounding Bus Bar:
   a) Chatsworth
   b) Erico
   c) Square D
   d) Panduit

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section "Conductors and Cables."

B. Equipment Grounding Conductors: Insulated with green-colored insulation.

C. Isolated Ground Conductors: Insulated with green-colored insulation with yellow stripe. On feeders with isolated ground, use colored tape, alternating bands of green and yellow tape to provide a minimum of three bands of green and two bands of yellow.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare, Solid-Copper Conductors: ASTM B 3.

G. Assembly of Bare, Stranded-Copper Conductors: ASTM B 8.

H. Bare, Tinned-Copper Conductors: ASTM B 33.

I. Copper Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

J. Copper Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

K. Tinned-Copper Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

L. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulated spacer.

M. Connectors: Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items. Exothermic-welded type, in kit form, selected per manufacturer's written instructions.

N. Telecommunications Grounding System: Mount telecommunications main grounding busbar (TMGB) in each MDF. Install main telecommunications bonding backbone (TBB) conductor continuous from the MDF to every IDF. Bond the TMGB to the main building electrical grounding system and the nearest acceptable structural ground with a 3/0 AWG copper equipment grounding conductor.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.

1. Size: 3/4 inch in diameter by 120 inches in length.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.

2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the indicated height above the floor.

E. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

F. Equipment Grounding Conductors: Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

1. Install insulated equipment grounding conductors in feeders.

2. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

4. Air-Duct Equipment Circuits: Install an insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

5. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an insulated equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

6. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

7. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing an insulated equipment grounding conductor with supply branch-circuit conductors.

G. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except as otherwise indicated. Make connections without exposing steel or damaging copper coating.

H. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

I. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers or supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

J. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

K. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

L. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

M. Connections: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

6. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

7. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

8. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit

with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

9. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

10. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

11. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

N. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

O. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is indicated and at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3. Provide drawings locating each ground rod, ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results.

Describe measures taken to improve test results. Nominal maximum values are as follows:

a. Equipment Rated 500 kVA and Less: 10 ohms.

b. Equipment Rated 500 to 1000 kVA: 5 ohms.

c. Equipment Rated More Than 1000 kVA: 3 ohms.

d. Substations and Pad-Mounted Switching Equipment: 5 ohms.

e. Manhole Grounds: 10 ohms.

END OF SECTION 260526

SECTION 26 05 33 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, underground pull boxes, hinged-cover enclosures, and cabinets indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:
1. Allied Steel
2. Certainteed
3. Jones & Laughlin
4. Carlon
5. Kraloy

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.

1. Fittings: Set-screw or compression type.

E. FMC: Aluminum.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

H. Underground Pull boxes:

1. Sizes: 17”(width) x 30” (length) x 24”(depth),(minimum dimensions, U.O.N)

2. Pull boxes shall be precast concrete as indicated on plans.
   a) Traffic Box-High density reinforced concrete box with non-setting shoulders positioned to maintain grade and facilitate backfilling. Utility boxes shall be used where shown on the drawings. Use steel checker plate, H/20 loading, bolt down. Provide 12”extension pieces.
   b) Vandal Resistant Pull box insert-3/16 inch Hot dipped galvanized steel lid and lockbox. Varies according to style and size of pullbox. Mc Cain Inc. or approved equal.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. Allied Steel
2. Certainteed
3. Jones & Laughlin
4. Carlon
5. Kraloy

B. RNC: NEMA TC 2, Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: NEMA TC 3; match to conduit or tubing type and material.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
1. Outlet Boxes:
   a) Bowers
   b) Hubbell
2. Weatherproof Outlet Boxes and Box Extension Adapters:
   a) Bell
   b) Red Dot
   c) Carlon
3. Junction and Pull Boxes:
   a) Circle AW
   b) Hoffman
4. Conduit Fittings:
   a) O-Z Gedney
   b) Thomas & Betts, or approved equal.
5. Floor Boxes:
   a) Wiremold/Walker
   b) Hubbell
6. Underground PullBoxes:
   a) Mc cain Inc. WWW.mccain-inc.com
   b) Jensen Pre-cast
   c) Christy Concrete Products
   d) BES Concrete Products
   e) Old Castle Precast Solution

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Floor Boxes: Cast metal, fully adjustable, rectangular.

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

G. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

I. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.5 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.

2. Concealed: Rigid steel or IMC.

3. Underground, Single Run: RNC.

4. Underground, Grouped: RNC.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Exposed: EMT.

2. Concealed: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.

4. Damp or Wet Locations: Rigid steel conduit.

5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

   a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Conduits used for fiber optic cable installation shall be provided with inner duct.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3.2 INSTALLATION

A. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above finished slab.

F. Provide inner duct in conduit for all fiber optic cable installation.

G. Provide flexible metal conduits for conduits installed inside cabinets.

H. Make bends and offsets so ID is not reduced. Keep legs of bends in same plane and keep straight legs of offsets parallel, unless otherwise indicated.

I. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

J. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

4. Change from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

K. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.

2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

L. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors on all raceways 2” and larger.

M. Tighten set screws of threadless fittings with suitable tools.

N. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

P. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

Q. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

R. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

S. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

T. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

U. Set floor boxes level and flush with finished floor surface.

V. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

W. Install cable tray in accordance with NEMA VE 2 requirements.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 26 05 33 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

Identification of electrical equipment and devices for all renovation and new building projects.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for Identification of materials and method.

C. Samples: One for each type of materials specified.

1.3 QUALITY ASSURANCE

A. All identification material and methods, engraved labels, conductor numbers, branch circuit schedules, relay panel schedules, identification for circuit breakers and underground utility markers shall meet Code requirements and industry standards.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For Engraved Labels: Lamicoid

B. For Conductor Numbers: Brady

C. For Underground Utilities Ribbon: Allen Systems, Inc.

2.2 IDENTIFICATION MATERIALS AND METHODS

A. Coordinate names, abbreviations and other designations with equipment specified in this or other Divisions of the Specification or identified by the District.

B. Conform to requirements of the CEC, latest adopted version with amendments by local AHJs including warning labeling and identification on existing equipment.

C. Furnish products listed by UL or other testing firm acceptable to AHJ.

2.3. ENGRAVED LABELS

A. Melamine plastic laminate, white with black core, 1/16-inch thick.

B. Dymo tape labels are not acceptable.

2.4 CONDUCTOR NUMBERS

A. Manufacturers standard vinyl-cloth self-adhesive cable and conductor markers of the wraparound type. Preprinted black numbers on yellow field.

2.5 BRANCH CIRCUIT SCHEDULES

A. Provide branch circuit identification schedules, typewritten, clearly filled out, to identify load connected to each circuit and location of load. Numbers to correspond to numbers assigned to each circuit breaker pole position.

B. Provide two columns, odd numbers in left column, even numbers in right column, with 3-inch-wide line for typing connected load information.

2.6 RELAY PANEL SCHEDULES

A. Provide typewritten schedule to identify the incoming circuit, the controlled load, and the controlling devices for each relay.

2.7 IDENTIFICATION FOR CIRCUIT NUMBERS

A. Provide permanent identification number in or on panelboard dead-front adjacent to each circuit breaker pole position. Square D adhesive is approved, other adhesives by specific prior approval only.

B. Horizontal centerline of engraved numbers to correspond with centerline of circuit breaker pole position.

C. Detectable plastic ribbon, 6-inch wide by 4 mil thick.

2.8 Underground utility markers:

A. Color code as recommended by APWA. Safety Red for electric power distribution. Safety Alert Orange for telephone, signal, data and cable TV.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten labels to equipment in a secure and permanent manner.

B. Mark underground utilities in conformance with APWA.

C. Where signs are to be applied to surfaces which require finish, install identification after completion of painting.

D. Engravers standard letter style, minimum 3/16-inch high capital letters.

E. Drill or punch labels for mechanical fastening except where adhesive mounting is necessary

because of substrate. Use self tapping stainless steel screws.

F. Install an engraved label on each major unit of electrical equipment indicating both equipment name and circuit serving equipment (e.g. "EF-1, CKT. 2P1-1,3,5), including but not limited to the following items:
1. Disconnect switches, identify item of equipment controlled.
2. Relays.
3. Contactors.
4. Time switches.
5. Override switches.
6. Service disconnect and distribution switches, identify connected load.
7. Branch circuit panelboards.
8. Central or master unit of each electrical system including communication/signal systems, unless the unit incorporates its own self-explanatory identification.

G. Install engraved on the inside of flush panels, visible when door is opened. Install label on outside of surface panel.

H. Apply markers on each conductor for power, control, signaling and communications circuits where wires of more than one circuit are present.

I. Match conductor identification used in panelboards, shop drawings, contract documents and similar previously established identification for division 26 work.

J. Provide branch circuit identification schedules, typewritten, clearly filled out, to identify load connected to each circuit and location of load. Numbers to correspond to numbers assigned to each circuit breaker pole position.

K. Provide two columns, odd numbers in left column, even numbers in right column, with 3-inch-wide line for typing connected load information.

L. Provide typewritten schedule to identify the incoming circuit, the controlled load, and the controlling devices for each relay.
1. Imprint over entire length of ribbon in permanent black letters, the system description, selected from manufacturer's standard legend which most accurately identifies the subgrade system.
2. Install continuous tape, 6 to 8 inches below finish grade, for each exterior underground raceway.
3. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16 inches, install a single marker. Over 16 inch width of lines, install multiple tapes not over 10 inches apart (edge to edge) over the entire group of lines.

END OF SECTION 260553

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Lighting control devices shall include the following:
   1. Time switches.
   2. Occupancy sensors.
   3. Multipole lighting relays.
   4. Multipole lighting contactors.
   5. Basic control contactor panels
   6. System clock

B. Photo-cell controls of exterior lighting are NOT ALLOWED. Provide astro-dial function time clock controls as required by CCR Title 24 and under the control of the lighting control panel.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.

C. Comply with CEC.

1.3 SUBMITTALS

A. Manufacturer's Product Data:

1. List of Materials: For each item, Include:

a) Manufacturer

b) Model number

c) Listing: UL, City Lab or none

d) Quantity

2. Manufacturer's Product Data: In sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Contactors and Relays:
      a. Automatic Switch Co.
      b. Challenger Electrical Equipment Corp.
      c. Cutler-Hammer Products; Eaton Corporation.
      d. Furnas Electric Co.
      e. GE Lighting Controls.
      f. Hubbell Lighting, Inc.
      g. Siemens Energy and Automation, Inc.
      h. Square D Co.; Power Management Organization.
      i. Zenith Controls, Inc.
   2. Time Switches:
      a. Diversified Electronics, Inc.
      b. Grasslin Controls Corp.
      c. Intermatic, Inc.
      d. Leviton Manufacturing.
      e. Paragon Electric Co., Inc.
      f. Tork, Inc.
      g. Zenith Controls, Inc.
      h. Watt Stopper, Inc. (The).
   3. Photoelectric Relays:
      a. Allen-Bradley/Rockwell Automation.
      b. Area Lighting Research, Inc.
      c. Fisher Pierce.
      d. Grasslin Controls, Corp.
      e. Intermatic, Inc.
      f. Paragon Electric Co., Inc.
      g. Rhodes, M H, Inc.
      h. SSAC, Inc.
      i. Tork, Inc.
   4. Occupancy Sensors:
      a. Watt Stopper, Inc. (The).
      b. Honeywell, Inc.; Home and Building Controls.
      c. Hubbell Lighting, Inc.
      d. Lightolier.
      e. Lithonia Control Systems.
      f. MyTech Corporation.
      g. Novitas, Inc.
      h. RAB Electric Manufacturing Co., Inc.
   5. Basic control contactor panels and associated accessories:
      a. Watt Stopper, Inc. (The).
      b. Lithonia control systems
      c. Leviton company Inc.
      d. GE Industrial Systems; Total Lighting Control.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

2.3 TIME SWITCHES

A. Description: Solid-state programmable type with alphanumeric display complying with UL 917.
   1. Astronomic dial.
   2. Two contacts, rated 30 A at 277-V ac, unless otherwise indicated.
   3. Two pilot-duty contacts, rated 2 A at 240-V ac, unless otherwise indicated.
   4. Eight-day program uniquely programmable for each weekday and holidays.
   5. Skip-day mode.

2.4 OCCUPANCY SENSORS

A. Ceiling and Non-Switch-Box Mounting Units: Unit receives control power from a separately mounted auxiliary power and control unit, and operates power switching contacts in that unit in response to signals from sensors.
   1. Auxiliary Power and Control Units: Matched to sensors with which used. Features as follows:
      a. Relays rated for a minimum of 20-A normal ballast load or 13-A tungsten filament or high-inrush ballast load.
      b. Sensor Power Supply: Rated to supply the number of connected sensors.

B. B.Switch-Box-Mounting Units: Unit receives power directly from switch leg of the 120- or 277-V ac circuit it controls and operates integral power switching contacts rated 800 W at 120-V ac, and 1000 W at 277-V ac, minimum.
   1. Manual Override Switch: Turns lights on/off manually regardless of elapsed time delay.

C. C.Operation: Turns lights on when room or covered area is occupied and off when unoccupied, unless otherwise indicated.
   1. Time Delay for Turning Lights Off: Adjustable over a range from 1 to 15 minutes, minimum.
   2. Ambient-Light-Level Control: Adjustable for setting a level of ambient illumination above which sensor will not turn lights on when occupancy is sensed.

D. Passive-Infrared Type: Detects occupancy by a combination of heat and movement in zone of coverage. Each sensor detects occupancy anywhere in an area of 1000 sq. ft. (93 sq. m) by detecting occurrence of 6-inch (150-mm) minimum movement of any portion of a human body that presents a minimum target of 36 sq. in. (232 sq. cm) to the sensor.

E. Ultrasonic Type: Emits a beam of ultrasonic energy and detects occupancy through use of Doppler's principle in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy.

F. Dual-Technology Type: Uses a combination of passive-infrared and ultrasonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in the field by operating controls on unit.

2.5 MULTIPOLE CONTACTORS AND RELAYS

A. Description: Electrically operated and mechanically held, and complying with UL 508 and NEMA ICS 2.
   1. Listed Current Rating for Switching: Consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballasts with 15 percent or less total harmonic distortion of normal load current).
   2. Control Coil Voltage: Match control power source.

2.6 BASIC CONTROL CONTACTOR PANELS

A. Description: Shall be UL listed and consist of following:
   1. Tub: Empty NEMA 1 enclosure that can accept an interior sized to accept up to 16, 32, or 64 contactor poles.
   2. Cover: Surface or Flush as required, with captive screws in a hinged, lockable configuration.
   3. Interior: Metal back plate and barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. Intelligence board with eight channels of control provided regardless of interior size. Interiors shall be provided with up to 16, 32, or 64 DIN rail mounted contactor poles.

B. Features:
   1. Contactors shall be DIN rail mounted, four pole, normally closed, electrically held with coil voltage to match panel control power voltage. Contactors shall be compatible with all lighting, ballast and HID loads and be rated for 20 Amp tungsten up to 277V and rated for 30 Amp ballast and general use up to 600V. Provide 20% spare contactor poles.
   2. Eight automatic control channels for operating contactors controlling exterior and/or interior lighting. Each channel shall be individually configurable to meet project needs. Each channel shall include an LED light status indicator to provide channel status and a separate ON/OFF/Auto switch for manual channel control.
   3. Clock port for connection to an optional system clock. When a system clock is installed, eight override inputs are activated providing logic control of the eight channels from external photocells, switches, occupancy sensors, timers, daylighting controllers, etc.
   4. Expansion terminals shall be provided for low voltage wiring connection between main and expansion panels in a multiple panel system. All automatic channel operation in the designated main panel (panel with the system clock), shall signal expansion panels' corresponding channels to operate.
   5. Auxiliary power for operating optional system devices provides 350mA at 24VDC and 350mA at 24VAC power.

2.7 SYSTEM CLOCK

A. Description:
   1. 1.The system time clock shall be installed in the main or central panel of a multiple panel system or in each panel when individual panel time control is desired. The system clock shall provide time-based control with eight-year time back-up, non-volatile memory program storage, automatic daylight savings adjustment, selectable 12/24-hour time

formats and selectable date formats. All clock programming shall be accessible from the clock front display/keypad.

B. Features:
1. Control of eight control channels shall be available on the clock. Provide status and manual ON/OFF control of each channel from the front display and keypad.
2. The clock shall have control of eight individual override inputs, which can be used to connect external devices such as photocells, switches and daylighting controllers. Each of these inputs can be configured to operate as a photocell, as an ON/Auto switch, as a maintained ON/OFF switch, or as a momentary ON/OFF switch.
3. Schedules shall be assigned to any combination of days of the week and/or 3 holiday day types. Other scheduling features shall include:
4. Temporary schedules: schedules that execute on an assigned day then automatically delete themselves from memory.
5. Repeating schedules: repeat a schedule at intervals that are adjustable from 5 minutes to 10 hours.
6. 32 perpetual holidays assigned to any one of three holiday day schedules and continuing for 1 to 120 days. Holiday dates shall be specific day/month/year, or perpetual dates including day/month/all years or day of the week in a given month every year or self-calculating Easter Sunday.
7. Astronomic capability for calculating sunrise and sunset based on time, latitude, longitude, and time zones. All scheduled astronomic/time operations shall be interlocked so loads are not turned on when astronomic off times are earlier than scheduled on times or astronomic on times are later than scheduled off times. Each schedule shall have an independent astronomic offset of + 120 minutes.
8. Following a power outage, the system clock shall run a start-up process that executes schedules that would have been missed during the power outage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

3.2 CONTROL WIRING INSTALLATION

A. A.Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Section "Basic Electrical Materials and Methods."

B. Bundle, train, and support wiring in enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 26 05 00.

3.4 FIELD QUALITY CONTROL

A. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

B. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:
   1. Continuity tests of circuits.
   2. Operational Tests: Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions. Record control settings, operations, and functional observations.
   3. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 1 Section "Closeout Procedures – Demonstration and Training."

3.6 SPARE PARTS

A. Provide minimum of 10% spare parts for occupancy sensors.

END OF SECTION 26 09 23

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide new direct/indirect lighting with average of 50 foot-candles horizontal and minimum of 5 foot-candles vertical.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with
   1. CEC California Electric Code
   2. UL
      a. UL 875 Light Emitting Diode (LED) Lighting Sources for Use in Lighting Products
      b. UL 1598 Luminaires
      c. UL 1012 Power Units Other Than Class 2
      d. UL 1310 Class 2 Power Units
      e. UL 2108 Low Voltage Lighting Systems
   3. ANSI
      a. C78.377.2008Specifications for the Chromaticity of Solid State Lighting Products
   4. IESNA
      a. LM 79-80Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.
      b. LM 80-08Approved Method for lumen Maintenance Testing of LED Light Sources
      c. TM 20-11Projecting Long Term Lumen Maintenance of LED Light Sources

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.3 SUBMITTALS

A. Manufacturer's Product Data:
   1. List of Materials: For each item, Include:
      a. Manufacturer
      b. Model number
      c. Listing: UL, City Lab or none
      d. Quantity
   2. Manufacturer's Product Data: In sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 FIXTURES AND COMPONENTS, GENERAL

A. Air-Handling Fixtures: For use with plenum ceiling for air return and heat extraction and for attaching an air-diffuser-boot assembly specified in Division 15 Section "Diffusers, Registers, and Grilles."
   1. Air Supply Units: Slots in one or both side trims join with air-diffuser-boot assemblies.
   2. Heat Removal Units: Air path leads through lamp cavity.
   3. Combination Heat Removal and Air Supply Unit: Heat is removed through lamp cavity at both ends of the fixture door with air supply same as for air supply units.
   4. Dampers: Operable from outside fixture for control of return-air volume.
   5. Static Fixtures: Air supply slots are blanked off, and fixture appearance matches active units.

2.3 LIGHTING FIXTURES

A. Fixture: Energy efficient volumetric type meeting Title 24 and District standards.

2.4 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: Light-emitting diodes with 25 years warranty.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   1. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.5 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.
   1. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.
5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.6 LED LIGHTING

A. Correlated color temperature (CCT): 3500 ºK.

B. Color rendering index (CRI): 75 minimum.

C. Off-state power consumption: The power draw of the luminaire (including PE or remote monitoring unit) shall not exceed 2.50 watts when in the off state.

D. Operating environment: Luminaire shall be able to operate normally in temperatures from -20º C to 50º C.

E. Cooling system: Shall consist of a heat sink with no fans, pumps, or liquids, and shall be resistant to debris buildup that does not degrade heat dissipation performance.

F. Lumen depreciation: LED module(s)/array(s) shall deliver at least 70% of initial lumens, when installed for a minimum of 100,000 hours.

G. Lighting Distribution: Per lighting fixture schedule and in accordance with IESNA Lighting Distributions.

H. Maximum amperage at LED: Maximum amperage at LED shall not exceed driver current to meet lumen depreciation value described above but shall not exceed 700 mA per mm^2 of chip. Multi-current (dimming) driver output shall be within the limits described in this Section. Provision only for dimming function controllable via networked control system.

I. The Driver and LED arrays shall be designed for multi-current input operation, with adjustable ratings at 350 mA, 525 mA and 700 mA.

J. Transient protection: Per IEEE C.62.41-1991, Class A operation. The line transient shall consist of seven strikes of a 100k HZ ring wave, Min. 10kV level, for both common mode and differential mode.

K. Operating temperature: Power supply shall operate between -20º C and 50º C.

L. Frequency: Output operating frequency must be ≥ 120 Hz (to avoid visible flicker) and input operating frequency of 60 Hz.

M. Interference: Power supplies shall meet FCC 47 CFR Part 15/18 (Consumer Emission Limits).

N. Noise: Power supply shall have a Class A sound rating per ANSI Standard C63.4.

O. Fixture Warranty: Manufacturer shall warranty to replace defective light fixtures or parts thereof for a period of 5 years.

2.10 FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage.

E. Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.11 LIGHTING CONTROL DEVICES

A. Dimming Driver Controls: Sliding-handle type with on/off control; compatible with driver and having light output and energy input over the full dimming range.

B. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change.
   1. Sensor Capacity: At least 40 electronic dimming driver.
   2. Adjustable Ambient Detection Range: 10 to 100 fc minimum

C. Occupancy Sensors: Adjustable sensitivity and off delay time range of 5 to 15 minutes.
   1. Device Color:
      a. Wall Mounted: White.
      b. Ceiling Mounted: White.
   2. Occupancy detection indicator.
   3. Ultrasonic Sensors: Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
   4. Infrared Sensors: With daylight filter and lens to afford coverage applicable to space to be controlled.
   5. Combination Sensors: Ultrasonic and infrared sensors combined.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Provide both grid and additional wire supports. Refer to DSA IR 25-2/1.11 for requirements.
   1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.
   2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
   3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
   4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Fixture Support: As follows:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
   4. Continuous Rows: Suspend from cable.

D. Air-Handling Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable fixtures to provide required light intensities.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide pole and wall mounted exterior lighting per Code requirements and District Standards. General site lighting shall be 0.5 foot-candles average maintained.

B. Provide emergency egress exterior lighting per CBC requirements with 1 foot-candles maintained light level along path of egress to public ways.

1.2 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with
1. IEEE C2 National Electrical Safety Code
2. CEC California Electric Code
3. UL
   a. UL 875 Light Emitting Diode (LED) Lighitng Sources for Use in Lighting Products
   b. UL 1598 Luminaires
   c. UL 1012 Power Units Other Than Class 2
   d. UL 1310 Class 2 Power Units
   e. UL 2108 Low Voltage Lighting Systems
4. ANSI
   a. C78.377.2008Specifications for the Chromaticity of Solid State Lighting Products
5. IESNA
   a. LM 79-80Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.
   b. LM 80-08Approved Method for lumen Maintenance Testing of LED Light Sources
   c. TM 20-11Projecting Long Term Lumen Maintenance of LED Light Sources

1.3 SUBMITTALS

A. Manufacturer's Product Data:
1. List of Materials: For each item, Include:
   a. Manufacturer
   b. Model number
   c. Listing: UL, City Lab or none

d. Quantity

2. Manufacturer's Product Data: In sequence of List of Materials, Data sheet for each item, including all accessories, marked for proposed product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 EXTERIOR LUMINAIRES, GENERAL

A. Complying with UL 1598 and listed for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

2.3 PHOTOELECTRIC RELAYS

A. UL 773 or UL 773A listed, factory mounted to the luminaire.

B. Contact Relays: Single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc and off at 4.5 to 10 fc with 15-second minimum time delay. Contacts shall have directional lens in front of photocell to prevent fixed light sources to cause turnoff.
   1. Relay with locking-type receptacle shall comply with NEMA C136.10.
   2. Adjustable window slide for adjusting on-off set points.

2.4 LED LIGHTING

A. Correlated color temperature (CCT): 3500 ºK.

B. Color rendering index (CRI): 75 minimum.

C. Off-state power consumption: The power draw of the luminaire (including PE or remote monitoring unit) shall not exceed 2.50 watts when in the off state.

D. Operating environment: Luminaire shall be able to operate normally in temperatures from -20º C to 50º C.

E. Cooling system: Shall consist of a heat sink with no fans, pumps, or liquids, and shall be resistant to debris buildup that does not degrade heat dissipation performance.

F. Housing: Shall be primarily constructed of metal. Unless otherwise noted, finish shall be white in color, powder coated and rust resistant, unless otherwise noted; driver shall be mounted internally, be replaceable, and be accessible without tools. Captive screws or use of latches are needed on any components that require maintenance after installation. For exterior fixtures, no parts shall be constructed of polycarbonate unless it is UV stabilized (lens discoloration shall be considered a failure under warranty); ingress Protection shall be rated a minimum of IP54.

G. Lumen depreciation: LED module(s)/array(s) shall deliver at least 70% of initial lumens, when installed for a minimum of 100,000 hours.

H. Lighting Distribution: Per lighting fixture schedule and in accordance with IESNA Lighting Distributions.

I. Maximum amperage at LED: Maximum amperage at LED shall not exceed driver current to meet lumen depreciation value described above but shall not exceed 700 mA per mm^2 of chip. Multi-current (dimming) driver output shall be within the limits described in this Section. Provision only for dimming function controllable via networked control system.

J. The Driver and LED arrays shall be designed for multi-current input operation, with adjustable ratings at 350 mA, 525 mA and 700 mA.

K. Transient protection: Per IEEE C.62.41-1991, Class A operation. The line transient shall consist of seven strikes of a 100k HZ ring wave, Min. 10kV level, for both common mode and differential mode.

L. Operating temperature: Power supply shall operate between -20º C and 50º C.

M. Frequency: Output operating frequency must be ≥ 120 Hz (to avoid visible flicker) and input operating frequency of 60 Hz.

N. Interference: Power supplies shall meet FCC 47 CFR Part 15/18 (Consumer Emission Limits).

O. Noise: Power supply shall have a Class A sound rating per ANSI Standard C63.4.

P. Fixture Warranty: Manufacturer shall warranty to replace defective light fixtures or parts thereof for a period of 5 years.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lamps in each fixture.

B. Luminaire Attachment: Fasten to indicated structural supports.

C. Adjust luminaires that require field adjustment or aiming.

END OF SECTION 265600

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Single and duplex receptacles, ground-fault circuit interrupters.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Floor service outlets, poke-through assemblies and multioutlet assemblies.

1.2 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Wiring Devices:
    a. Bryant Electric, Inc./Hubbell Subsidiary.
    b. Eagle Electric Manufacturing Co., Inc.
    c. Hubbell Incorporated; Wiring Device-Kellems.
    d. Leviton Mfg. Company Inc.
    e. Pass & Seymour/Legrand; Wiring Devices Div.
2. Multioutlet Assemblies:

a. Hubbell Incorporated; Wiring Device-Kellems.

b. Wiremold Company (The).

3. Poke-Through, Floor Service Outlets and Telephone/Power Poles:

a. Hubbell Incorporated; Wiring Device-Kellems.

b. Pass & Seymour/Legrand; Wiring Devices Div.

c. Square D/Groupe Schneider NA.

d. Thomas & Betts Corporation.

e. Wiremold Company (The).

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: Heavy-Duty grade.

C. Straight-Blade Receptacles: Hospital grade.

D. GFCI Receptacles: Straight blade, non-feed-through type, Hospital or Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type.

C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

1. Switch: 20 A, 120/277-V ac.

2. Receptacle: NEMA WD 6, Configuration 5-15R.

D. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

2. Incandescent Lamp Dimmers: Modular, 120 V, 60 Hz with continuously adjustable rotary knob, toggle switch, or slider; single pole with soft tap or other quiet switch; EMI/RFI filter to eliminate interference; and 5-inch wire connecting leads.

3. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces:

a. Steel with white baked enamel, suitable for field painting

b. 0.035-inch- thick, satin-finished stainless steel (above counters and in restrooms)

3. Material for Unfinished Spaces: Galvanized steel.

4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.5 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, solid brass with satin finish.

D. Power Receptacle: NEMA WD 6, Configuration 5-15R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: See telecommunication specifications for requirements.

2.6 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.

1. Service Outlet Assembly: Flush type with two simplex receptacles and space for two RJ-45 jacks.

2. Size: Selected to fit nominal 4-inch cored holes in floor and matched to floor thickness.

3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

4. Closure Plug: Arranged to close unused 4-inch cored openings and reestablish fire rating of floor.

5. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 5 voice and data communication cables.

2.7 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: PVC.

C. Wire: No. 12 AWG.

2.8 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install wall dimmers to achieve indicated rating after derating for ganging.

C. Install unshared neutral conductors on line and load side of dimmers.

D. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on bottom. Group adjacent switches under single, multigang wall plates.

E. Remove wall plates and protect devices and assemblies during painting.

F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 16 Section "Basic Electrical Materials and Methods."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 267626

SECTION 27 00 00 - GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under Division 1 and 2, General Requirements, are included as a part of this section as though bound herein.

1. DRAWINGS:

a. The Drawings prepared for this Project are an outline to show where apparatus must go in order to harmonize with the building and installations of the various trades. Work must be installed in accordance with the drawings insofar as possible. Drawings shall be carefully checked during the course of bidding and construction. If discrepancies, errors, or omissions are discovered prior to or during the construction phase, notify the Owner's Agent immediately for interpretation or correction. Take necessary measurements and be responsible for same, including clearances for equipment that is to be furnished. The Owner shall reserve the right to make minor location changes of equipment where such adjustments are deemed desirable from an appearance or operational standpoint. Such changes will be anticipated sufficiently in advance to avoid extra work or unduly delayed progress on the Project.

1.2 SUMMARY

A. RELATED SECTIONS

1. The requirements of this Section supplement the General Conditions and shall apply to Work for Sections listed under Division 27 – TECHNOLOGY.

B. PERFORMANCE

1. Provide the labor, materials, equipment, appliances, services and transportation, and perform the operations in connection with the construction and installation of the Work. Work shall be as herein specified and as denoted on the accompanying Drawings.

1.3 REFERENCE STANDARDS

A. NOTE: Educational facilities are unique facilities and do not specifically conform to the TIA/EIA standard, they are not commercial buildings that must flex with each new tenant. The Owner will deviate from the standard to enhance the instructional impact of the technology implementation. Deviations will be noted below:

1. Quantity of drops in a given space.

2. Quantity of drops within a single communications box.

3. Use of a collapsed backbone data system architecture.

4. Deletion of wiring closets (IDF).

5. Fiber cable direct to the classroom.

6. No patch panels in classrooms containing hub units.

7. When wiring closets (IDF) are used, room size requirements are not strictly adhered to.

B. Where practices noted within this specification do not adhere strictly to the TIA/EIA standards, The Owner has done so for a specific purpose related to educational facilities. For those areas deviating from the standard, this contractor will not be liable for complying with the TIA/EIA standards.

C. The standard references for the layout and construction of the system shall be the current version of:

1. GENERAL, (Includes Copper and Fiber):

a. TIA/EIA-568 - Commercial Building Standard for Telecommunications Wiring

b. TIA/EIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.

c. TIA/EIA-606 - Administrative Standard for the Telecommunications Infrastructure of Commercial Buildings.

d. TIA/EIA-607 - Commercial Building Grounding/Bonding Requirements.

e. BICSI-TDM Manuals-Building Industry Consulting Service International-Telecommunications Distribution Methods Manuals.

f. ANSI - American National Standards Institute

g. UL Listed - Underwriter’s Laboratories Listed

h. UL Certified - Underwriter’s Laboratories LAN Cable Certification Program.

i. NEMA - National Electrical Manufacture’s Association.

2. AUDIO:

a. Handbook for Sound Engineers

b. The New Audio Cyclopedia (Howard W. Sams, Indianapolis, Indiana 1987)

c. Davis Sound System Engineering Second Edition (Howard W. Sams, Indianapolis, Indiana 1987)

3. VIDEO:

a. National Association of Broadcasters.

b. Engineers Handbook.

1.4 DEFINITIONS

A. PRECEDENCE

1. Precedence of project documents shall be as follows:
   a. In the event of a discrepancy between the specifications and drawings, whichever is more stringent or calls for the highest quantity or quality of materials has precedence.

B. OMISSIONS

1. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from providing such parts.

C. ANCILLARY AND ACCESSORY ITEMS

1. No exclusion from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the accessories necessary to complete any required system or item of equipment are to be omitted.

D. DRAWINGS

1. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the intent diagrammatically expressed on the drawings and described in these specifications. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

E. ORDINANCES

1. All work shall conform to all federal, state, and local ordinances and building official requirements.

F. BUILDING CODES

1. All work shall conform to all state and local building codes and the following:
   a. National Electrical Code (NEC)
   b. National Fire Protection Association (NFPA)
   c. EIA/TIA Standards and Recommendations.

G. UL LISTING

1. All material and equipment shall be listed, labeled, or certified by Underwriter's Laboratories, Inc., where such standards have been established.

H. FCC APPROVAL

1. The system shall be approved for direct interconnection to the utility services under Part 68 of FCC rules and regulations. Those systems that are not FCC approved or utilize an intermediary device for connection will not be considered. Provide FCC registration number of system being proposed with submittals.

I. SUBMITTALS

1. GENERAL:

a. Provide complete shop drawings and submittals for all systems specified within 30 days of notice of award or actual award of contract which ever occurs first. The Architect/Consultant will review and return submittals and shop drawings within fourteen (14) days. Failure to obtain submittal approval within sixty (60) days of contract award, where the delay is due to the poor performance of the contractor, may be cause for cancellation of the contract without penalty of the Owner.

b. Where applicable, the Contractor will submit the greatest quantity of submittal copies noted herein or in the General or Supplemental Conditions of the project documents. If not noted elsewhere within the project documents, the Contractor will submit a minimum of five (5) sets of submittals and shop drawings.

c. The Contractor should not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of submittals, including substitutions, indicates only the acceptance of intent to comply with general design or method of construction and quality as specified. The functional requirements, operations, arrangements, and quantities must comply with the contract documents unless changes are specifically approved in writing. Submittal approval does not relieve the Contractor of responsibility for errors in dimensions, details, sizes, etc.. or coordinating items with actual building conditions. Contractor's responsibility for error and omissions in submittals is note relieved by the Consultant or Owner review of submittals.

d. Submittals and shop drawings will be provided in a single package, multiple partial submittals are not acceptable.

e. Submittals which, in the Consultant's opinion, are incomplete deviate significantly from the requirements of the Project Specifications, or contain numerous errors will be returned without review for rework and are to be re-submitted.

f. If submittals and/or drawings are rejected, or approved with noted changes and resubmittal required, the Contractor will correct the documents as required and resubmit within fourteen (14) days.

g. The Contractor will not fabricate products, begin work, or submit invoices for the scope of work defined in the project documents until return of submittals and shop drawings with Consultant acceptance.

2. SCALED DRAWINGS (Shop Drawings):

a. Each drawing shall have a descriptive title and all subparts of each drawing shall be completely described. All drawings shall have the name of the project, Owner's name and address, consultant, and electronics contractor in the title block.

b. Backboards:

1) Provide complete scaled elevation drawings of all backboards with equipment designations and locations. Provide dimensional relation of each piece of equipment to other pieces of equipment. If other Contractor(s) are providing equipment on the backboard, this Contractor will coordinate the layout of equipment on the backboard with the other Contractor(s).

c. Device Locations:

1) Provide complete scaled drawings detailing projected primary cable paths and locations of all equipment such as control panels, plug panels, video monitors, video projectors, equipment racks, speakers, etc… in quantities noted in the general requirements. These drawings will be utilized for "as-built" submittals with cable numbers noted at the end of the project.

d. Assembly, Supports, and Panel/Plate Layout:

1) Provide diagrammatic representation of all assemblies, i.e. monitor mount assembly, projector mount assembly, and connector panel and/or plate layout. Identify the components that make up the assembly or are used on the panel/plate. For connector panel or plate, indicate identification location and methodology.

e. One-Line System Diagram:

1) Provide one-wire drawings of all racks, consoles, control panels, and custom assemblies, etc., in quantities noted in the general requirements. Each drawing shall delineate circuit numbers for all cables and terminal connections. Provide typical wiring termination for all devices.

3. MANUFACTURERS PRODUCT DATA

a. Manufacturer Cut Sheets:

1) Provide complete sets of a project material list with manufacturer specification sheets for each manufactured device utilized within the system in quantities noted in the general requirements. The Owners Agent will use these sets in determining that all products listed are being supplied as required.

b. Samples:

1) Provide samples of the following:

a) Any plastic or custom metal panels.

b) All paint finishes of cabinets or custom assemblies. (These may be manufacturer cuts sheets indicating the various colors and finishes available).

c) Equipment identification tag material, labeling method, and numbering method.

d) Cable labeling material, labeling method, and numbering method.

e) Faceplate and modules of selected color for approval by Owner/architect.

f) Faceplate labeling material, labeling method, and numbering method.

4. SCHEDULE

a. The Consultant has been retained by the Owner to provide inspection services throughout the duration of the project. Those services include:

1) Inspection of technology rough-in methodologies (cable installation and support methods, component support methodologies.)

2) Inspection of cable, face plate, and cabinet termination and labeling methodologies.

3) Review of Verification Test Reports.

4) Attend and Witness Final Acceptance Test (Proof of Performance Tests).

5) Verify Contractor provision of training requirements.

b. The Contractor is required to provide a projected schedule of activities for the Consultant to plan site visits. The Contractor is responsible to notify the Consultant of any changes in their activity schedule due to change in the overall construction schedule or Contractor schedule. Provide dates for the following:

1) Date upon which 10% of the project cable is expected to be installed.

2) Date upon which 10% of system supports are expected to be installed.

3) Date upon which 10% of cable and plates are terminated and labeled.

4) Date of Verification Test Report completion.

5) Date of expected Final Acceptance Testing.

6) Dates of expected Systems Training.

1.5 QUALITY ASSURANCE

A. GENERAL

1. All equipment and materials required for installation under these specifications shall be new (less than 1 year from date of manufacture) and without blemish or defect.

B. SPECIFIC

1. Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.

1.6 ACCEPTABLE MANUFACTURERS

A. These specifications are based on equipment manufactured by or for specific manufacturers. It is not the intent of these specifications to limit or restrict submission of proposals for products by other manufacturers but to set a baseline of operational functions, which all proposals must meet.

1.7 INSTALLING CONTRACTOR QUALIFICATIONS

A. The Premises Wiring contractor performing work under this Section 27 00 00 shall be certified by the manufacturer of the equipment and components being furnished and be authorized by the manufacturer to install and convey the product warranty and performance guarantee to the Owner upon completion of contract. Installing contractor for all other sections must have a minimum of three years previous experience in audio/visual systems, and/or data communications, and/or telecommunication systems. All contractors and/or vendors supplying all or parts of the work described herein shall supply three project references, which substantiate the contractor/ vendors' previous experience as noted herein and in addition Division 27.

B. Provide three project references for all subcontractors supplying all or parts of the work described herein which substantiate their previous experience as noted herein.

1.8 ENVIRONMENT

A. The equipment specified herein is designed to operate in environments of normal humidity, dust, and temperature. Protect equipment and related wiring where extreme environmental conditions can occur.

PART 2 - PRODUCTS

2.1 DEVICE LOCATIONS

A. Locate all apparatus requiring adjustments, cleaning, or similar attention so it will be accessible for such attention. Equipment racks are existing to remain.

2.2 PAINTING

A. All supporting structures and enclosures supplied by the contractor not having a standard factory paint finish shall be painted in a manner approved by the Owner.

2.3 PAINT COLOR

A. Provide, as may be required, custom color and/or finish for any equipment or materials supplied which are exposed to public view. Color and finish of all such equipment or materials shall be submitted to the Architect for approval. This does exclude equipment or materials where standard colors and finishes are specified herein, unless otherwise noted.

2.4 BLANK AND CUSTOM PANELS

A. Finish of blank panels and/or custom assembly panels utilized for termination and/or interconnection as part of this system shall be stainless steel.

B. In addition, provide blank plastic panels finished in matte (or satin) black to close off all spaces around the source equipment in the distribution room racks. These panels shall have cutouts that provide access to the source machine and its controls. Match each panel to the device it is covering in the racks. Submit a sample of the plastic with finish to the Consultant for approval.

2.5 MARKINGS

A. Switches, connectors, jacks, receptacles, outlets, cables and cable terminations shall be logically and permanently marked in a manner approved by the Owner. Custom panel nomenclature shall be engraved, etched, or screened. Marking for these items are purposely detailed in the drawings to ensure consistency and clarity. Verify any changes in working type size, and/or placement with the Owner prior to marking. Mount on the custom rack panels as described above a designation of each source machine, which correlates to the system architecture. Submit a sample layout for Consultant approval.

PART 3 - EXECUTION

3.1 INSTALLATION

A. GENERAL

1. Perform this work in accordance with acknowledged industry and professional standards and practices, existing building conditions, and as specified herein. Provide and install all materials, devices, components, and equipment for complete, operational systems.

2. Maintain a competent supervisor and supporting technical personnel, acceptable to the Architect, during the entire installation. Change of the supervisor during the project shall not be acceptable without prior written approval from the Owner and the Owner's Agent.

3. Coordinate all efforts with those of related trades. In the event of any conflicts, delayed or improper preparatory work by others, notify the Owner's Agent. The Owner's Agent's decision will be binding. Verify all field conditions.

3.2 BOXES

A. MOUNTING:

1. With the exception of portable equipment, all boxes, conduits, cabinets, equipment and related wiring shall be held firmly in place and the mounting shall be plumb and square. All boxes shall be rigidly and securely mounted to building structure. All boxes shall be installed so that wiring contained in them is accessible. Install blanking devices or threaded plugs in all unused holes.

B. WIRING:

1. Wiring groups and circuits shall be isolated as indicated herein. Common pull or junction boxes shall be avoided. Where deemed necessary and approved, they shall be barrier.

C. CLEANING:

1. Clean all box interiors thoroughly before installing plates, panels, or covers.

3.3 WIRING METHODS & PRACTICES

A. SUPERVISION

1. Installation of all audio, video and control cable to be provided under this scope of work is by this contractor. Supervision to include, but not be limited to ensuring proper:

   a. Pulling Tensions.

   b. Quantities.

   c. Types.

   d. Lengths.

   e. Routing.

   f. Wire Group Separation.

g. Identification.

B. IDENTIFICATION

1. All wires shall be permanently identified at each wire end utilizing a self-laminating wire or cable marker comprised of a white label with black lettering and clear over laminate area, in a manner approved by the Owner's Agent.

2. All faceplates will be permanently identified with engraved plastic laminate or metallized polyester identification labels.

C. TERMINAL BLOCKS

1. All terminal block connections shall be readily accessible. Not more than one wire connected to one terminal. Spare terminal blocks, equivalent to 10% of those in actual use shall be provided.

D. SPLICING:

1. Splicing of cables is not permitted between terminations.

E. PULLING CABLE:

1. Do not pull wire or cable through any box fitting or enclosure where change of raceway alignment or direction occurs; do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, rollers, and other necessary items to protect cables from excess tension, abrasion, or damaging bending during installation. Care shall be taken not to bend, crush or kink cables.

F. CABLE MANAGEMENT:

1. Building Locations:

a. Comb straight and form in a neat and orderly manner all conductors in large junction boxes and cable support bridle rings or other types of open top support systems, providing circuit and conductor identification. Tie wraps are only to be used for cable management, not support. Arrange as required using tie wraps of appropriate size and type, (plenum rated as required). Limit spacing between ties to six inches and provide circuit and conductor identification at least once in each enclosure.

2. Equipment Cabinets or Racks:

a. Comb straight and form in a neat and orderly manner all conductors located within equipment cabinets, located in the head end room or remote locations, and wiring harnesses in the head end room. Tie as required using Velcro cable ties of appropriate type and size.

G. SERVICE LOOPS:

1. Provide ample service loops at each termination and/or per drawings so that plates, panels, and equipment can be dismounted for service and inspection. Provide the following as a minimum:

    a. Outlet box: Eighteen (18) inches from wall surface to jack.

    b. Termination panel: Four (4) inches behind termination panel from last cable tie to jack.

H. NON-CABLE TRAY INSTALLATION :

1. All cable installations which are not supported by a cable tray or conduit system and where educational technology system cables are allowed to be placed loosely in the ceiling must follow the TIA/EIA standard methodology as noted in TIA/EIA 569 - Part 4.6 Ceiling Pathways. Specifically, sections 4.6.1 General, 4.6.2 Design Guidelines, and 4.6.5 Cable Support. Those sections are paraphrased herein (the contractor will be familiar with the specifics of these sections and install their cables in accordance with the standard or as noted herein).

2. The installation of all education technology cabling, regardless of type and separation requirements, from the head end room to various zones throughout the facility will use common pathway routes.

3. Inaccessible ceiling areas, such as lock-in ceiling tiles, drywall or plaster, will not be used as distribution pathways. Should the contractor find inaccessible ceiling areas as the only available pathway, the contractor will notify the Owner’s Agent immediately for direction prior to proceeding with the cable installation.

4. Accessible ceiling areas must have adequate and suitable space available for the distribution layout (minimum of three inches clear vertical space between ceiling tiles and distribution wiring and pathway).

5. The design shall provide a suitable means and method for supporting cables and wires from the head end room (and/or telecommunications closet) to the area being served. The cable will not be laid directly on the ceiling tiles or rail. The Owner allows the use of “Caddy - Multifunction Clip” (as manufactured by ERICO or other equivalent manufacturer) installed on the ceiling support wire at a minimum height of eighteen inches above the tile and utilizing the appropriate D-ring or bridle ring for the installation of cable within a single zone.

6. Cable support will be provided through the use of open-top cable supports located on 48-60 inch centers. Where large quantities of cables (50-75) are bunched together in the ceiling at a congested area, the contractor will use multiple open-top cable supports or a special support designed to carry the additional weight.

7. A single classroom or suite of offices (with an area not exceeding 1200 square) feet will be considered a single telecommunication zone. Instructional spaces which exceed the 1200 square foot limit must be brought to the attention of the Owner’s Agent for review and approval as a single zone. Loose cables from each zone to the telecommunications closet or headend room will be grouped and tied.

I. WIRING HARNESSES:

1. All wires and cables used in assembling custom panels and equipment racks shall be formed into harnesses, tied with Velcro tie wraps and supported in accordance with accepted engineering practice.

2. Harnessed cables shall be combed straight. Each cable that breaks out from a harness for termination shall be provided with an ample service loop.

3. Harnessed cables shall be formed in either a vertical or horizontal relationship to equipment, controls, components, or terminations.

3.4 GROUNDING

A. GROUNDING PROCEDURE:

1. The system wiring will conform to the following procedures:

ITEM	PROCEDURE
Equipment AC Ground Pins:	Connect to AC ground.
Equipment Chassis:	Connect to AC ground and/or rack frames
Rack Frames:	Connect to AC ground. Use insulated bushings for all conduit connections
Shielded Cable Between AC powered equipment:	Connect to ground at one end only.
Unbalanced Equipment:	Float chassis from rack.
Conduit/Back Boxes:	Isolate system wiring, including AC power, from all conduits and permanent backboxes
AC Ground:	Green wire (grounding conductor) system shall be isolated from all other facility grounds. Connects at one point to earth.

B. METALLIC CONDUIT & ENCLOSURES

1. All metallic conduit, boxes, and enclosures shall be permanently and effectively grounded in accordance with the National Electrical Code. Metallic enclosures containing active equipment shall be grounded with due regard for minimization of electrical noise.

3.5 EQUIPMENT RACKS

A. The equipment racks are existing to remain

3.6 IDENTIFICATION:

A. All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled in a manner acceptable to the Owner as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black background or dark background. Handwritten identification is not

permitted. The contractor may substitute metallized polyester permanent identification labels with black printing on silver, white, or another light color background for the phenolic labels above.

3.7 CABLE TEST METHODOLOGY

A. TEST DOCUMENTATION:

1. Upon substantial completion of the data network and interfacing of the Owner supplied equipment, test every data port for the functional requirements as listed in previously. Document, on a contractor generated form, the compliance of every port and the testing individual will initialize the results of each location. Submit a written report detailing the results of initial adjustments and verification tests including all relevant drawings, charts, and photographs.

B. FIELD TEST REQUIREMENTS FOR A BALANCED TWISTED-PAIR CABLING SYSTEM

1. Every cabling link in the installation shall be tested in accordance with the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-B.2-1 (June 2002) Section 11.2: “100-Ohm twisted-pair transmission performance and field test requirements”.

2. The installed twisted-pair horizontal links shall be tested from the IDF in the telecommunications room to the telecommunication wall outlet in the work area against the “Permanent Link” performance limits specification as defined in ANSI/TIA/EIA-568-B.2-1 (June 2002).

3. 100% of the installed cabling links must be tested and must pass the requirements of the standards mentioned in subsection 1 above and as further detailed in Section 27 15 00 - Horizontal Cabling. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation as described below.

4. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. Appropriate training programs include but are not limited to installation certification programs provided by BICSI or the ACP (Association of Cabling Professionals).

5. The test equipment (tester) shall comply with or exceed the accuracy requirements for enhanced level II (Level II-E) field testers as defined in TIA-568-B; Annex I: Section I.4. The tester including the appropriate interface adapter must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table I.4 of Annex I of TIA/EIA-568-B.2. (Table I.5 in this TIA document specifies the accuracy requirements for the Channel configuration.)

6. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

7. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the perma-

nent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction. The Fluke DSP-LIA101S permanent link adapter available for the DSP-4000 Series CableAnalyzer™ is an example of a tester interface that fully complies with this requirement.

8. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Section 27 15 00 - Horizontal Cabling). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.

9. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks. (Reference TIA-568-B; Annex I: Section I.2.2)

10. A representative of the end-user shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase 5 business days before testing commences.

11. A representative of the end-user will select a random sample of 10% of the installed links. The representative (or his authorized delegate) shall test these randomly selected links and the results are to be stored in accordance with the prescriptions in Section 27 15 00 - Horizontal Cabling. The results obtained shall be compared to the data provided by the installation contractor. If more than 2% of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100% testing and the cost shall be borne by the installation contractor.

C. BALANCED TWISTED-PAIR CABLING SYSTEM PERFORMANCE TEST PARAMETERS

1. The test parameters for Cat 6 are defined in ANSI/TIA/EIA standard 568-B.2-1 "*Parameters to be reported".* The test of each Cat 6 link shall contain all of the following parameters as detailed below. In order to pass the link test all measurements (at each frequency in the range from 1MHz through 250MHz) must meet or exceed the limit value determined in the above-mentioned Cat 6 standard.

   a. Wire Map [as defined in TIA/EIA-568-B.2-1]: Wire Map shall report Pass if the wiring of each wire-pair from end to end is determined to be correct. The Wire Map results shall include the continuity of the shield connection if present.

   b. Length [as defined in TIA/EIA-568-B.2-1]: The field tester shall be capable of measuring length of all pairs of a permanent link or channel based on the propagation delay measurement and the average value for NVP. The physical length of the link shall be calculated using the pair with the shortest electrical delay. This length figure shall be reported and shall be used for making the Pass/Fail decision. The Pass/Fail criteria are based on the maximum length allowed for the permanent link configuration (90 meters – 295 ft) or the channel (100 meters – 328 ft) plus 10% to allow for the variation and uncertainty of NVP.

c. Insertion Loss (Attenuation) [as defined in TIA/EIA-568-B.2-1]: Insertion Loss is a measure of signal loss in the permanent link or channel. The term 'Attenuation' has been used to designate "insertion loss". Insertion Loss shall be tested from 1 MHz through 250 MHz in maximum step size of 1 MHz. It is preferred to measure attenuation at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk Ratio (ACR) parameter. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.

d. NEXT Loss, pair-to-pair [as defined in TIA/EIA-568-B.2-1]: Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12 pair combinations). This parameter is to be measured from 1MHz through 250MHz. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the standards as shown in Table 1, column 2. A smaller step size more accurately identifies worst case margin conditions (see summary results, below).

Table 1

Frequency Range (MHz)	Maximum Step size (MHz)	Fluke DSP-4000 Fluke DSP-4100
1 – 31.25	0.15	0.10
31.26 – 100	0.25	0.20

Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin (1) and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

e. PSNEXT Loss [as defined in TIA/EIA-568-B.2-1]: Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link-under-test (a total of 8 results). PSNEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when all other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1MHz through 250MHz and the step size may not exceed the maximum step size defined in the standards as shown in Table 1, column 2.

f. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSNEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

g. ELFEXT Loss, pair-to-pair [as defined in TIA/EIA-568-B.2-1]: Pair-to-pair FEXT Loss shall be measured for each wire-pair combination from both ends of the link-under-test. FEXT Loss measures the unwanted signal coupling (crosstalk disturbance) on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair.

FEXT is measured to compute ELFEXT Loss that must be evaluated and reported in the test results. ELFEXT measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire-pair combinations. ELFEXT is to be measured from 1MHz through 250MHz and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the standards as shown in Table 1, column 2. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

h. PSELFEXT Loss [as defined in TIA/EIA-568-B.2-1]: Power Sum ELFEXT is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields 8 wire-pair combinations. Each wire-pair is evaluated from 1MHz through 250MHz in frequency increments that do not exceed the maximum step size defined in the standards as shown in Table 1, column 2. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSELFEXT. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

i. Return Loss [as defined in TIA/EIA-568-B.2-1]: Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured form 1 through 100 MHz in frequency increments that do not exceed the maximum step size defined in the standards as shown in Table 1, column 2. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

j. ACR (Attenuation to crosstalk ratio): ACR provides an indication of bandwidth for the two wire-pair network applications. ACR is a computed parameter that is analogous to ELFEXT and expresses the signal to noise ratio for a two wire-pair system. This calculation yields 12 combinations – six from each end of the link. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case margin and the wire pair combination that exhibits the worst value for ACR. These wire pair combinations must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

k. PSACR: The Power Sum version of ACR is based on PSNEXT and takes into account the combined NEXT disturbance of all adjacent wire pairs on each individual pair. This calculation yields 8 combinations – one for each wire pair from both ends of the link. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst case margin and the wire pair that exhibits the worst value for PSACR. These wire pairs must be identified for the tests performed from each end. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

l. Propagation Delay [as defined in TIA/EIA-568-B.2-1:Propagation delay is the time required for the signal to travel from one of the link to the other. This measurement is to be performed for each of the four wire pairs. Minimum test results documentation (summary results): Identify the

wire pair with the worst case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.

m. Delay Skew [as defined in TIA/EIA-568-B.1; Section 11.2.4.11]. This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero. Minimum test results documentation (summary results): Identify the wire pair with the worst case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.

D. BALANCED TWISTED-PAIR CABLING SYSTEM TEST RESULT DOCUMENTATION

1. The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.

2. The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test and that these results cannot be modified at a later time. Superior protection in this regard is offered by testers that transfer the numeric measurement data from the tester to the PC in a non-printable format such as the Fluke DSP-4000 Series CableAnalyzer™.

3. The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.

4. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information.

   a. The identification of the link in accordance with the naming convention defined in the overall system documentation:

   b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.

   c. The date and time the test results were saved in the memory of the tester.

5. General Information to be provided in the electronic data base with the test results information for each link:

   a. The identification of the customer site as specified by the end-user.

   b. The identification of the link in accordance with the naming convention defined in the overall system documentation.

   c. The overall Pass/Fail evaluation of the link-under-test.

   d. The name of the standard selected to execute the stored test results.

   e. The cable type and the value of NVP used for length calculations.

f. The date and time the test results were saved in the memory of the tester.

g. The brand name, model and serial number of the tester.

h. The identification of the tester interface.

i. The revision of the tester software and the revision of the test standards database in the tester.

j. The test results information must contain information on each of the required test parameters that are listed in Section 27 15 00 - Horizontal Cabling and as further detailed below under paragraph 6.

6. The detailed test results data to be provided in the electronic database for each tested link must contain the following information:

a. For each of the frequency-dependent test parameters, the minimum test results documentation shall be stored for each wire-pair or wire-pair combination as observed from each end of the link. The minimum test results documentation for each test parameter shall be in compliance with the information described herein.

1) Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.5 m *[optional:* foot*]* and the test limit value

2) Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value

3) Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value

4) Insertion Loss (Attenuation): Minimum test results documentation as explained in Section 27 15 00 - Horizontal Cabling for the wire pair with the worst insertion loss

5) Return Loss: Minimum test results documentation as explained in Section 27 15 00 - Horizontal Cabling. Identify as detected from each end of the link, the wire pair that exhibits the worst case margin and the wire pair with the worst RL. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

6) NEXT, ELFEXT, ACR: Minimum test results documentation as explained in Section 27 15 00 - Horizontal Cabling. Identify as measured from each end of the link, the wire pair combination that exhibits the worst case margin and the wire pair combination that delivers the worst case value. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

7) PSNEXT, PSELFEXT, and PSACR: Minimum test results documentation as explained in Section 27 15 00 - Horizontal Cabling. Identify as detected from each end of the link, the wire pair that exhibits the worst case margin

and the wire pair with the worst value. Each reported case shall include the frequency at which it occurs as well as the test limit value at this frequency.

8) Link length, propagation delay, and delay skew shall be reported for each wire pair as well as the test limit for each of these parameters.

7. The test result information for each link shall be recorded in the memory of the field test equipment upon completion of the test.

8. The test result records saved by the test equipment shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records.

9. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the test equipment" at the end of each test.

10. The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable.
11. The database for the completed job – including twisted-pair copper cabling links if applicable – shall be stored and delivered on CD-ROM; this CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

12. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

    a. The identification of the link in accordance with the naming convention defined in the overall system documentation.

    b. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst case margin (margin is defined as the difference between the measured value and the test limit value).

    c. The date and time the test results were saved in the memory of the test equipment.

13. General Information to be provided in the electronic data base containing the test result information for each link:

    a. The identification of the customer site as specified by the end-user.

    b. The overall Pass/Fail evaluation of the link-under-test. The name of the standard selected to execute the stored test results.

    c. The cable type and the value of the 'index of refraction' used for length calculations.

    d. The date and time the test results were saved in the memory of the test equipment.

    e. The brand name, model and serial number of the test equipment.

f. The revision of the test equipment software and the revision of the test standards database in the test equipment.

g. The detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information:

h. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

i. The attenuation measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value).

j. The link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas previously shown.

k. All fiber optic cable shall be factory tested on a reel basis with performance data for each cable supplied to the contractor and to the Owner. Tests shall be conducted utilizing an OTDR (Optical Time Domain Reflectometer) at 850nm and 1300 nm with the attenuation in dB/km recorded for each fiber.

3.8 VERIFICATION TEST REPORT

A. Submit a written report detailing the results of initial adjustments and verification tests including all relevant drawings, charts, and photographs. This report will be completed and submitted for review at least five (5) days prior to acceptance testing.

3.9 ACCEPTANCE TESTING

A. The Acceptance Testing and provision of testing equipment will be the responsibility of and performed by the Contractor in the presence of the Owner, Architect, or the Owner's representative. Coordinate this period so that free access, work lighting, electrical is available on the site.

B. Should the contractor schedule an Acceptance Test and the system or components are not ready for or fail Acceptance Testing, the contractor will pay for all subsequent trips and man-hours required for the consultant to properly document specification conformance by the contractor. The Owner will have the right to reduce pay requests or final application of payment to the contractor in an amount equal to the travel costs and man-hours expended by the Consultant and charged to the contractor. The Owner would then pay the Consultant from the funds with held from the contractor.

C. Upon witness of the Acceptance Testing and the determination, in the Consultant's opinion, that the Contractor has falsified the Verification Test Reports, the Owner has the right to hire an Independent Testing Agency to provide outside verification of the results. Falsification of the test results is defined as cables shown as testing correctly in the Verification Report fail during the Acceptance Testing. (The Contractor has the right to hire an Independent Testing Agency approved by the Consultant and the Owner directly.) Furthermore, the Owner will have the right to reduce pay requests or final application of payment to the Contractor in an

amount equal to the travel costs and man-hours expended by the Independent Testing Agency and Consultant and charged to the contractor. The Owner would then pay the Independent Testing Agency and Consultant from the funds with held from the contractor.

3.10 SYSTEM DOCUMENTATION

A. Prior to final acceptance tests, the Contractor shall submit to the Owner three copies of an operating and maintenance manual for the system that has been installed. These manuals will be used during the final acceptance testing of the system. Each manual will contain the following information:

B. As-built project drawings. Provide three copies.

C. Manufacturer Operation and Maintenance manuals. Provide three copies.

D. Where applicable, single line diagrams showing levels throughout system and impedances. Provide three copies.

E. Copies of Training materials. Provide three copies

F. Verification and Acceptance Test Reports. Provide three copies.

END OF SECTION 270000

SECTION 27 05 00 - BASIC COMMUNICATIONS MATERIALS AND METHODS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Division 00 General Conditions and division 01 General Requirements apply to the work of this Section.

B. The Contractor shall have a Project Manager with a MUSD on staff and submit a copy of their current credentials.

1.2 WORK INCLUDED

A. This Section describes the scope of work, standards, products and execution to provide new and complete Voice and Data Backbone Cabling and routing on the (Headstart Stonegate Elementary School) campus. This project includes the following types of cabling: and Category 6 and 6A copper (voice and speaker backbones). This is a cabling-only project, and does not include specifications for PBX, handsets, desktop PCs, or servers used for the generation of communication signals on the installed wiring.

1. Installation of Inside Plant Category 6A horizontal distribution cable from the new Building IDF to wall and ceiling mounted outlets.

2. Routing, suspension, and mounting of cabling.

3. Termination of all cables in Telecommunications Spaces and other specified locations.

4. Testing, labeling, and documentation of all cable and hardware installed under this contract.

5. Preparation and submission of testing reports, as-built drawings and cabling documentation.

6. Sealing of OSP entrance conduits and all penetrations after cabling is installed.

B. It is the intent of the Drawings and Specifications to provide a cabling system ready for use. Any item not specifically drawn or called for in the Specifications, but normally required for a complete system, is considered to be part of the Contract.

1.3 RELATED WORK INCLUDED IN OTHER SECTIONS

A. Sections of Division 26 00 00, Electrical General Requirements.

B. Sections of Division 27 00 00 General Technology Requirements.

1.4 SUBMITTALS

A. The Contractor shall provide submittals within 30 working days of Notice to Proceed. The Contractor shall not deliver materials to the site until submittals are approved.

B. Product Data

1. Provide manufacturer's catalog information showing dimensions, colors, and configurations.

2. Submittals shall include all items called for in PART 2 – PRODUCTS of this document and the manufacturers cut sheets for the following:

a. All single mode fiber optic cable
b. All multimode fiber optic cable
c. All balanced twisted pair cable
d. All connectors and required tooling
e. All termination system components
f. All grounding and surge suppression system components
g. All test equipment to be used

3. Identify each submittal item by reference to Specification Section paragraph in which item is specified or Drawing and Detail number.

4. Organize submittals in the same sequence as they appear in Specification Sections, articles, or paragraphs.

1.5 PRE-INSTALLATION CONFERENCE

A. Convene a pre-installation conference at least seven calendar days prior to installing any equipment, devices or systems in the IDF Room. For projects with underground and/or roof mounted conduits convene a separate pre-installation meeting

B. Attendance: Architect, Construction Manager, Contractor, Electrical Subcontractor, Low Voltage Subcontractor/s, District Low Voltage System Representative and Project Inspector.

C. Agenda: Review all low voltage systems related to the project. Subcontractors shall come prepared to discuss how the low voltage systems are being installed and run throughout the building/s.

PART 2 – PRODUCTS

2.1 GENERAL

A. The voice and data cabling system is defined as all required equipment and cabling, including hardware, termination blocks, cross-connects, patch panels, patch cords, copper and fiber cabling.

B. The Contractor shall supply the products as detailed in this specification. If not specified, the Contractor can select products of suitable quality and workmanship. For any products selected by the Contractor, the Contractor is required to submit product documentation

including manufacturer's original literature, product specifications and testing reports as previously described.

C. Equal Product may be considered for substitution for those products specified, however, any equivalent product(s) must be approved by the District IT Representative prior to installation, and show demonstrated and documented equivalence or superiority in performance and functionality to the product(s) specified.

D. All material furnished shall be new and unused. All materials used shall bear the Underwriter's Laboratory, Inc. label, provided a standard has been established for the material in question. All products and materials to be clean, free of defects, and free of damage and corrosion.

E. The Contractor must provide a 20 year Leviton / Superior EssexOutside Plant warranty and a Limited Lifetime Leviton/Berk-Tek warranty upon completion of this project. All warranties are processed by the contractor through Leviton Network Solutions and delivered directly to the Owner.

2.2 OUTSIDE PLANT COPPER BACKBONE CABLE

A. All voice grade cable placed in the outside environment shall be solid, unshielded twisted pair, PE-89, 24 AWG Outside Plant Cable (OSP). Twenty-five pair cable shall be Superior Essex 09-097-92 for speakers. Fifty pairs cable shall be Superior Essex 09-100-92 for analog lines and cameras.

B. The copper twisted pair shall have a mutual capacitance at 1kHz of 83 nF/mile and meet ANSI/ICEA S-84-608 2007.

C. The cable shall be resistant to mechanical damage, lightning, or damage from wildlife. The cable shall have a dual shield design with fully flooded shield interfaces.

2.3 BUILDING ENTRANCE PROTECTORS

A. All OSP balanced twisted pair cable pairs shall be provided with protection at each building with an entrance cable protector panel. Circa Telecom 1880ECA1-50G regardless of the number of pairs required.

B. The protector panel shall be equipped with a ground lug that will accept a 6 AWG copper bonding conductor.

C. Each protector panel shall be fully loaded with 5-pin plug-in protector modules 4B1FS-240.

2.4 110-TYPE WIRING BLOCK KIT

A. The wiring block kit shall support Category 3 applications and facilitate cross connection and interconnection using cross connect wire. Leviton 41MB2-3F4. Each kit shall be provided with a vertical cord manager, Leviton 41880-300.

B. The wiring block shall be fire retardant, molded plastic consisting of horizontal index strips for terminating 25 pairs of conductors each. The index strips shall be marked with

five colors on the high teeth, separating the tip and ring of each pair, to establish pair location. The wiring block shall accommodate 22 through 26-AWG conductors.

C. The wiring block kit shall include multiple 100 pair blocks, mounting frame, horizontal cord manager and label holder.

D. Provide C5 clips for ISP feeder terminations only. No station cabling is to be terminated directly onto 110 frames unless otherwise specified by District Low Voltage System Representative.

E. Every 110 frame is to be provided fully loaded with C5 Clips.

2.8 UTP STATION CABLE

A. UTP Station cable shall consist of 4-pair Category 6, 23 AWG thermoplastic insulated conductors. All station cabling in plenum rated areas must have a minimum cable sheath rating of CMP. (All systems consist of CAT6 cabling)

1. This cable must meet parameters of the Cat 6 Cable TIA/EIA-568-Cand CAT 6 Permanent Link TIA/EIA-568-CCommercial Building Telecommunications Wiring Standard.

a. Input Impedance – 100 Ohms +/- 15% at 1-100 MHz
b. ACR at 250 MHz shall be a minimum of 8.7 dB/100m.
c. PS NEXT at 250 MHz shall be a minimum of 39.3 dB/100m.
d. Insertion loss at 250 MHz shall be a maximum 32.6 dB/100m.

2. Data station cable jacket shall be blue, Berk-Tek LANmark-1000, 10032094 (CMP).
3. Wireless cable jacket shall be green, Berk-Tek LANmark-1000, 10032097 (CMP).

2.9 COPPER OUTLET TERMINATIONS

A. T568B eight position, 8-conductor RJ45 jacks with 110 style rear termination. These terminations shall meet or exceed the requirements of the Cat 6A Cable TIA/EIA-568-Cand CAT 6A Permanent Link TIA/EIA-568-CCommercial Building Telecommunications Wiring Standard.

1. Four Pair data station cables in surface wall boxes shall be terminated on blue jacks, Leviton 61110-RL6.

2. Four pair cables for wireless outlets in ceiling mounted boxes shall be terminated on green jacks, Leviton 61110-RV6.

3. Four pair cables for camera outlets shall be terminated on yellow jacks, Leviton 61110-RY6. (refer to surveillance section)

4. Four pair cables for intrusion panel IP connectivity shall be terminated on gray jacks, Leviton 61110-RG6. (refer to intrusion section)

5. Four pair cables for speakers shall be terminated on purple jacks, Leviton 61110-RP6. (refer to paging section)

B. Universal faceplates that will accept the jack of the connectivity solutions shall be used throughout this project. Material shall be stainless steel. Leviton 43080-1S2 (2 ports) and 43080-1S4 (4 ports).

C. Wall phone faceplates to be provided under this scope shall accept the jacks used on this project. Leviton 4108W-0SP.

D. Wireless face plates shall be Leviton Quick Port 2 Port Face Plate 41080-2IP.

2.10 COPPER PATCH PANELS

A. High density unshielded twisted pair termination panels with space for 48 8P8C modules. Panels shall mount in a standard 19 inch equipment rack with universal hole spacing and allow for independent installation and removal of jack modules. Rear cable management bar shall be included with each patch panel. Cable termination modules shall be included as needed to complete the installation. All unused ports shall be covered with blank modules. Provide 20% additional patch panels for future growth.

1. Modular jack panels shall be 48 ports in a 2U space. Leviton 49255-H48 for CAT6A cabling.

2.11 WIRE MANAGEMENT

A. Horizontal and Vertical cable managers shall be capable of managing cables on the front and rear of a standard 19 inch equipment rack. Horizontal managers shall have pass through holes that incorporate integral bend radius control and fingers with rounded edges. Hinged covers shall allow access to the cable pathway without having to remove the cover from the wire manager. Install horizontal wire managers above and below each patch panel.

1. Horizontal cable manager 2U high, Chatsworth 30530-719.

2. Vertical cable managers shall be Chatsworth 30095-703.

2.12 TELECOMMUNICATIONS GROUNDING AND BONDING

A. All grounding and bonding conductors shall be copper and may be insulated When conductors are insulated, the sheath shall be green or marked with a distinctive green color, and shall be listed for the application. The minimum bonding conductor size shall be 6 AWG.

B. The Telecommunications Ground Busbar (TGB) shall be dedicated and pre-drilled copper busbar provided with holes for use with standard sized lugs. This busbar shall have minimum dimensions of .25 inch thick, 4 inches wide, and be variable in length. The busbar shall be connected to a dedicated ground rod to be installed at each IDF/MDF.

C. Two-hole compression ground lugs shall be Chatsworth 40162-901, 40162-904, 40162-909, and 40162-911, or equal, based on the size of the copper conductor to be terminated.

D. All low voltage systems in this project are to be grounded and bonded.

2.13 LABELS

A. The contractor shall provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels must be of high quality that will endure heat, water, and time.

B. Shall meet the legibility, defacement, exposure, and adhesion requirements of UL 969.

C. Shall be pre-printed using a mechanical means of printing.

D. Where used for cable marking, provide vinyl substrate with a white printing area and a clear “tail” that self laminates the printed area when wrapped around the cable. The cable marking should be immediately visible and be within two inches from the termination point.

E. Where insert type labels are used, provide clear plastic cover over label.

F. Copper patch panel labeling shall be completed with adhesive labeling kit specifically designed for the panel, Leviton 49257-QHD.

G. Labeling P-touch font size 4MM bold, black on White, 3/8” labeling tape on all work stations, panels and devices.

H. A round Avery label green in color Product Number: 5463 and a station label utilizing the same font size as on work station face plate must be installed on ceiling grid below each wireless cable location for identification. See type “D” Wireless Location Detail.

I. Labels shall be numbered consecutively and separate for each type of use. Refer to Work Station

J. Details and Floor Plan Device Numbering Example for additional information

K. Both patch panel and drop must be labeled in the following formats:

Patch Panel Side
Non-Wireless is a three-digit port number [XXX] along with A/B designations for dual drops – vendor to check with SCCOE for what number to start with when adding ports
Wireless will have a “W-“ prefix along with the APs inventory number – vendor to check with SCCOE for what number to start with when adding ports
Drop-Side
Non-Wireless label must be on both the end of the cable as well as the cover plate.

The plate label will include floor and building, along with three-digit port number in the format of X.Y.ZZZ, where X is the building number, Y is the floor number and Z is the port number. Drops may be labeled on the jack itself, rather than on the cover plate.
he cable will be labeled with only the ZZZ number format.
Wireless drops will be labeled with building, floor and AP number format. Label should be on both the T-Bar and the jack where the drop is located.

2.14 EQUIPMENT AND LADDER RACK SYSTEM

A. UL listed Chatsworth 24”W x 36”H x 24” D 45 RMU Aluminum cube it rack

B. Wall support for cable runway Chatsworth Triangular Support Bracket P.N. 11312-712

C. Equipment rack bonding material Chatsworth Green Ground Jumper P.N. 40159-009 and Chatsworth Green Cable Runway Ground Strap Kit P.N. 40164-001. Remove paint under each ground lug

2.15 POWER DISTRIBUTION UNIT

A. Rack mounted power distribution unit shall be a 19 inch wide 20 amp 125V horizontal unit with eight 5-20R receptacles and a standard 10 foot power cord with 5-20P straight blade plug, Geist RCURN082-102D20ST5-OD to be installed in the MDF/IDF.

B. Add two dedicated 20 Amp 5-20R each, four-plex power receptacle per rack

2.16 OTHER EQUIPMENT

A. Plywood Backboard: The Contractor shall provide fire-rated, A/C grade, void free, ¾”x4’x8’ plywood. To reduce warping, fire rated plywood should be kiln dried to a maximum moisture content of 15%. Plywood shall be securely fastened to the wall. Plywood shall be painted with two coats of white paint. The Contractor shall not paint over the fire rating stamp. The plywood is to be mounted vertically and is to cover all walls of the IDF.

B. Service loop mounts: The Contractor shall provide service loop mounts for management of the fiberand copper service loopsat both ends. Leviton Storage Rings for OSPriser backbone cabling shall be provided. The Contractor shall provide a service loop equal to the maximum length allowable so as to not exceed a total of 50 feet of exposed cable from building entrance to termination. Leviton Storage Rings 48900-OFR.

B. Fabric Innerduct: The contractor shall install 3 cell fabric innerduct in all sections of conduit, Maxcell or equal. Installation must follow manufacturer’s installation requirements, using recommended installation tools. Fabric Innerduct size shall match manufacturer recommended maximum size. Fiber shall be installed within fabric innerduct.

C. Patch Cords: The Contractor shall provide Leviton bootless / snagless patch cords for both station and IDF equipment end. Counts to support cable drop counts build out of all low voltage systems terminated on patch panels. Lengths and colors are as follows:

8’ Blue patch cord Cat 6A bootless / snagless6D460-08L
7’ Blue patch cord Cat 6A bootless / snagless6D460-07L
6’ Green patch cord Cat 6A bootless / snagless 6D460-06G
6’ Yellow patch cord Cat 6A bootless / snagless 6D460-06Y
6’ Grey patch cord Cat 6A bootless / snagless 6D460-06S
6’ Purple patch cord Cat 6A bootless / snagless 6D460-06P
6’ Orange patch cord Cat 6A bootless/snagless 6D560-06O

D. Fiber Patch Cords: The contractor shall provide and install (4) duplex SM Leviton UPDLC-S10and (4) duplexMM Leviton 62DLC-M10 fiber patch cords not to exceed 15 meters each and which will not introduce a loss greater than 1.0 dB, including connectors. The contractor shall confirm actual length and connector types with the district IT representative.

E. Cross-connects: Each IDF and MDF receives one CPI 11435-719 Cable Reel with four reels of Superior Essex cross-connect wire. One 1k roll of white/blue 02-001-13 for voice,one 1k roll of yellow/blue 02-002-13 for speakers, one 1k roll of red/blue 02-053-13 for stationary cameras and one two pair red/blue, red/orange 02-221-13 for ptz cameras.

F. Port Installation Details
Excess service loop of 10 (ten) feet must be added for each new drop and coiled above the ceiling.
Always pull pairs of copper when adding ports, vertically mounted wall plates.
Location on the wall must be ADA compliant.
Wireless infrastructure drops must terminate to a surface mount box above drop tile.
If materials are not available check with SCCOE for equivalent.

2.17 FIRE STOP SYSTEM:

1. See project drawings for detailed fire caulk systems and products.
2. Intumescent fire caulk:
    a. The firestop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
    b. Firestop systems comprise an effective block for fire, smoke, heat, vapor and pressurized water stream.
    c. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper firestop equipment.
    d. Firestop systems shall be UL Classified to ASTM E814 (UL 1479).

e. Approved Fire Barrier/Caulk – 3M Fire Barrier CP25 or equal STI, PN# SSS100.

2.18 Re-Enterable Fire Stop System:

1. See project drawings for detailed fire thru systems and products.
   a. The re-enterable fire stop system is comprised of the item or items penetrating the fire rated structure, the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure.
   b. No additional fire stopping material shall be required to obtain proper fire stopping.
   c. The system shall offer full fire resistance whether it is empty or 100% visually filled.
   d. The system shall be self-contained, and shall automatically adjust to differing cable loads.
   e. The system shall allow add, moves, and changes without additional materials.
   f. All penetrations through fire-rated building structures (walls and floors) shall be sealed with an appropriate re-enterable fire stop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating item i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall use the proper fire stop equipment.
   g. Fire stop systems shall be UL Classified to ASTM E814 (UL 1479).
   h. The system shall be gang-able using wall plates for additional capacity.
   i. Quantity: See Drawing for quantity and installation details.
   j. Part #: Equal to STI
      1) STI PN# EZDP33FWS.
      2) STI PN# EZDP33WR.

PART 3 – EXECUTION

3.1 GENERAL

A. Manufacturer’s recommended installation practices shall be followed.

3.2 DAMAGES

A. The Contractor shall be liable for any and all damages to portions of the existing Campus caused it, its employees or subcontractors, including, but not limited to:

1. Damage to any portion of the Campus caused by the movement of tools, materials, or equipment.

2. Damage to any component of the existing telecommunications spaces accessed by the Contractor.

3. Damage to the existing electrical, telecommunications, mechanical and/or life safety or other systems caused by inappropriate operation or connections made by the Contractor or other actions of Contractor.

3.3 OUTSIDE PLANT CABLE INSTALLATION

A. Use pulling compound when necessary. Pulling compounds must be water-base lubricant that will not deteriorate cable or conduit.

B. All cable/cabling shall be kept 30 inches away from any heat source; i.e. steam valves, etc.

C. Cables shall be pulled free of sharp bends, kinks, twists, or impact damage to the sheath. Cables shall not be pulled across sharp edges. All conduits and sleeve with rough edges will be provided with bushings on both ends. Cables shall not be forced or jammed between metal parts, assemblies, etc.

D. All outside plant cables will be terminated within 50 feet of the building entrance point. This is a maximum cable measurement and includes lengths for service loops, routing, backboard and patch panel mounting. If the cables cannot be terminated within the 50 foot length, the cables shall be extended in an uninterrupted rigid conduit from the point of building entry to within a 50 foot distance from the point of termination.

E. Cable mountings and service loops on backboards will be installed efficiently to minimize the backboard space consumed. All cables will be routed at right angles, in accordance with the bend radius specifications for the type of cable being routed. Multi-pair copper cables will be tie wrapped every 4 feet. Fiber and Category 6 cables shall use Velcro wraps.

F. Polarization for entire system shall be maintained as described in ANSI/EIA/TIA-568-Csection 12.7.1.

3.4 COPPER BACKBONE TERMINATIONS

A. All copper shall be terminated on building entrance protector panels.

B. The building Entrance blocks shall be fully populated with protection fuses.

C. The OSP copper cable shall be exposed for no more than 50 feet from the point of entry in each building to where it is terminated on the protector panels as defined in Article 800-2 of the National Electrical Code.

D. The Building Entrance protection blocks shall be grounded with a 6 AWG copper bonding conductor between the protector ground lug and the grounding bus bar.

E. From the protector blocks, the Contractor shall provide ISP feeder to match OSP feeder count to new, wall mount 110 style blocks. All pairs shall be extended from the protector blocks to the 110 blocks.

3.5 FIBER OPTIC BACKBONE TERMINATIONS

A. Fiber will directly terminate on the rack mount fiber shelves without additional splicing. Sufficient cable slack to allow for movement and relocation will be required.

B. Field terminated LC connectors are required for all fiber strands in the telecommunications closets. All optical fiber strands shall be terminated. Connectors will be color-coded to distinguish core size.

C. Fiber Patch Cords: The contractor shall provide and install (4) duplex each SM & MM fiber patch cords not to exceed 15 meters each and will not introduce a loss greater than 1.0 dB, including connectors. The contractor shall confirm actual length and connector types with the district IT representative.

3.6 HORIZONTAL CABLE

A. Place UTP cable so as to maintain the minimum cable bend radius limits specified by the manufacturer.

B. To avoid damaging horizontal cable conductors during installation, do not exceed a 25-pound force pulling tension.

C. Place copper cables transitioning between overhead pathways and cabinets in a neat and orderly manner without stressing, excessively bending, or pinching the bottom cables of the bundle.

D. Directly terminate twisted pair cable on patch panels and outlets in standard color code order.

E. Cable runs of low voltages cabling systems shall maintain a minimum of 4” clearance throughout entire length of runs. Bundling of different systems cables is not permitted.

3.7 LABELING

A. Outside Plant

1. The Contractor is required to provide labels for all cables at any vaults, pull box, or access panel crossing. The Contractor shall provide cable labels twelve inches from the end of the cable as it enters the building, on service loop mounts, and twelve inches from the end of the cable at the point of termination. Fiber Optic and Copper Cable Orange Laminate Tag (3.5” x 2”) Hellermanntyton P.N. CT2003X2. Telephone Cable Yellow Laminate Tag (3.5” x 2”) Hellermanntyton P.N. CT2012X2. Cable Orange Laminate Write-On Tag (4” x 1.5”) Hellermanntyton P.N. WC1503X2. The Contractor shall provide adhesive labels on all termination hardware such as fiber distribution shelf, protector, and 110 blocks.

2. All cables will be labeled according to the guidelines shown below as adapted from the EIA/TIA 606-A standard.

3. Both patch panel and drop must be labeled in the following formats:

Patch Panel Side
Non-Wireless is a three-digit port number [XXX] along with A/B designations for dual drops – vendor to check with SCCOE for what number to start with when adding ports
Wireless will have a "W-" prefix along with the APs inventory number – vendor to check with SCCOE for what number to start with when adding ports
Drop-Side
Non-Wireless label must be on both the end of the cable as well as the cover plate.
The plate label will include floor and building, along with three-digit port number in the format of X.Y.ZZZ, where X is the building number, Y is the floor number and Z is the port number. Drops may be labeled on the jack itself, rather than on the cover plate.
The cable will be labeled with only the ZZZ number format.
Wireless drops will be labeled with building, floor and AP number format. Label should be on both the T-Bar and the jack where the drop is located.

B. Horizontal Distribution

1. The Contractor is required to provide labels at all termination hardware such as patch panels and faceplate outlets and devices.
2. Provide Room Number label at all patch panels. Coordinate with District Low Voltage System Representative prior to final labeling
3. The Contractor shall provide 1/8 inch thick engraved plastic labels for new cabinets or racks installed. The engraving shall be white on black background.
4. Labeling at Rooms
   a. Start numbering at the room with the lowest number. Label clockwise starting at the room entry door
   b. Computer Labs are to be labeled after all rooms have been labeled.

3.8 TESTING

A. The Contractor's staff selected to provide the testing of this installation shall be certified by the manufacturer of the test equipment utilized, trained in all aspects of telecommunications acceptance testing procedures of the products described herein and shall have a minimum of five years experience in telecommunications acceptance testing.

The contractor shall notify the district prior to start of testing and provide the date that testing will start for the district to be present when the testing is started

B. Field test instruments shall have a current calibration certificate on hand during testing and the latest software and firmware installed.

C. All cables and termination hardware shall be 100% tested to verify cabling system performance under installed conditions. All pairs/strands of each installed cable shall be verified prior to system acceptance.

D. Balanced Twisted Pair Cable Testing

1. CAT 6 test results must include the following tests and provided in electronic format upon completion of each site: Wire Map, Length; Propagation Delay; Delay Skew; Attenuation; NEXT, NEXT @ Remote; Power Sum NEXT, PSNEXT @ Remote; ELFEXT, ELFEXT @ Remote; Power Sum ELFEXT;

Attenuation-to-Crosstalk Ratio (ACR), ACR @ Remote; Characteristic; Impedance; DC Loop Resistance; Return Loss (RL), RL @ Remote.

Each test page must be properly identified with School site, IDF and Station location, Example:"**ST BLDG K W001A"**. All test results must be submitted in sequential order. All tests are to be "Permanent Link" type.

2. All pairs shall be tested with a copper test tool that conforms to the specifications of a certified Level II-E test set as described in TIA/EIA 568-B.2.

3. Copper backbone cabling shall be tested for conformance to the specifications of EIA/TIA Category 3 for multi-pair cable. Test shall include opens, shorts, polarity reversals, transposition, TDR for length, DC resistance, and tip/ring per pair.

E. Optical Fiber Cable Testing

1. The contractor shall conduct on reel test of all optical fiber cable prior to the installation.

2. Optical fiber testing shall be performed on all terminated fiber in the completed end-to-end system. Testing shall consist of an end-to-end OLTS and OTDR test performed per TIA/EIA-526-7. These tests also include continuity checking and optical length measurement of each fiber.

3. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with sub clause 10.3 of ANSI/TIA/EIA 568-B.1. The polarity of the paired duplex fibers shall be verified using an OLTS.

4. All singlemode fiber optic cabling shall be tested at both 1310 and 1550 nm per TIA/EIA 526-7 Methods "A.1" (OLTS) and "B" (OTDR). All multimode fiber optic cabling shall be tested at 850 and 1300 nm.

5. Each fiber shall be tested in both directions.

6. Link test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation may be generated. All test results must be submitted in sequential order.

3.9 TEST RECORDS

A. General

1. All cables will be tested and the results in electronic format on CD-ROM, with the resulting file capable of being formatted with one test result per 8.5 inch by 11 inch page. A hard copy of all tests is to be submitted in a 3 ring binder.

2. Test results saved within the field test instrument shall be transferred to a Windows based database utility that allows for the maintenance, inspection, and archiving of the test records. The test records shall be uploaded to the PC

unaltered, i.e. “as saved in the field test instrument”. The file format CSV does not provide adequate protection of these records and shall not be used.

3. The database for the complete project shall be stored and delivered on CD-ROM prior punch walk and/or to the acceptance of the project. This CD-ROM shall include the software tools required to view, inspect, and print any selection of the test reports in the native format of the tester. All test results must be submitted in sequential order.

3.10 AS BUILT DOCUMENTATION

A. The Contractor will be provided drawings in electronic format (DWG, AutoCAD release 14 or later) on which as-built construction information can be added.

B. Upon completion of the project, the Contractor is to prepare as-built documentation showing actual site conditions and installation as constructed.

C. The Contractor shall annotate the base drawings and return a hard copy and electronic form (AutoCAD release 14 or later).

D. The Contractor shall provide and install a C-size framed floor plan with outlet and device locations for all low voltage systems. The floor plan shall be framed and installed in the new MDF/IDF Room. The drawing should be a plan of the building with a symbols legend showing where all the devices are and the labeling for each device only. Remove all general notes and details not applicable to the low voltage systems.

END OF SECTION 270500

SECTON 27 51 17 -ASSISTIVE LISTENING SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Work Included: Materials, equipment, fabrication, installation and tests a portable Assistive Listening System.

1.3 RELATED WORK

A. Division 26 Section “Electrical General Requirement”.

1.4 SUBMITTALS

A. Provide submittals for materials and equipment in accordance with Division 1 Submittal requirements.

1. Assistive listening system equipment and components.

PART 2 - PRODUCTS

2.1 ASSISTIVE LISTENING SYSTEM

A. Provide one portable assistive listening system each for use at HUB and learning center including wireless transmitters, microphoness, receivers, headphones, associated hardwires and connection to the local sound system.

B. One (1) wireless FM transmitter with digital tuning and lapel microphone, Gentner #PTX, one for each identified area. Provide 2-AA Duracell or equal batteries for transmitter.

C. Provide eight (8) FM receivers as required by Code, equal to 4% of the area occupancy, single channel, wrist strap: Gentner #RX-1A with mono Walkman-style (over the head) headphones, Gentner #910-402-103, quantity as shown. Provide 2-AA Duracell or equal batteries per each receiver. (2 FM receivers shall be hearing-aide compatible

(2 FM receivers required (2 shall be hearing-aide compatible)

D. One (1) ADA requirement Window Sticker, Gentner #460-402-002, one at each identified area.

E. Provide a “pelican” type portable case large enough to contain and organize all materilas and equipment with closed cell foam material to securely hold and protect all contents in place. Provide and attach engraved pheolic label “Assistive Listening System” label with lettering not smaller than ¾” in height and mechanically fastened to the exterior of the case. Provide a laminted system operation instruction and a list of system contents contained in the case. Case color to be yellow or orange.

PART 3 - EXECUTION

3.1 INSTALLATION, TESTING, AND TRAINING

A. Test the transmitter and each receiver for proper operation. Store the transmitter and receiver in the original packages and store at a site location determined by the District.

B. Provide a training seminar of minimum one hour duration to instruct school personnel in the operation of the system. Provide three copies of the Owner's Manual with individual catalog and specification sheets, and maintenance instructions at this time.

3.2 WARRANTY

A. Provide documentation of the manufacturer's standard warranty of the equipment.

END OF SECTION

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SECTION 28 31 00 - FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 CONDITIONS AND REQUIREMENTS

A. Refer to the General Conditions, Special Conditions and Division 1 - General Requirements.

1.2 INCORPORATED DOCUMENTS

A. Related work included in other sections:

1. Basic Construction Materials and Methods: Section 26 05 00.

1.3 DESCRIPTION

A. This specifications intends to describe a fire alarm system which is intelligent analog detecting, low voltage and modular with multiplex communication techniques in full compliance with all applicable codes and standards. The features described in this specification are a requirement for this project and shall be furnished by the successful contractor.

1. The system shall include all required hardware, conduits, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether itemized or not.

2. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years. The manufacturer shall have an installed base of analog systems as a reference.

3. The existing Fire Alarm panel is Siemens MXL.

1.4 MATERIALS AND SERVICES

A. The system shall include the below listed component and material, but not be limited to the following elements:

1. Master system CPU including all fire detection modules.
2. Power supplies, batteries and battery chargers.
3. Equipment enclosures.
4. Intelligent addressable manual pull stations, heat detectors, smoke detectors, strobes, speaker-strobe combination, speaker, horn-strobes, horns, alarm monitoring modules, and supervised control modules;
5. Multiplex driven remote LCD Annunciator panels.
6. Software and devices as required to provide a complete functioning system.
7. Wiring, raceway, and all necessary cutting and patching.

8. Installation, testing, certification, and operator's training.
9. Field verifying field existing conditions before doing any work.
10. Labeling each addressable device with its specific device address with labels and black markings in large font.
11. Test the complete work. Correct any deficiencies to the satisfaction of the San Jose Fire Department and the Moreland School District or its designated representative.

1.5 APPLICABLE STANDARDS

A. The publications listed below forms a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. Factory Mutual (FM).
2. National Fire Protection Association (NFPA):
   a. NFPA 13 Standard for the Installation of Sprinkler Systems.
   b. NFPA 70 National Electrical Code.
   c. NFPA 72 National Fire Alarm and Signaling Code.
   d. NFPA 90A Standard For The Installation of Air Conditioning And Ventilating Systems
3. Underwriters' Laboratories, Inc. (UL)
4. State and Local Building Codes as adopted by the Division of the State Architect.
5. Dept. of Justice rules for Building Accessibility by The Handicapped.
6. Installation shall be in accordance with the California Administrative Code, Title 24.

1.6 QUALIFICATIONS OF THE INSTALLER

A. Before commencing work, submit data showing that the contractor has successfully installed fire alarm systems of the same type and design as specified, or that they have a firm contractual agreement with a subcontractor having the required manufacturers' training and experience. The contractor shall include the names and locations of at least two installations where the contractor, or the subcontractor above, has installed such systems of similar size and scope.

1.7 MANUFACTURER'S REPRESENTATIVE

A. Provide the services of representative or technician from the manufacturer of the system, experienced in the installation and operation of the type of system provided. The technician shall provide technical assistance in the installation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation, maintenance and local operators interface programming.

1.8 SUBMITTALS

A. The contractor shall include the following information in the equipment submittal for the District:

1. Scope of project, as they relate to the fire alarm system.

2. Floor Plans Showing Fire Alarm Devices: An AutoCAD file of the Floor plans shall be provided by the District to the contractor. Floor plans shall indicate room identifications, the location of fire and smoke barrier walls for verification of smoke and fire smoke damper, and fire door detection and control.

B. For use in system test, a complete operation and maintenance manual with two sets of proposed installation drawings shall be submitted.

1. The following information shall be inscribed on the cover:

a. "OPERATION AND MAINTENANCE MANUAL"
b. Site Name and Building location.
c. The name of the contractor, system manufacturer and system subcontractor.
d. The name and phone number of the fire department required to respond to alarms at the project location.

2. The manual shall be legible and easily read with large drawings folded and contained in pockets. Included in the manual shall be circuit drawings, wiring and control diagrams with data to explain detailed operation and control of each item of equipment and a control sequence describing start up instructions. Included shall be installation instructions, maintenance instructions, safety precautions, test procedures, performance data, software documentation and a print out of all system points. A CD of all documents supplied shall be supplied in the manual.

C. Upon completion of the installation, record drawings shall be submitted on each system before final acceptance of the work. The contractor shall furnish to the Engineer a set of record drawings including system diagrams for each system. The record drawings masters shall be on CD in an AutoCAD Ver. 2000 format and shall be prepared by the fire alarm vendor on their title block.

1.9 MAINTENANCE MATERIAL SUBMITTALS

A. Provide 10% of each addressable field device installed.

1. Provide not less than (1) device or no more than (15) of each type

1.10 SYSTEM FUNCTION

A. The system shall be a complete, electrically supervised multiplex style fire detection system with intelligent analog alarm initiation, to be device addressable and annunciated as described and shown on the drawings.

1. The maximum usage of loop addresses shall not exceed 85% of loop capacity.

a. Devices attached to the signaling circuit shall be individually identifiable at the control panel for alarm and trouble indication. Smoke detectors shall be interrogated for sensitivity settings from the control panel, logged for

sensitivity changes indicating the requirement for cleaning, and tested by a single technician using the panel field test routine.

b. Sensitivity settings of individual detectors shall be automatically or manually adjustable from the control panel to reduce the incidence of false alarms caused by environmental conditions.

c. The analog signaling circuits shall be installed in the fire alarm control panel enclosure or in remote circuit interface panel enclosures.

2. The system shall support intelligent analog smoke detection, conventional smoke detection, manual station, water flow, supervisory, security, Strobes, speaker-strobes, speakers, horns-strobe, horns and status monitoring devices.

3. The panel shall be UL listed as a test instrument for the measurement of the sensitivity or connected intelligent analog ionization and photoelectric smoke detectors to comply with the testing requirements of NFPA 72.

4. The system shall annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, signaling the need for service and eliminating unwanted alarms.

5. Any intelligent analog smoke detector or conventional smoke detector zone shall include a selectable alarm verification capability. This feature shall provide automatic verification of smoke detector alarms as described by NFPA 72.

6. All external circuits shall be listed as power limited circuits per article 760 of the National Electrical Code.

7. The system shall provide a one person field test of either the complete system or a specified area, maintaining full functions of areas not under test.

8. Not Used.

9. The system shall be programmed in the field via a laptop computer. All programmed information shall be stored in nonvolatile memory after downloading into the Fire Alarm Control Panel.

   a. During program upload or download the system shall retain the capability for alarm reporting.

   b. The system shall download to a PC for program editing. System program shall be stored on a CD and all programming shall be multi-level password protected.

10. The system shall consist of a central architecture using a single centrally located control unit. The system also shall be operable in a distributed multiplex architecture using a centrally located control unit with interconnection to remote circuit interface panels containing any combination of plug in intelligent analog signaling circuits, plug in conventional initiating device circuits and plug in relays.

11. The system shall support UL listed pre-actin/deluge releasing under NFPA 13 Sprinkler Service.

1.11 SYSTEM ZONING

A. Each intelligent addressable device or conventional zone of the system shall be displayed at the fire alarm control panel and remote annunciation panel by a unique alpha numeric label identifying its location.

1.12 SYSTEM DESCRIPTION AND OPERATION

A. Provide an addressable system that utilizes smoke detectors, heat detectors, water flow indicators, valve supervisory devices, horns, horn-strobe, speakers, speaker-strobes, speakers and controls as shown on the Drawings.

1. Power systems and components form DC power supplies.
2. Provide CLASS B system wiring.

B. Trouble and alarm systems shall activate the control panel devices, and remote annunciators.

C. Provide wall or ceiling mounted annunciators for any concealed smoke detectors.

1. The smoke detectors shall be individually annunciated.
2. Locate the annunciators in public areas, close to the devices, and in accordance with present life safety codes.
3. Provide access hatches and/or panels for each fire alarm device located above the ceiling to allow safe and easy access for testing & maintenance. Coordinate with architect for approval. Document all access hatch and panel locations on Record Drawings.

D. Electrically supervises alarm and initiating circuits for wiring or ground faults.

1. Any fault shall cause an audible and visual trouble indication at the control panel and the remote annunciation panel.
2. The zone or addressable device having trouble shall be identified.
3. Zone or addressable device trouble shall not affect normal operation of other system zones.

E. Provide 20% expansion space for future system upgrades.

F. Activation of any alarm initiating device shall:

1. Cause all audible alarm devices to pulse in temporal code 3 until silenced at the control panel or at the remote annunciation panel;
2. Cause all alarm lamps to flash;
3. Indicated the zone or addressable device at the control panel and at the remote annunciation panel;

G. Activation of any smoke detector device shall;

1. Perform all functions of initiating devices as noted in the drawing and notify fire department via Central Station connection.
2. Light the LED lamp on an operated smoke detectors.

H. Operation of any sprinkler water flow switch shall:

1. Perform all functions of initiated devices as noted in the drawing and notify fire department via Central Station connection.

I. Operation of any sprinkler valve supervisory device such as tamper switchers and OS & Y valves shall:

1. Activate a dedicated supervisory zone at the control panel and annunciation at the remote annunciation panel and shall notify the Central Station.
2. Not cause evacuation alarm devices to sound.
3. Water flow alarm circuit trouble use for valve supervision is not permitted.

J. Provide audible and visual trouble indication at the control panel and the remote annunciation panel for the following conditions:

1. Removal of a detection device from the detection circuit;
2. An open or ground fault in a detector circuit or device;
3. An open, short or ground fault in an audible signal circuits;
4. Removal of a system input, output or control module;
5. Improper condition of a battery or charger.

K. Failure of AC power shall:

1. Cause the trouble signal to sound at the control panel and annunciation at the remote annunciation panel and shall notify the Central Station.
2. Cause the automatic transfer to stand-by battery power.
3. All system functions shall be operational, on battery power, for a minimum of 24 hours during a power failure.

L. System zone assignments shall be per drawings.

M. Fire Drill: Provide fire drill switch at the fire alarm control panel. When activated, the fire drill switch shall turn on all horns, speakers and strobes and other alarm notification devices, but it shall not call fire department.

1.13 WARRANTY

A. The contractor shall warrant the entire system against mechanical and electrical defects for a period described in the contact general conditions. This period shall begin upon completed certification and test of the system or upon first beneficial use of the system, whichever is earlier.

PART 2 – PRODUCTS

2.1 FIRE ALARM CONTROL PANELS

A. Fire alarm control panel is existing to remain.

B. Existing Fire alarm Panel is Siemens MXL.

C. The following FACU hardware shall have:
   1. Power Limited base panel with red cabinet and door, 120 VAC input power.
   2. 640 point capacity where (1) point equals (1) monitor (input) or (1) control (output).
   3. 640 points of annunciation where one (1) point of annunciation equals:
      a. 1 LED driver output on a graphic driver or 1 switch input on a graphic switch input module.
      b. 1 LED on panel or 1 switch on panel.
   4. From all battery charging circuits in the system provide battery voltage and ammeter readouts on the FACU LCD Display.
   5. One Auxiliary electronically resettable fused 2A @24VDC Output, with programmable disconnect operation for 4-wire detector reset.
   6. One Auxiliary Relay, SPDT 2A @32VDC, programmable as a trouble relay, either as normally energized or de-energized, or as an auxiliary control.
   7. Three (3) Class B Addressable Notification Appliance Signaling Line Circuits (SLCs).
      a. Each Addressable Notification Appliance SLC shall be rated at 3A and capable of supporting up to 63 Notification Appliances per channel.
      b. Wiring shall be 18 AWG to 12 AWG unshielded twisted pair wire. Systems that require shielded wire for Notification Appliances shall not be accepted.
      c. A constant voltage under both primary and secondary power conditions shall be maintained at the notification appliance field wiring terminal connections in the FACU to ensure the voltage drop on the circuit is consistent under both primary and secondary power conditions.
      d. For systems that do not provide a constant voltage source at the FACU notification appliance field wiring terminal connections, the fire alarm contractor shall:
         1) Provide separate point-to-point voltage drop calculations for all notification appliances under worst case secondary power specifications, and
         2) Perform a complete functional test of all notification appliances under worst case secondary power conditions.
      e. Where required provide Intelligent Remote Battery Charger for charging up to 110Ah batteries.
      f. Power Supplies with three (3) Class B integral Intelligent Addressable Notification Appliance Signaling Line Circuits (SLCs) for system expansion.
      g. The FACU shall support up to (5) RS-232-C ports and one service port. All (5) RS-232 Ports shall be capable of two-way communications.
      h. Remote Unit Interface: supervised serial communication channel for control and monitoring of remotely located annunciators and I/O panels.
      i. Fire Panel Internet Interface to provide supplemental notification and remote user access to the FACU using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3.
      j. Modular Network Communications Card.
   8. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures.
   9. Alphanumeric Display and System Controls: Panel shall include an 854 character, expanded content multi-line QVGA LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands.

a. The system shall include the necessary hardware to provide expanded content, multi-line, operator interface displays as indicated on the drawings and specifications. The expanded content multi-line displays shall be Quarter-VGA (QVGA) or larger and be capable of supporting a minimum of 854 standard ASCII characters to minimize or eliminate the levels of navigation required for access to information when responding to critical emergencies and abnormal system conditions. The QVGA operator interface shall provide operator prompts and six context sensitive soft-keys for intuitive operation.

10. Distributed Module Operation: FACU shall be capable of allowing remote location of the following modules; interface of such modules shall be through a Style 4 (Class B) supervised serial communications channel (SLC):
    a. Addressable Signaling Line Circuits
    b. Initiating Device Circuits
    c. Notification Appliance Circuits
    d. Auxiliary Control Circuits
    e. Graphic Annunciator LED/Switch Control Modules.
    f. Amplifiers, voice and telephone control circuits

2.2 FIRE ALARM SYSTEM POWER SUPPLIES

A. System primary power:

1. Primary power for the FACP and the secondary power battery chargers shall each is obtained from the power panel board. Circuit breakers shall be fitted with a suitable guard, requiring removal of a screw to open, and used only for fire alarm.

2. The power supply and battery charging shall be provided by the power supply interface board and power supply module.

3. A fusible double throw AC power disconnect switch, lockable in the open and closed positions shall be provided adjacent to the Fire Alarm Control Panel.

B. Secondary power supply:

1. Provide sealed gelled electrolyte batteries as the secondary power supply for the fire alarm control panel and each system circuit interface panel. The battery supply shall be calculated to operate its load in a supervisory mode for 24 hours with no primary power applied and, after that time, operate its alarm mode for five minutes.

2. Provide battery charging circuitry for each standby battery bank in the system low voltage power supply or as a separate circuit. The charger shall be automatic in design, adjusting the charge rate to the condition of the batteries. Battery charge rate and terminal voltage shall be read using the fire alarm control panel LCD display in the service mode, indicating directly in volts and amps.

2.4 AREA AND SPOT DETECTION

A. Furnish and install Simplex, Photoelectric True Alarm Smoke Sensors, with Simplex True Alarm Detector Bases.

B. General:
1. Common base for detachable, low profile, photoelectric type smoke, and heat detector heads.
2. Monitoring: FACU shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
3. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
4. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
5. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
6. Environmental Compensation: The FACU shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
7. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACU.
8. Sensitivity Testing Reports: The FACU shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
    a. Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
    b. Where required, reports shall be accessible remotely through:
        1) A Fire Panel Internet Interface using Ethernet and TCP/IP communications protocol compatible with IEEE Standard 802.3. The Fire Panel Internet Interface shall be capable of automatically scheduling email reports to individual user accounts on a weekly, bi-weekly, or monthly schedule
        2) A PC Annunciator using an RS232-C connection to the FACU or a PC Annunciator Client using a TCP/IP communications protocol connection to the PC Annunciator server compatible with IEEE Standard 802.3.

9. The FACU shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACU as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACU and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the

control unit.

10. The FACU shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.

11. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.

12. Programmable bases. It shall be possible to program relay and sounder bases to operate independently of their associated sensor.

13. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.

C. Photoelectric type area smoke detector:
   1. LED light source, silicon photodiode receiving element. Line filter and time delay circuitry to prevent transient false alarms.
   2. 360-degrees smoke entry, locking tamper screw, pulsating on power LED indicator, UL 268.

D. Area heat detector:
   1. 135-degrees fixed temperature self restoring type.
   2. Locking tamper screw, UL 521.
   3. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermostat-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
   4. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACU for either 15-deg F or 20-deg F per minute.
   5. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.

2.6 ADDRESSABLE MODULE

A. Furnish and install Fire Lite Individual Addressable Module(s).

2.7 MANUAL STATIONS

A. Provide and install Notifier Addressable Manual Pull Stations Single Action, with Notifier Individual Addressable Modules and Notifier Back Box for Pull Stations. All except the Master pull stations shall be provided with an additional cover box. Manufactured by Signal Communications Corp. Front Cover Model NO.ST-FRCO1, Extender Model NO. ST KTRO1 with Alarm Module NO. ALMO1 or approved equal.

2.9 BEAM DETECTORS

A. Separate transmitter and receiver units, UL 268.

B. Microprocessor based, temperature compensated, automatic gain control, field-adjustable beam obscuration sensitivity, adjustable optics, auxiliary contacts, tamper switch, red LED alarm indicator, and yellow LED trouble indicator.

C. Provide a remote indicator/test unit.

2.10 DUCT TYPE SMOKE DETECTION

A. General:
1. Common base for detachable ionization or photoelectric type smoke detector head.
2. Duct housing with hinged door and full-length sampling tube. Visible alarm LED, remote LED output, UL 268A.
3. Provide auxiliary contacts.
4. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
5. Duct Housing shall provide a relay control trouble indicator Yellow LED.
6. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
7. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
8. Duct Housing shall provide a magnetic test area and Red sensor status LED.
9. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover

B. Photoelectric type area smoke detector:
1. LED light source, silicon photodiode receiving element. Line filter and time delay circuitry to prevent transient false alarms.

C. Remote alarm indicator:
1. Ceiling mounted, red LED, stainless steel faceplate engraved ALARM. Provide where duct type smoke detectors are installed above a ceiling.

2.11 ADDRESSABLE TRANSMITTERS/MONITOR MODULES

A. Addressable transmitters/monitor modules shall be provided where required to interface with contact alarm devices.

2.12 ADDRESSABLE RELAY MODULES

A. Addressable relay modules shall be provided where required to provide audible alarm interface and/or relay control interface.

2.13 ADDRESSABLE TRANSMITTERS/MONITOR/CONTROL MODULES

A. Addressable Dual point Multi-state input and relay output modules shall be provided where required to interface with tri-state alarm devices.

2.14 DOOR HOLDERS

A. Door Holders shall be Notifier Signaling type and shall be 24VDC with operating power provided by the FACP

B. Description: Units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Unit shall operate from a 120VAC, a 24VAC or a 24VDC source, and develop a minimum of 25 lbs. holding force.

C. Material and Finish: Match door hardware.

2.15 TAMPER SWITCH

A. Tamper switch with Individual Addressable Module.

2.16 FLOW SWITCH

A. Flow switch with Individual Addressable Module.

B. System software programming shall be performed by Notifier. Other vendor programming of system software is not permitted.

C. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor, subject to the approval of the District's Electrical Engineer.

2.17 EVACUATION SIGNAL

A. Furnish and install where show on the drawings, audible and /or visual signals, Firelite type audio visual devices with the following characteristic and capacities:

1. Electronic horn model series with a sound rating of 90 dba and temporal pattern per code and speaker per code, and a strobe light with an intensity of 15, 75, and 110 candela (where required) Provide and install factory-manufactured red-painted steel wireguard to protect unit(s) in boys and girls bathrooms areas subject to vandalism, mount exterior horns in weather proof enclosures.

2. Visual alarm signals model 15, 75 and 110 series shall be furnished with minimum light intensity of 15, 75, and 110 candela complying with the ADA act and the following requirements:

   a. Xenon strobe with a minimum repetition rate of 1HZ, not exceeding 2 HZ and maximum duty cycle of 40% with pulse duration of .2 seconds.

b. Provide factory-made re-painted steel wire-guard to protect strobe.

3. If more than one strobe in one room or area, all strobes shall be synchronized.

PART 3 - EXECUTION

3.1 DESIGN AND INSTALLATION DRAWINGS

A. Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verify dimensions and assure compatibility all other systems interfacing with the fire alarm system.

1. Identify on the drawings, the system address for every addressable device. Signals shall be sequentially numbered as the address of the controlling module.

2. Indicate on the point-to-point wiring diagrams, interconnecting wiring within the panel between modules, and connecting wiring (conduit size and conductor number and AWG size) to the field device terminals.

3. Provide mounting details of FACP and other boxes to building structure, showing fastener type, sizes, material and embedded depth where applicable.

3.2 INSTALLATION

1. Perform work in accordance with the requirements of NEC, NFPA 70, and NFPA 72.

2. Fasten equipment to structural member of building or metal supports attached to structure, or to concrete surfaces.

   a. Use clamping devices for attaching to structural steel, or when clamping is impractical, obtain written authority to well or to drill.
   b. Fasten equipment to concrete or masonry with expansion anchors.
   c. Fasten equipment to drywall by screws into studs, and to metal wall panels by weld studs, bolts or self-taping metal screws.
   d. Do not install conduit raceways and boxes in positions that interfere with the work of other trades.
   e. Attach nameplates on panels or other components as specified.
   f. Use of plastic anchors is prohibited.

3. All fire alarm wiring shall be in conduits.

3.3 CONDUIT

A. Design conduit run and size between device, control panel and fire alarm equipment. Minimum conduit size shall be 3/4 inch.

B. Use rigid steel conduit at 12” or less above finished floor where subject to mechanical damage. PVC coated rigid steel shall be installed in concrete floors, walls, and where exposed to weather. EMT may be used elsewhere. Schedule 40 rigid PVC conduits at a

minimum of 18" below finished grade. PVC coated ridged steel 90-degree bends shall be used for transition from PVC to stub ups above grade.

C. Install #14 gage galvanized pull wire or 1/8 inch polyethylene rope in conduit installed for future use, and seal the ends.

D. Install concealed conduits as directly as possible and with bend radii as long as possible. Where allowed on drawings, install exposed conduit parallel with or at right angles to building lines. Where conditions permit, maintain continuous exposed horizontal runs along walls at minimum height of 9 feet above floor level or grade.

E. Permanently label or mark at both ends with conduit number of each wire as shown on the drawings. Conduit and junction box labels shall be permanent and conform to the requirements of the National Electrical Code, Art. 760.

F. Make elbows offsets and bends uniform and symmetrical. Bend conduit with approved bending devices.

G. Cut conduit ends square, ream and remove burrs. Conduit shall be clean, dry, and free of debris. Immediately after installation, plug or cap exposed ends with standard accessories until wires are pulled.

H. Use galvanized steel lock nuts for attachments to enclosures except threaded hubs may be used where permitted by the NEC. Thread less fittings will not be permitted for rigid conduit. Use Erikson type coupling with running threads.

I. Use one-hole clamps equipped with clamp backs to secure conduits.

J. Install without moisture traps wherever possible. Where practicable, provide drain holes in pull boxes or fittings at low points in systems and remove burrs from drilled holes.

K. Use flexible conduit to made connections to equipment subject to vibrations. Use liquid tight flexible metal conduit where conduit and fittings are installed outdoors or exposed to moisture or chemical fumes indoors. Flexible conduit may be used in lengths not exceeding four feet for other equipment, with the approval of the acceptance inspector.

L. Set up joints in conduit installed in concrete, underground, or exposed to weather, with high temperature, anti-seize, conductive thread lubricant and sealant.

M. Seal openings around conduit at exterior wall penetrations and penetrations of walls forming boundaries between adjoining ventilation zones, using specified sealant. Make all seals waterproof and finish flush with surrounding wall surfaces.

N. Use hangars with 3/8 inch rods for 2 inch conduit or smaller. If conduit is suspended on rods more than 2 feet long, conduit shall be rigidly braced to prevent horizontal motion or swaying.

O. Apply sealing compound in conduit at box or enclosure nearest exterior wall penetration on both sides of wall.

P. Where routing is parallel with hot water or steam pipers, conduits shall not be installed within six inches of the pipe covering. When routing is not parallel with pipes, it is acceptable to

install within six inches providing the do not touch the pipes.

Q. Use PVC coated rigid steel conduit below on-grade floor slabs.

1. Install PVC coated rigid steel conduit in accordance with the manufacturer recommendations. Coating damaged during handling or installation shall be repaired using PVC paint recommended by the conduit manufacturer.

3.4 BOXES, ENCLOSURES AND WIRING DEVICES:

A. Boxes shall be installed plumb and firmly in position.

1. Extension rings with blank covers shall be installed on junction boxes where required.
2. Junction boxes served by concealed conduit shall be flush mounted.
3. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.
4. Paint all covers of junction boxes red.

3.5 FIRE ALARM TERMINAL CABINET

A. Provide where shown on drawings and for area larger than 10,000 square per floor, one or more central terminal cabinets location of cabinet to be approved by the Architect) for building zone area fire alarm wiring distribution. Cabinets shall be hinged, with hasp for pad locks and panel I.D.

3.6 CONDUCTORS

A. Design and provide number conductors and AWG sizes between devices, control panel, annunciation panels and all detached fire alarm equipment.

B. Each conductor shall be identified as shown on the drawing at each with wire markers at every splice and terminal point. Attached permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

1. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.
2. All splices shall be made using solder less connectors. All connectors shall be installed in conformance with the manufacturer recommendations.
3. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

C. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

D. A District standard color-code for fire alarm system conductors throughout the installation.

1. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types, per School District standard.

E. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.7 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within subpanels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.8 SPLICES AND CABLE TERMINATIONS

A. All splices shall be made using solderless connectors or compression type terminal strips. Al connectors shall be installed in conformance with the manufacturer recommendations.

B. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

3.9 CERTIFICATE OF COMPLIANCE (UL)

A. Complete and submit to the Project Engineer in accordance with NFPA 72. The equipment installer or supplier shall issue UL certification on the fire alarm system in accordance with the county of San Francisco requirements.

3.10 TEMPORARY LABEL OF EXISTING FIRE ALARM DEVICES

A. Provide labels for all existing fire alarm devices and equipment disable during construction. Label “wording” per District standard.

3.11 FIELD QUALITY CONTROL

A. Testing, general:

1. All intelligent analog devices shall be tested for correct address and sensitivity using test equipment specifically designed for that purpose. These devices and their bases shall be tagged with adhesive tags located in an area not visible when installed, showing the system address, initials of the installing technician and date.

    a. A systematic record shall be maintained of all reading using schedules or charts of tests and measurements. Areas shall be provided on the logging form for readings, dates and witnesses.
    b. The acceptance inspector shall be notified before the start of the required test. All items found at variance with the drawings or this specification during testing or inspection by the acceptance inspector shall be corrected.

c. Test reports from the FACP historical logs shall be delivered to the acceptance inspector as completed.

2. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the installing contractor. The following equipment shall be a minimum of conducting the tests:

a. Ladders and scaffolds as required to access all installed equipment.
b. Multimeter for reading voltage, current and resistance.
c. Laptop computer with programming software for any required program revisions.
d. Two way radios, flashlights, smoke generation devices and supplies.
e. Spare printer paper.
f. A manufacturer recommended device for measuring airflow through air duct smoke detector sampling assemblies.
f. Decibel meter.
g. Smoke Detector tester as recommended by the manufacturer

3. In addition to the testing specified to be performed by the installing contractor, the installation shall be subject to test by the acceptance inspector.

2 System wiring: fire alarm circuits shall be tested for continuity, conductors, grounds, short circuits and proper shielding.

3 Provide all pre-testing reports to inspector prior to scheduling acceptance testing. Provide per phase if applicable.

B. Acceptance testing:

1. The inspector in accordance with NFPA will prepare a written acceptance test procedure (ATP) and Record of Completion for testing the fire alarm system components and installation per NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

2. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input. In the case of outputs programmed using more complex logic functions involving “any”, “or”, “count”, “time”, statements; the complete output equation shall be referenced in the matrix.

3. A complete listing of all device labels for alpha-numeric annunciator displays and logging printers shall be prepare by the installing contractor prior to the ATP.

4. The acceptance inspector shall use the system record drawings in combination with the documents specified under paragraph 3.01 during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:

a. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation.

b. System evacuation alarm indicating appliances shall be demonstrated.
c. System indications shall be demonstrated as follows:
(01) Correct message display for each alarm input at the control panel.
(02) Correct annunciator light for each alarm input at each annunciator.
d. System off-site reporting functions shall be demonstrated.
e. Secondary power capabilities shall be demonstrated.

3.12 NAMEPLATE

A. Provide nameplate per School District standard.

3.13 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:

1. System record drawings and wiring details including one set of reproducible masters and drawings on CD in AutoCAD 2000.
2. System operation, installation and maintenance manuals.
3. Written documentation for all logic modules as programmed for system operation with a matrix showing interaction of all input signals with output commands.
4. NFPA 72 Record of Completion.

3.14 TEST EQUIPMENT

A. The contractor shall furnish all test equipment as required to program devices and test the system.

3.15 SERVICES

A. The successful bidder shall supply on-site training at the owner’s facility. The training shall have a duration of four (4) hours and shall be conducted by a full time employee of the Fire Alarm System Manufacturer.

1. The training shall cover operation and maintenance of the fire alarm system.

END OF SECTION 283100

SECTION 31 00 00 - EARTHWORK

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. All excavating, filling, backfilling, compacting and grading required for the Project.

2. Adjusting manhole rims, grates, valve boxes, etc. to finished grade indicated.

3. Pumping, draining, shoring, cribbing and other protective measures.

4. Importing fill materials.

5. Shoring and cribbing.

6. Removing excess and unsatisfactory excavated materials from the site.

B. Related work in other Sections:

1. Selective Demolition: Section 02 41 13.

2. Site Clearing: Section 31 10 00.

2. Trenching, backfilling and compacting for utilities: Section 31 23 33.

3. Disconnecting utilities: Section 02 41 13.

4. Re-routing utilities: Sections 33 00 00, 33 10 00, 33 30 00 and 33 40 00.

5. Aggregate base under asphalt paving: Section 32 12 16.

6. Finish grading for landscaping and asphalt paving: Section 32 12 16.

1.02 QUALITY ASSURANCE

A. Lines and levels: All construction staking shall be provided by Contractor.

B. Inspections and tests: The Owner will employ a Geotechnical Consultant to inspect and test the work of this Section. At completion of this work, the Geotechnical Consultant will be required to submit written report certifying that the site was developed with acceptable materials in accordance with these Specifications and the recommendations of the Soil Investigation Report.

1. The Geotechnical Consultant will:

a. Make the tests and inspections of the structural subgrades required by the nature of the subsurface conditions discovered during the progress of the earthwork operations.

b. Approve for use of imported fill material.

c. Inspect all filling, backfilling, and compacting of the soils.

1.03 SUBMITTALS

A. Imported fill materials: Submit samples of proposed imported materials, minimum 40 lbs., tagged with source location and manufacturer to the Owner's Representative at least 15 days prior to import. Material shall not be imported to job site without written approval by the Owner's Representative.

1.04 GEOTECHNICAL INVESTIGATION

A. A geotechnical investigation report has been prepared for the site by Cornerstone Earth Group (408) 245-4600, (Project No. 974-3-1, dated July 23, 2021) and is available for the Contractor's review from the Owner, the Owner's Representative or the Geotechnical Engineer. All grading, excavation, compaction, and expansive soil remediation shall be per the geotechnical investigation report.

B. Neither the Owner nor the Owner's agents assume any responsibility for conclusions the Contractor may draw from the soil investigation report. The investigation is not a guarantee of subsurface conditions other than at the boring locations. The Contractor/Bidder shall examine the site and determine all conditions affecting the performance of the work.

C. In case of conflict between these Specifications and the recommendations of the geotechnical investigation, the geotechnical investigation shall govern.

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2.00 PRODUCTS

2.01 FILL MATERIALS

A. Select (porous) fill under building slab-on-grade and behind retaining and basement walls: Clean gravel or crushed rock complying with CalTrans Standard Specifications, Section 68, Class 2.

B. Imported fill materials and on-site select materials shall be granular in nature, non-expansive, free of organic materials, with a plasticity index of less than 12, and an expansion index of less than 20 and graded as follows:

Sieve Size	Percentage Passing Sieve
3"	100
No. 4	60 - 100

No. 200	Less than 20

C. On-site materials, less debris and organic matter, shall be approved by the Geotechnical Engineer.

D. Import shall be approved by the Geotechnical Engineer.

3.00 EXECUTION

3.01 PROTECTIVE MEASURES

A. Underground utilities: Report any lines encountered that are not indicated, or are in location other than indicated, on the Drawings to the Engineer's attention who will issue instruction for proceeding with the work.

B. Moisture control: Remove water and debris, which would interfere with construction, from excavated areas and keep working areas dry when work is in progress. Grade perimeter of excavations so that water run-off drains away from the excavations.

1. Keep excavations free from loose material and water while fill is placed and compacted.

2. Dispose of water resulting from dewatering operations in a manner that will not cause damage to public or private property, or constitute a nuisance or menace to the public.

3. Make sure that debris and dirt generated by this work does not block existing storm drain system. Keep adjacent paving (outside Contract area) broom clean and free of debris and dirt. Clean any existing facilities that become plugged.

C. Shoring, cribbing and bracing: Provide and install shoring, cribbing and bracing of the excavations as necessary to prevent cave-ins and to support and protect adjacent construction in accordance with Federal, State and local laws. Contractor shall be completely responsible for adequacy and safety of shoring design, construction, and removal.

D. Benchmarks and monuments: Protect benchmarks, monuments and other reference points against displacement and damage. Repair or replace benchmarks, monuments and other permanent survey data that becomes displaced or damaged due to the performance of the work of this Section.

E. Dust palliation: Keep down dust at the site by intermittent watering and sprinkling while the work of this Section is being performed. Earthwork operations shall be conducted so as to prevent windblown dust and dirt. Assume liability for all claims related to windblown dust and dirt. Apply water in accordance with applicable provisions of Section 17 of California Transportation Standard Specifications and with Section 1590 (e) of CAL/OSHA, Title 8.

F. Protection of existing facilities and landscape: Protect all trees, plants, utilities and existing improvements to remain from injury and damage resulting from the work of this Section. Replace all damaged landscaping, improvements or utilities in kind. Refer to Section 31 10 00 for additional requirements on tree protection. Clean staging and other use areas of debris and dust upon completion of project. Re-stripe portions of parking lot where, in the opinion of the Owner's Representative, the striping was damaged or destroyed by Contractor's operations.

G. Protection of completed work:

1. Protect finished areas from weather damage to prevent erosion of graded areas.

2. Hauling and other activities on prepared grades which will deform them from required cross sections will not be permitted. Repair and re-compact damage to prepared grades caused by such operations at no additional cost to the Owner.

3.02 EXCAVATING AND FILLING

A. Site clearing is specified in Section 31 10 00 and/or soils report. Verify that existing paving, curbs, light posts and other improvements, and all debris are removed from the site.

B. After site has been properly cleared, stripped, and excavations to rough grade have been made, exposed surface soils in those areas to receive engineered fills, concrete slabs-on-grade, or pavements should be scarified to a depth of 12 inches, moisture conditioned, and compacted (see D). In building areas to receive concrete slabs-on-grade, sub-grade preparation shall extend at least 5 feet beyond the limits of the proposed structures and any adjoining flat work. In pavement areas and for exterior flatwork not connected to buildings, sub-grade preparation shall extend at least 2 feet beyond the back of the curbs or outside limits of flatwork.

C. Any portions of the site which are disturbed or softened by standing water shall be re-graded and re-compacted to 90% of maximum density (ASTM D-1557) as recommended by the Owner's Representative. Portions of the site which show evidence of "pumping" or movement under load shall be excavated, dried out, or filled with bridging rock or other material determined to be suitable by the Owner's Representative, then recompacted to the above standards. All this work shall be done at no additional cost to the Owner.

D. Place fill materials in loose lifts no more than 8" in uncompacted thicknesses. Compaction of fill should be accomplished by mechanical means only. Compact engineering fills consisting of expansive clay soil between 88% to 93% relative compaction at soil moisture content of between 3 and 5 percent above the laboratory optimum moisture content. Compact on-site or imported soils with low expansion potential to at least 90% relative compaction at soil moisture content of between 1 and 3 percent above the laboratory optimum moisture content. In pavement areas, the upper 12 inches of sub-grade shall be compacted to at least 95% percent relative compaction at soil moisture content 1 to 3 percent above optimum value. Aggregate base material in pavement areas shall be compacted slightly above the optimum moisture content to at least 95% relative compaction. Behind retaining walls, care should be taken to avoid over-compaction of the

backfill materials. Avoid excessive wall movements and lateral pressures use lightweight hand-operated equipment to compact backfill within 3 feet behind retaining walls.

E. Do not place fill during unfavorable weather conditions. If work is interrupted by heavy rain, do not resume operations until the proper moisture content and density of the materials have been achieved.

F. Earth and rock, regardless of character and subsurface conditions, shall be excavated to depths shown on Drawings and to the neat dimensions of the footings wherever practicable, to permit pouring of footings and grade beams without use of side forms, except at slab perimeters.

3.04 BACKFILLING

A. Place backfill in loose layers not exceeding 8" thick, as construction operations permit, but not before work to be covered has been inspected and approved, and loose soils and debris have been removed from the excavations.

B. Do not place backfill during unfavorable weather conditions as specified for fill above.

C. Compact backfill to 95% of maximum density (ASTM D1557).

D. Where backfill is required on both sides of a structure, place it simultaneously so that the height of fill remains approximately equal on both sides at all times.

E. Brace construction which has not been designed to withstand eccentric loading during backfilling.

F. Backfill only after the structure to be backfilled against has attained its design strength or has been properly braced, to resist the load of the backfill. No compacting by jetting permitted.

G. Keep rollers and other heavy equipment at least 4 feet from footings, foundations, piers and walls of building and appurtenances.

3.05 GRADING

A. The locations and elevations of all construction are indicated on the Drawings and, unless inconsistencies are brought to the Owner's Representatives attention prior to commencement of work, the Contractor will be held responsible for the proper location and elevations of the completed work.

B. Grade all areas to the lines and levels required. Keep grades straight between changes in elevations. Finish grading tolerance shall not exceed plus or minus one half inch (½") of required elevations, if evenly distributed.

C. The required subgrade elevation shall be such that when subbase and indicated construction are added, the final elevations will be those shown on the Drawings.

3.07 FRAMES, COVERS, GRATES AND VALVE BOXES

A. Adjust frames, grates, valve boxes, and covers of existing manholes, inlets, or other facilities to grade in conformance with Sections 15 of the CDT Standard Specifications.

B. A structure located in a paved area shall not be constructed to final grade until the adjacent pavement or surfacing has been compacted.

3.08 DISPOSAL OF SURPLUS AND UNSUITABLE EXCAVATED MATERIALS

A. Remove these materials from the Owner's site and dispose of them in a legal manner; this includes materials resulting from all excavations including elevator cylinder, concrete piles and utility excavations. Burning and burying materials on-site is prohibited.

3.09 FIELD QUALITY CONTROL

A. Field density tests: To check the degree of compaction of native soils and fill will be taken by the Owner's Representative. The location and frequency of the tests will be at the Owner's Representative discretion.

B. Verification of elevations: Owner will provide the services of a licensed Civil Engineer or Land Surveyor upon completion of earthwork operations to verify that grades are within the tolerances specified. Should the grades be found to be out of tolerance, the site shall be reworked and resurveyed by the Owner at the Contractor's expense.

END OF SECTION 31 00 00

SECTION 31 10 00 - SITE CLEARING

1.00 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Protection of existing trees.

2. Removalof trees and other vegetation.

3. Topsoil stripping.

4. Clearing and grubbing.

5. Removing above-grade improvements.

6. Removing below-grade improvements.

B. Related work in other Sections: The following sections are noted as containing requirements that relate to this Section, but may not be limited to this listing.

1. Earthwork: Section 31 00 00.

2. Selective Site Demolition: Section 02 41 13.

1.03 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities, unless otherwise noted, without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner's property.

2. Restore damaged improvements to their original condition, as acceptable to property owners.

C. Protection of Existing Trees and Vegetation: Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary guards to protect trees and vegetation to be left standing.

1. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction operations.

2. Provide protection for roots over 1-1/2 inch diameter that are cut during construction operations. Coat cut faces with an emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out; cover with earth as soon as possible.

3. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Architect. Employ a licensed arborist to repair damages to trees and shrubs.

4. Replace trees which cannot be repaired and restored to full-growth status, as determined by arborist.

D. **Improvements on Adjoining Property:** Authority for performing removal and alteration work on property adjoining Owner's property will be obtained by Owner prior to award of contract.

1. Extent of work on adjacent property is indicated on Drawings.

E. **Salvable Improvements:** Carefully remove items indicated to be salvaged (to remain property of Owner), and store on Owner's premises where indicated or directed.

2.00 PRODUCTS (Not Applicable)

3.00 EXECUTION

3.01 SITE CLEARING

A. **General:** Remove trees, shrubs, grass and other vegetation, improvements, or obstructions as required to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. "Removal" includes digging out and oft-site disposing of stumps and roots or other material.

1. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of new construction.

B. **Topsoil:** Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and

other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.

1. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with underlying subsoil or other objectionable material.

2. Stockpile suitable topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

3. Dispose of unsuitable or excess topsoil same as specified for disposal of waste material, or use for fill if approved by Architect or Soils Engineer.

C. **Clearing and Grubbing:** Clear site of trees, shrubs and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface.

2. Use only hand methods for grubbing inside drip line of trees indicated to remain.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

D. Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Abandonment or removal of certain underground pipe or conduits may be indicated on civil, plumbing, mechanical or electrical drawings. Removal of abandoned underground piping or conduit is included under this Section.

2. Back-filling of underground trenches resulting from removal of piping or conduits shall be completed as follows per specification section 31 23 33.

3.02 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property: Remove waste materials and unsuitable or excess topsoil from Owner's property, except as otherwise noted.

END OF SECTION 31 10 00

SECTION 31 23 33 - TRENCHING, BACKFILLING & COMPACTING

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Trenching, backfilling and compacting.

2. Surface restoration.

B. Related work in other Sections:

1. Selective demolition: Section 02 41 13 .

2. Earthwork: Section 31 00 00.

3. Storm Drainage Utilities: Section 33 40 00.

4. Piped Utilities: Section 33 00 00.

5. Sanitary Sewerage Utilities: Section 33 30 00.

6. Water Utilities: Section 33 10 00.

1.02 QUALITY ASSURANCE

A. Reference standards: The applicable provisions of the following govern the work of this Section.

1. American Society for Testing and Materials (ASTM).

a. D1556: Density of Soil in Place by Sand Cone Method.

b. D1557: Moisture Density Relations of Soils and Soil-Aggregate Mixtures Using a 10 lb (4.5 kg) Rammer and 18" (457mm) drop.

2. California Department of Transportation (CDT).

a. Standard Specifications.

b. Standard Test Methods: No. 202, 216, and 231.

3. CAL/OSHA Regulation for Construction: Section 29 CFR.

B. The degree of compaction specified herein shall be determined by California Test Method No. 216 or No. 231. Unless otherwise noted, the percentage specified shall be the minimum allowable.

1.03 SUBMITTALS

A. Submit Product Data under 2.01 Materials, certifying that each material item complies with specified requirements.

1.04 SITE CONDITIONS

A. Comply with OSHA Construction Safety Orders, and specifically with those provisions dealing with trenching and underground construction.

1.05 SYSTEM DESCRIPTION

A. Definitions:

1. A trench is defined as an excavation in which the depth is greater than the width of the bottom of the excavation.

2. Excavations for appurtenant structures, such as but not limited to manholes, transition structures, junction structures, vaults, valve boxes, catch basins, thrust blocks, and boring pits shall be deemed to be in the category of trench excavation.

B. Unless otherwise indicated on the Drawings, excavation for pipelines shall be open cut.

2.00 PRODUCTS

2.01 MATERIALS

A. Select backfill material:

1. Sand or granular materials, free from organic matter, of the quality herein specified. Select backfill material shall have a size and gradation falling within the following limits when determined by California Test No. 202:

Sieve Size	Percentage Passing Sieve
1"	100
No. 4	50-100
No. 200	5 max.

2. The minus 200 portion of the material expressed as a percentage multiplied by the Plasticity Index shall not exceed 100.

B. Detectable tape: Detectable tape shall be 5.0 mil composition film containing metalized foil laminated between layers of inert plastic film, such as Detectable Terra Tape or approved equal. The tape shall be highly resistant to alkalis and acids found in the soil.

The tape, when buried 4' deep, shall be detectable by buried pipe or cable locating equipment. The tape shall be 3" wide and bear a continuous printed message warning of the type of utility buried beneath.

3.00 EXECUTION

3.01 PREPARATION

A. General:

1. Prior to trenching excavate at locations where new lines cross other utilities of uncertain depth and determine the elevation of the utility in question to ensure that the new line will clear the potential obstruction.

2. If, after excavation, the crossing utility does present an obstruction, then the line and grade of the new line will be adjusted as directed by the Engineer to clear the utility.

3.02 TRENCHING

A. General:

1. Trenching shall include removal of all water and materials that interfere with construction. Remove water which may be encountered in the trench by pumping or other methods during the pipe laying, bedding and backfill operations. Material shall be sufficiently dry to permit approved jointing.

2. Excavation shall include the construction and maintenance of bridges required for vehicular and pedestrian traffic, support for adjoining structures and where necessary, the rearrangement and repair of adjoining utilities.

3. It shall be the Contractor's responsibility to direct vehicular and pedestrian traffic through or around his work area at all times.

4. Except as specified in other Sections, the Contractor shall relocate, reconstruct, replace or repair, at his own expense, existing utilities, walls, fences, services, other structures or improvements of what ever nature, which are in the line of construction or which may be damaged, removed, disrupted or otherwise disturbed by the Contractor whether specifically identified on the Drawings or not. The Contractor shall connect such utilities to existing systems and leave all in a workable and operating condition.

5. Tree roots over 2" in diameter and crossing pipelines shall be protected by using hand excavation; refer to Section 31 10 00. Hand excavation shall mean excavation using the smallest piece of motorized equipment available in combination with manual use of hand equipment, with the intent to minimize the damage to low hanging tree limbs, tree roots and utilities.

B. Existing paving and concrete: The following supplements the requirements of Section 31 10 00.

1. Existing pavement over trench shall be sawcut, removed and hauled away from the job. Existing pavement shall be neatly sawcut along the limits of excavations. If a longitudinal pavement joint or edge of pavement is located within 3' of the limit of excavation, all intervening pavement shall be removed and replaced after completion of backfilling.

2. Existing concrete over the trench shall be sawcut to a minimum depth of 1½" in straight lines either parallel to the curb or at right angles to the alignment of sidewalk. No section to be replaced shall be smaller than 30" in either length or width. If the sawcut would fall within 30" of a construction joint, expansion joint, or edge, or within 12" of a score mark, the concrete shall be removed to the joint, edge or mark.

3. Place boards or other suitable material under backhoe outrigging to prevent damage to paved surfaces.

C. Trench Width:

1. The maximum allowable trench widths at the top of the pipe shall be the following:

Pipe Type	Trench Width (Max.)
Cast-iron	Outside diameter of barrel plus 18"
Ductile-iron	Outside diameter of barrel plus 18"
PVC	Outside diameter of barrel plus 18"
VCP	Outside diameter of barrel plus 18"
Concrete cylinder	Outside diameter of barrel plus 18"
Welded steel	Outside diameter of barrel plus 18"
Corrugated metal	Outside diameter of barrel plus 18"
RCP	Outside diameter of barrel plus 18"

a. The maximum trench width shall be inclusive of all shoring.

b. If the maximum trench width is exceeded, the Architect may direct the Contractor to embed or cradle the pipe in concrete at no additional charge to the Owner.

2. In no case shall the free working space on each side of the pipe barrel be less than 6".

D. Open trench:

1. The maximum length of open trench shall be 300' or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is greater. No trench shall be left open at the end of the day.

2. Provisions for trench crossings and free access shall be made at all street crossings, driveways, water gate valves and fire hydrants.

E. Excavation bracing:

1. The excavation shall be supported and excavation operations conducted in accordance with the California Industrial Accident Commission, State of California, Division of Industrial Safety requirements, and OSHA.

2. The Contractor shall, at his own expense, furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of all excavations (whether above or below the pipe grade), and to prevent any movement which could in any way diminish the required trench section or otherwise injure or delay the work. The sheeting and bracing shall be withdrawn to prevent any earth movement that might overload the pipe.

F. Excavated material:

1. Material excavated and not required for backfill shall be immediately removed and properly disposed of off the Owner's site.

2. Material excavated in streets and roadways shall be laid alongside the trench and kept trimmed to minimize inconvenience to public traffic.

3. Provisions shall be made whereby all storm and wastewater can flow uninterrupted in gutters or drainage channels.

4. Excavated material shall not be stored on landscaping.

3.03 PIPE BEDDING

A. Bedding excavation: Excavate the trench below the grade of the pipe bottom to the following minimum depths:

Pipe Type	Depth
Cast-iron	6"
Ductile-iron	6"
PVC	6"
VCP	6"
Concrete cylinder	4"
Welded steel	4"
Corrugated metal	3"
RCP	3"

B. Stabilization of trench bottom: When the trench bottom is unstable due to wet or spongy foundation, trench bottom shall be stabilized with gravel or crushed rock. The Engineer will determine the suitability of the trench bottom and the amount of gravel or crushed rock needed to stabilize a soft foundation. Soft material shall be removed and replaced with gravel or crushed rock when ordered by the Soils Consultant.

C. Placement of bedding material: Sufficient select backfill material as specified in Paragraph 2.01 A (above) shall be placed in trench and tamped to bring trench bottom up to grade of the bottom of pipe. The relative compaction of tamped material shall be not less than 90% as determined by ASTM D1556 or California Test 216. It is the intent of these Specifications to provide uniform bearing under the full length of pipe to a minimum width of 60% of the external diameter.

3.04 TRENCH BACKFILL

A. Initial backfill:

1. Prior to trench backfill, the Owner's Representative will inspect the condition of the trench and laying of pipe.

2. Select backfill material as specified in Paragraph 2.01 A (above) shall be used for initial backfill. After the pipe has been properly laid and inspected, select backfill material shall be placed on both sides of the pipe and compacted to final depth as follows:

Pipe Type	Depth
Cast-iron	12" above top of pipe
Ductile-iron	12" above top of pipe
PVC	12" above top of pipe
VCP	12" above top of pipe
Concrete cylinder	12" above top of pipe
Welded steel	12" above top of pipe
Corrugated metal	½ outside diameter of pipe
RCP	(Pipe spring line)

3. Compaction:

a. Initial backfill compaction shall be by mechanical means. The initial backfill material shall be hand tamped in layers not exceeding 4" in uncompacted depth and shall be brought up uniformly on both sides of the pipe to avoid bending or distortional stress. After hand tamping, the relative compaction of the initial backfill material shall be not less than 90%.

b. Compaction testing will be in accordance with one or more of the following methods: California Test No. 216, California Test No. 231, ASTM 1556, or ASTM 1557.

B. Detectable Tape: In trenching continuing non-metallic pipes, detectable tape shall be placed on top of the initial backfill, except with reinforced concrete pipe where the tape shall be placed 12" above top of pipe.

C. Subsequent Backfill:

1. Above the level of initial backfill, the trench shall be backfilled with native material from trench excavation or with select imported material. Subsequent backfill shall be free of vegetable matter, stones, or lumps exceeding 3" in greatest dimension, and other unsatisfactory material. The Soil Engineer shall approve the backfill material prior to replacement.

2. Subsequent backfill compaction shall be by mechanical means. The backfill material shall be placed in layers not exceeding 6" in loose depth, and each layer shall be thoroughly compacted before succeeding layers are placed. The use of machine tampers, except manually held types, shall not be permitted.

3. Relative compaction shall be at least 90%.

D. Backfill Cap: trench backfill shall be capped with 12 inches of backfill compacted to 95% of relative compaction. Lift shall be no more than 6".

3.05 TRENCH SURFACING

A. General: In areas to be improved under separate contract, the trench shall be backfilled and graded to the level of adjacent surfaces. No mounds of earth shall be left along the trench.

B. Temporary surfacing in areas to remain in use by the public:

1. Temporary surfacing shall be 2½" of cut back asphalt on 12" of Class 2 aggregate base.

2. Temporary surfacing shall be laid within one day after backfilling.

3. Before the trenching area is opened to traffic, excess dirt, rock and debris shall be removed and the street surface shall be swept clean.

4. Temporary surfacing shall be maintained to prevent the occurrence of mudholes and prevent the surface from settling below 1" or rising more than 1" from the existing pavement grade.

3.06 INSPECTION

A. Pipes shall be inspected/tested prior to backfilling and compaction, tests as required shall be performed to ensure compliance with these Specifications. The test(s) shall be conducted at no cost to the Owner.

B. A final inspection upon completion of the paving operation shall be made to ensure conformity with the existing pavement surface.

END OF SECTION 31 23 33

SECTION 32 12 16 - ASPHALT CONCRETE PAVING

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Aggregate base material.

2. Prime coating.

3. Paint binder as required herein.

4. Asphalt concrete.

5. Seal coat.

B. Related work in other Sections:

1 Earthwork: Section 31 00 00.

2 Curbs and gutters: Section 32 16 00.

3 Pavement marking and accessories: Section 32 17 23.

1.02 QUALITY ASSURANCE

A. Reference standards: Applicable provisions of the following govern the work of this Section.

1. American Association of State Highway and Transportation Officials (AASHTO), M 288-96 or Latest Version Thereof.

2. California Department of Transportation (CDT).
   a. Standard Specifications: Sections 26, 37, 39, 92, 93, and 94.

   b. Standard Test Method No. 399A.

B. All work in this Section shall conform to Sections 26, 37, 92, 93, and 94 of the Standard Specifications (CDT).

1.03 SUBMITTALS

A. Certificates: Submit the following:

1. Two copies of material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds specified requirements.

2. Certified weight or load slip to the Owner's representative for each load of material used in the construction of the asphalt concrete pavement.

1.04 SITE CONDITIONS

A. Prime coat, seal coat and paint binder.

1. Apply only when the ambient temperature is above 50°F and when temperature has not been below 30°F for 12 hours immediately prior to application.

2. Do not apply when base or surfaces are wet or contain an excess of moisture.

B. Construct asphalt concrete surface course only when atmospheric temperature is above 40°F and when base is dry.

2.00 PRODUCTS

2.01 AGGREGATE BASE

A. Class 2 aggregate base, three quarter inch (¾") maximum size, as specified in Section 26 of the CDT Standard Specifications.

B. Mineral aggregate shall be Type B mineral aggregate as specified in Section 39 of the CDT Standard Specifications.

C. Grading of combined aggregates for new pavement shall be ½" maximum size, medium grading, except asphaltic concrete for overlaying existing paved surfaces shall be 3/8" maximum size.

D. Liquid asphalt for prime coat: Grade SC-70 in conformance with Section 93 of the CDT Standard Specifications.

E. Asphaltic emulsion for paint binder and fog seal coat: Emulsified asphalt, Type SS-1h, conforming to Section 94 of the CDT Standard Specifications.

3.00 EXECUTION

3.01 PREPARATION

A. Subgrade: The upper 12" of subgrade shall be compacted to 95% per Section 31 00 00 of these Specifications.

B. Crack sealing:

1. Before sealing, cracks shall be cleared of dirt, dust, soil vegetation debris, and other deleterious materials by means of air blowing to a depth of ¼" to ½".

2. Cracks 1/8" in width and greater in existing AC paving to be overlaid and shall be sealed.

3. Applications of crack sealer shall be in accordance with the manufacturer's recommendations or as directed by the Owner's representative.

3.02 AGGREGATE BASE

A. Place, spread and compact in conformance with Section 26 of the CDT Standard Specifications.

3.03 ASPHALT CONCRETE PAVING

A. Proportion, mix, place, spread and compact in conformance with Section 39 of the CDT Standard Specifications.

B. Before placing asphalt concrete on untreated base, apply liquid asphalt prime coat to base course in conformance with Section 39 of the CalTrans Standard Specifications. Apply prime coat at the rate of 0.25 gallons per square yard.

C. Before placing asphalt concrete, apply an asphalt emulsion tack coat (paint binder) to vertical surfaces of existing pavement, curbs, gutters, construction joints and existing pavement to be surfaced, in conformance with Section 39 of the CDT Standard Specifications.

D. Spread and compact asphalt concrete in accordance with Section 39 of CDT Standard Specifications.

E. Apply seal coat to all finished surfaces of asphalt concrete pavement in accordance with Section 37 of the CDT Standard Specifications.

F. After seal coat has been applied, allow ample time for drying before traffic is allowed on the pavement or paint striping is applied.

3.04 FIELD QUALITY CONTROL

A. Aggregate Base: The surface of finished aggregate base shall vary no more than 0.05' above or below the grade indicated.

B. Asphalt Concrete Paving:

1. The finished asphalt pavement, where not controlled by adjacent structures or features, shall not vary more than 0.05 feet above or below the planned grade, providing it is uniform and free of sharp breaks and does not pond water.

2. The cross section of the finished pavement shall be free of ridges and valleys and shall not vary more than 0.03' above or below the theoretical section at any point on the cross section.

3. The specified thickness of the finished pavement shall be the minimum acceptable.

4. Conforms shall form a smooth, pond free, transition between existing and new pavement.

END OF SECTION 32 12 16

SECTION 32 13 12 - SITE CONCRETE REINFORCING

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Reinforcing steel for site cast in place concrete.

2. Accessories such as chairs and tie wires.

B. Related work in other Sections:

1. Curb and Gutters: Section 32 16 00.

2. Site Cast-in-Place Concrete: Section 32 13 13.

1.02 QUALITY ASSURANCE

A. Source quality control:

1. The Contractor shall ensure that the material delivered for use is that represented by the mill reports and obtain copies of mill reports, examine them, certify whether the material represented complies with Specifications requirements, and make distribution of reports as required. Report chemical composition of each heat, as determined by ladle analysis.

2. Where materials proposed for use cannot be identified, the Contractor shall pay for an approved testing laboratory to make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel.

B. Standards: The applicable provisions of the following govern the work of this Section:

1. 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.

3. ACI SP 66 American Concrete Institute Detailing Manual.

4. ANSI/ASTM A497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

1.03 SUBMITTALS

A. Submit bar drawings, schedules and placing diagrams for reinforcing steel. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project at the time they are submitted.

1.04 HANDLING

A. Comply with the requirements of Specification.

B. Marking and shipping reinforcement: Bundle and tag with suitable identification. Transport to and store at the site to avoid damage to material. Maintain tags after bundles are broken.

2.00 PRODUCTS

2.01 MATERIALS

A. Reinforcement Steel - Bar Reinforcement - ASTM A 615 Grade 60 (ASTM A 615M Grade 400), deformed.

B. Reinforcement Steel - Reinforcing Fabric - Welded wire fabric - ASTM A 185, welded steel wire fabric.

C. Stirrup steel: ANSI/ASTM A1064.

D. Tie wire: 16 gauge (min.) annealed steel wire.

E. Chairs and similar support items:

1. Standard manufactured products conforming to CRSI Manual of Standard Practice, MSP-2.

2. Use dense precast concrete bar support with embedded wire ties for reinforcement placed on grade; elsewhere reinforcement shall be supported by wire bar supports.

2.02 FABRICATION

A. General: Except as modified by the Drawings and the Specifications, comply with CRSI and WCRSI Manual of Standard Practice for Reinforced Concrete Construction, for fabrication of reinforcing steel.

B. Bending and forming:

1. Fabricated steel bars, wire and fabric of indicated sizes, lengths, and gauges and accurately form to shapes indicated by methods that will not injure the materials.

2. Do not heat reinforcement for bending. Do not install bars with unscheduled kinks or bends.

3.00 EXECUTION

3.01 PLACING

A. Cleaning: Clean reinforcement of oil or other coating that might destroy or reduce its bond with concrete before placing it.

B. Placing: Conform to the Manual of Standard Practice for Reinforced Concrete Construction by CRSI and WCRSI, and the following:

1. Accurately place reinforcement and securely tie in position with steel wire at points where bars cross to hold them against displacement.

2. 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.

C. Spacing of reinforcement:

1. Space reinforcement to maintain the proper distance and clearance between parallel bars and between bars and forms. Provide metal spreaders and spacers to hold horizontal steel in position.

2. Support steel at proper height by using galvanized "S" chairs, or "Support Bars" and galvanized "S" chairs, with hangers, or in other manner, as necessary.

3. Where "Support Bars" are used to hold the slab reinforcement in place, space chairs under the support bars not to exceed the distances specified previously.

D. Splicing:

1. Stagger all lap splices. Bars shall be in contact, unless noted otherwise on the Drawings, at lapped splices and shall be firmly wired together before placing concrete. Lap bars as indicated.

2. Extend stubs and dowels required to receive and engage subsequent work a sufficient length to develop the strength of the bar. Place dowel and stub bars in the forms and secure against displacement during placing of concrete.

E. Maintain clear distances between reinforced steel and face of concrete indicated on the Drawings.

F. Dowels in existing concrete:

1. When drilling for dowels in existing concrete, use sharp bits, drill hole full depth and slightly oversize, fill with a 6000 psi epoxy and hammer dowel to refusal

END OF SECTION 32 13 12

SECTION 32 13 13 - SITE CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Site Cast-in-place concrete.

2. Shotcrete.

3. Replacement concrete (patios, walks, steps, etc.).

B. Related work in other Sections:

1. Site Reinforcing steel: Section 32 13 12.

2. Earthwork: Section 31 00 00.

1.02 QUALITY ASSURANCE

A. Reference standards: Applicable provisions of the following govern the work of this Section.

1. ACI 301, Specifications for Structural Concrete for Buildings.

2. ACI302, Recommended Practice for Concrete Floor and Slab Construction.

3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

4. ACI 305, Recommended Practice for Hot Weather Concreting.

5. ACI 306, Recommended Practice for Cold Weather Concreting.

B. Source quality control:

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

2. Testing coarse aggregates:

a. Test aggregate before and after concrete mix is established and whenever the character source of material is changed, but not less than one test for each 50 cubic yards.

b. Perform a sieve analysis to determine conformity with limits of gradation. Perform sampling and testing according to ASTM C33, and as follows:

1) Sampling of aggregates: ASTM D75. Take samples of aggregates at source of supply, or if source of supply has been approved, from storage bunkers at ready- mixed concrete plant.

2) Testing of aggregates shall include:

a) Sieve analysis: ASTM C136.

b) Organic impurities: ASTM C40. Fine aggregate shall develop a color not darker than the referenced standard color.

c) Soundness: ASTM C88. Loss after 5 cycles not over 8% for coarse aggregate, nor 10% for fine aggregate.

d) Abrasion of concrete aggregate: ASTM C131. Weight loss not over 10-1/2% after 100 revolutions, nor 42% after 500 revolutions.

e) Deleterious materials: ASTM C33.

f) Materials passing No. 200 sieve: ASTM C117, not over 1% for gravel, 1.5% for crushed aggregate per ASTM C33.

g) Reactive materials: ASTM C289. aggregates shall indicate no potential deleterious reactivity.

h) Definitions: ASTM C125.

3. Cement test:

a. The cement mill laboratory will be acceptable as testing laboratory for this purpose when approved by the Building Department. Submit evidence to show that the cement mill laboratory is qualified to perform tests. The laboratory shall make tests for every 500 barrels or fraction thereof for of cement used in accordance with ASTM C150.

b. Make tensile strength test at 7 days. Tag the cement for identification at the location of sampling. A representative of the Testing Laboratory shall certify that materials being used are taken from the lots sampled and tested for this report.

2.00 PRODUCTS

2.01 MATERIALS

A. Portland cement: ASTM C150, Type I or II low alkali with air entrainment as required. Do not change brand or type of cement without Engineer's written approval.

B. Aggregates:

1. Hardrock aggregates: ASTM C33 graded so that coarse aggregates nominal size is not larger than 1/5 the narrowest dimensions between form faces; nor 3/4 of the minimum clear spacing between individual reinforcing bars or bundles of bars, but never greater than 3/4" in any dimension for slabs 4" thick or less; 1-1/2" at all other locations.

C. Admixtures: ASTM C494, Type A, admixtures shall contain no chlorides and may be used only with the Engineers approval, except as specified. Submit manufacturer's data for products proposed for use to the Engineer.

D. Pozzolanic Fly Ash: ASTM C618, Class F.

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

F. Concrete curing compound:

1. Liquid membrane-curing compound containing a fugitive dye, conforming to ASTM C309, Type I, guaranteed not to affect the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.

G. Expansion joint materials:

1. Joint filler: Homex Expansion Joint by Homasote Co. or equal non-bituminous product compatible with sealant specified in Section 07 90 00 per ASTM D 1751.

2. Joint sealant and back-up rod: As specified in Section 07 90 00.

H. Dry pack and grout: One of the following or equal.

1. Masterflow 713 by Master Builders.

2. Five Star Grout by U.S. Grout Corporation.

3. Fondag Nonshrink Grout by Specrete Products, Ltd.

I. Aggregate Base: Class 2 aggregate base, three quarter inch (¾") maximum size, as specified in Section 26 of the CalTrans Standard Specifications.

2.02 MIXES

A. Mix design:

1. Employ a testing laboratory, acceptable to the Owner's Representative, to design all structural concrete mixes required for the Project to provide:

    a. Normal weight concrete with 3000 psi 28-day compressive strength, unless noted otherwise on the Drawings.

    b. Adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without segregation and excessive bleeding.

    c. Other requirements of these Specifications.

2. Proper proportions for design mixes shall be in accordance with ACI 211 or ACI 318.

3. Proper water-cement ratio shall be determined by the preliminary test made in accordance with ASTM C192.

4. Slump limits: Proportion and design mixes to result in the following concrete slump at point of placement.

    a. Tieback anchors: Not more than 7".

    b. Piers: Not less than 4" and not more than 6".

    c. All other concrete: Not less than 1" and not more than 4".

5. Use air-entering admixture in all concrete, unless otherwise shown or specified. Add air-entering admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within 3% to 6%.

6. Tests shall be conducted in accordance with ASTM C39.

B. Submit report showing results of sieve analysis, mix design and results of compression tests. Make test specimens from not less than 3 batches of each design specimens from not less than 3 batches of each design mix. The trial batch strength for each mix shall exceed indicated f'c by 25% or a lesser amount based on standard deviations of strength test records according to ACI 318. Do not start concrete production until mixes have been reviewed and are acceptable to the Engineer.

C. For each batch, weigh the fine and coarse aggregate separately, measure cement and water separately and introduce separately into the mix so that proportions can be accurately controlled and easily checked.

D. Do not change proportions established by the accepted mix design without the Engineer's written approval.

1. Cement: If concrete develops less than required minimum strength, adjust mix proportions and increase the amount of cement, as necessary.

2. Water: Do not exceed predetermined amount of water because of slowness of discharge from mixer necessary to produce concrete that will work readily into corners and angles of forms and around reinforcements, without segregation of materials and without free water collecting on the surface.

3. Aggregates: Reasonable variations in grading will be allowed by the Engineer because of characteristics of available materials and the need for workability and strength.

E. Concrete mixing:

1. Mixing and delivery shall comply with ASTM C94, these Specifications, and applicable Building Code requirements. If the referenced specifications, these Specifications or the Building Code conflict, comply with the most restrictive requirement.

2. The Owner's Testing Agency will perform check sieve analysis of the aggregates being used, check compliance with mix design and the cement being used against mix design; check that water has been removed from the drum before adding mix ingredients for the following load and shall witness the loading of mixing trucks. The Owner's Testing Agency will send a written report of each inspection to Engineer indicating compliance with these Specifications.

3. Provide a ticket signed by an authorized representative of the batching plant with each mixer truck of concrete delivered to the site indicating:

Name of Project.
Date of Delivery
Supplier of Concrete.
Brand of Cement.
Truck Identity and
Cement Content.
Ticket Serial Number.
Strength Classification.
Batching Time.
Admixture Content.
Point of Deposit.
Name of Contractor.
Total Amount of Water.
Water Added at Jobsite.
Name of Driver.
Weight of Aggregate.
Time loaded and First
Daily Temperature
Mixing Concrete.
Number of Cubic Yards
Reading of Revolution in Load.

4. Store batch tickets at time concrete is delivered in job file for reference at the site.

5. Remove all materials, including water, remaining in the ready-mix truck drum completely before ingredients for the following loads are introduced into the drum.

6. Retempered concrete: Do not use concrete which has not been placed 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

3.00 EXECUTION

3.01 PREPARATION

A. Inspect excavations, subgrades and formwork, as applicable for each placing operation, for accuracy of lines, levels, elevations and dimensions. Make necessary corrections to obtain concrete within the tolerances specified.

B. Inspect placement of reinforcement and accessories for proper positions, sizes, clearances, fastenings, laps and splices.

C. Moisten, do not saturate, earth subgrade and bearing surfaces. Moisten the sand base under slabs-on-grade the day before concrete is to be cast thereon.

D. Wet wood forms thoroughly when they are not treated with form release agent. Wet other materials sufficiently to reduce suction and maintain concrete workability.

E. Recompact disturbed gravel fill and install vapor barrier under building slabs on grade. Lap joints 4". Lap on walls 2". Cut patches at penetrations for a tight fit. Tape all joints to make moisture tight. Cover vapor barrier with a minimum of 2" of damp concrete sand.

F. Embedded items including, but not limited to, conduits, anchors and rough hardware, built into concrete as indicated or required.

1. Do not embed piping and conduits, other than electrical conduits, in structural concrete. Locate conduits so as to reduce strength of the structure the least amount, as approved by the Engineer, and as indicated on the Drawings.

2. Embed bolts, inserts and other items in the concrete, accurately secured so that they are not displaced during concrete placing and compacting operations.

3. Set embedded bolts for materials and equipment attached to concrete to template, layouts and shop drawings. Verify size, length and location of electric conduit with respect to equipment supports.

G. Do not proceed with placement of concrete until all conditions are satisfactory.

3.02 CONVEYING

A. Rapid handling: Transport concrete from the mixer to location of placing as rapidly as practical to avoid separation or loss of ingredients.

B. Transporting methods: Use cranes, carts, buggies or other approved means to deliver concrete to final locations. Do not use delivery systems (pipe, chutes, etc.) formed of aluminum for transporting concrete. If pumping of concrete is contemplated, first obtain Engineer's approval for the design mix and the placement method before placing concrete.

C. Free fall: Not more than 4 ft. in concrete which will remain exposed in the Work; no more than 6 ft. elsewhere. Avoid large concentration of concrete in one location which would produce unacceptable deflection in supporting formwork or on one side of steel soldier beam.

D. Lifts: No more than 2 ft. high.

E. Concrete flow: Carry concrete up uniformly for the length of walls being placed to reduce lateral flow of concrete to 5 ft. maximum.

F. Runways: Construct substantial runways and scaffolding to avoid movement and vibration in the forms and rein- forcing steel as a result of transporting and placing concrete.

3.03 PLACING

A. General: Comply with ACI 304. Do not place concrete in or under water.

B. Consolidation: Thoroughly consolidate concrete and work it around reinforcement and embedded items and into corners and angles of forms, by spading, rodding and tamping to exclude rock pockets, air bubbles and "honeycombs" and to obtain required density and strength.

C. Internal vibration:

1. Use mechanical vibrators to consolidate each layer with that previously placed, to completely consolidate the concrete in forms. Take care to avoid over-vibration, causing separation of ingredients. Keep extra standby vibrator at the site.

2. Vibration of pier concrete below grade is not required.

D. Flow of concrete: Keep surface of concrete level during placing, with a minimum of concrete allowed to flow from one position to another. Place concrete in a continuous operation until each section or panel has been completed.

E. Record: Keep records showing location, date and time of placement of all concrete batches.

F. Temperature: Do not place concrete when the ambient temperature is above +85°F or below +40°F. at the time of placing, or if it is likely to go above +85°F or below +40°F before the concrete has taken its initial set, unless special precautions recommended by ACI 305 and 306 are provided.

G. Construction joints:

1. Location:

a. Locate construction joints where indicated. When not shown, submit layout showing location of construction joints and placing procedure, for the Engineer's approval, before placing concrete.

b. Locate construction joints to least impair the strength and appearance of structure.

c. Off-set construction joints not less than 5 ft. with a minimum of 2 offsets.

2. Joints in channels: Locate as detailed on the Drawings.

3. Contact surfaces: Keep exposed face of construction joints continuously moist from time of initial set until subsequent placing of concrete against them, but not to exceed the curing period.

a. Clean contact surfaces thoroughly by chipping entire surface not earlier than 5 days after initial placing.

b. As an option, jet wash or sandblast the surface to expose clean aggregate solidly embedded in the mortar matrix; remove wash water entirely from surface.

c. If a contact surface becomes coated with foreign materials of any nature, after being cleaned, chip or rechip the surface completely, to suitable condition.

H. Tolerances: In compliance with ACI 117 as follows.

1. Paragraph 2.1, except for reference to slip-forming.

2. Paragraph 2.2, Class AX.

3. Paragraph 3.6.

3.04 FINISHING

A. Formed concrete surfaces:

1. General:

a. Remove fins, laitance and loose material from concrete surfaces when forms are removed.

b. Repair concrete honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by removing the damaged or unsatisfactory area to sound concrete, with slightly undercut edges, and filling-in with the same mix as the adjacent concrete minus the coarse aggregate.

c. Tamp and float the patch flush with adjacent surface.

2. Shotcrete walls: Provide a "rubbed finish" as defined in ACI 301 to produce a uniform surface by float trowel or rub board immediately after shotcrete is applied.

3. Clean surface of pier cast below grade by sandblasting. Apply a sand-cement mortar, trowel and rub to match shotcrete finish.

B. Top of grade beams, footings and pier caps: Screed to elevations indicated.

C. Channels:

1. Protection: Protect exposed flatwork as necessary to prevent damage resulting from impact or from subsequent work.

a. Protect work of other trades from damage by covering it with heavy kraft paper securely taped in place. Leave protection in place as long as its need exists.

b. Control the use of water and other contaminants within the area so that no damage to previously installed work or existing structure and finish occurs.

2. Compacting and floating:

a. Bring channels to proper elevations and strike off with a straightedge. Remove excess water and laitance.

1) Compact by rolling with weighted rollers or by tamping with grid tampers. Thoroughly hand-tamp areas not accessible to rollers.

2) Float and test surfaces with a 10 ft. straightedge and eliminate high and low spots to comply with tolerances specified.

3) From this point, use the methods and tools necessary to produce surface tolerances and finishes specified.

b. Use screeds to type and spacing required to produce specified channel tolerance.

3. Moisture control: In addition to other finishing requirements, use a water fog spray to reduce plastic shrinkage cracks during flatwork finishing operations when conditions of low humidity and/or high temperature exist.

   a. Immediately after concrete has been brought to a flat surface and the shiny film of moisture disappears, restore it and maintain until final troweling by applying a light film of moisture with an atomizing type fog sprayer.

   b. Use frequent light applications of moisture rather than excessive amounts at any one time. Adjust the amount and refrequency of fog spray as required by variable conditions of weather, wind, temperature and humidity.

4. General requirements:

   a. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.

   b. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces before allowing to harden.

   c. Use no troweling machines within 12" of electrical junction and outlet boxes which are set to finish flush with concrete floors. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.

5. Schedule of finishes:

   a. Float surfaces to produce a uniform broom sweep texture and finish throughout.

   b. Provide an equivalent of a medium salted finish along concrete surfaces at slopes of less than 6%.

   c. Provide an equivalent of a heavy broom slip resistant finish along concrete surfaces at slopes of 6% and greater.

D. Curbs: Immediately after removing forms, finish faces and top with a steel trowel.

3.05 CURING

A. Formed concrete:

1. Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.

2. If forms are removed before 14 days after concrete is cast, coat concrete with curing compound as specified for flatwork below.

B. Concrete flatwork:

1. After finishing, spray the specified curing compound uniformly in 2 coats at 90□ to each other not exceeding coverage rates recommended by the manufacturer.

2. Inspect treated surfaces daily for 14 days for evidence of drying. Re-wet the surfaces and apply a new application of curing compound if premature drying occurs, as soon as can be done after finishing without marring the surfaces.

C. Pits, trenches and curbs: Construct pits for transformers, sumps, valves, trenches, curbs, gutters, and other miscellaneous concrete work.

D. Grouting and drypacking: Install as indicated and required, except for items grouted by other trades.

1. Mix material, in accordance with its manufacturer's instructions, with sufficient water so it flows under its own weight for grout, and to just moisten and bind the materials together for drypack.

2. Place drypack by forcing and rodding to fill all voids and provide complete bearing under plates. Place fluid grout from one side only and puddle to completely fill voids; do not remove dams or forms until grout attains initial set. Finish exposed surfaces smooth, and damp cure at least 3 days.

E. Splash block: Precast in tight molds, to the dimensions and profiles indicated. Use a mix with coarse aggregates passing 3/8" sieve to obtain a compressive strength of 3,500 psi minimum at 28 days. Steel trowel unformed surface.

3.06 PROTECTING AND CLEARING

A. Protect finished surfaces from stains or abrasions. Do not allow fire in direct contact with concrete. Provide adequate protection against injurious action by sun or wind. Protect fresh concrete from heavy rain and mechanical injury.

B. Upon completion, wash and clean exposed concrete and leave free of oil, paint, plaster and foreign substances, ready to receive applied finishes or to be left exposed.

3.07 DEFECTIVE CONCRETE

A. Concrete finishes which are not within the specified tolerances nor finished as specified which do not connect properly to adjoining work, do not slope to drains or are not

properly cured, or do not meet other provisions of the Specifications, will be deemed defective.

B. Remove defective concrete as directed by Engineer and replace with concrete of specified strength.

3.08 FIELD QUALITY CONTROL

A. Concrete quality control (refer also to Section 01 40 00): The following will be performed by the Owner's Testing Agency.

1. Samples will be taken during progress of the work for determination of slump, compression strength, aggregate sieve analysis, and grout-mix tests, with assistance furnished by the Contractor.

2. 3 cylinders will be made for each day's pour or for each 100 cubic yards or less, or once for each 5,000 square feet of surface area, whichever is less, for each type of concrete being cast.

3. 1 cylinder will be tested at 7 days, and 1 cylinder at 28 days. The remaining cylinder will be kept in reserve in case tests are unsatisfactory.

4. Samples will be made in accordance with ASTM C172.

5. Specimens will be made and laboratory cured in accordance with ASTM C31.

6. The 28-day values will be the criteria for acceptance of concrete regarding strength only.

a. 7-day tests may be regarded as indicative of compliance or non-compliance with the 28-day strength requirements, and the Contractor should be guided accordingly in matter of adjusting proportions, if necessary, and notify the Engineer.

b. 7-day tests shall also be a guide to the Contractor regarding time for form removal.

7. Slump tests will be made for each set of tests cylinders in accordance with ASTM C142.

B. Tests evaluation:

1. Concrete cylinder test will be evaluated in accordance with ACI 214 and 318.

2. If 28-day test results indicate the concrete strength is not as specified, core concrete as directed by the Engineer in accordance with ASTM C42.

a. Plug core hole solid as specified in Article 3.04 of this Section.

b. The cost of cores, tests and patching shall be borne by the Contractor.

3. In the event that additional core tests do not show strength required, or as determined by load tests made in accordance with ACI 318, the defective concrete shall be removed and replaced or shall be reinforced as directed by the Engineer at the Contractor's expense.

4. If core tests results fall below design strength specified, adjust the concrete mix or water content for future batches, at not additional cost to the Owner.

END OF SECTION 32 13 13

SECTION 32 13 13.1 - CONCRETE WORK (LANDSCAPE)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. All grading, earthwork, excavations, backfills, compaction, and other grading operations shall be accomplished in accordance with the geotechnical report (which shall be part of the Contract Documents). Contractor shall be responsible for securing a copy of the geotechnical report. The project soils engineer shall be present during all grading operations. The soils engineer shall direct samples to be submitted and tests to be taken. Contractor shall cooperate with the requirements of the soils engineer.

C. Specification Division 31, Earthwork, Soils and Earthwork, Rough Grading, and Excavation and Fill.

1.2 DESCRIPTION OF WORK

A. The extent of concrete work is shown on the landscape architectural drawings and details and shall include, but is not limited to, pedestrian concrete walkways, steps, ramps, curbs, mowbands, footings and walls.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
   1. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
   2. ACI 318 Building Code Requirements for Structural Concrete.
   3. ASTM C150, for Type I, Type II or Type III Portland cement concrete.
   4. Chapter 19A, 2019 C.B.C.

B. Certification: Weighmaster Certificate

C. Duties of the Inspector: The inspector shall notify the Architect, Structural Engineer and the Division of State Architect at least 48 hours in advance of the first pour of concrete and sufficiently in advance of subsequent pours. Comply with Section 4-333.1 and Chapter 7, Part I, Title 24, California Code of Regulations (CCR).

D. Installer Qualifications
   1. Experience: The concrete installing firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
   2. Licensure: The concrete installation firm shall hold a current, active C8 “Concrete Contractor” license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.

3. Supervision: The concrete installing firm shall have a qualified and experienced concrete technician on site during concrete installation.

E. “Colored” Concrete Installer Qualifications: Installer of “colored” concrete shall be qualified by Scofield. Contact local Scofield Representative or the Division Office (323) 720-3055 for a list of locally qualified installers.

1.4 SUBMITTALS

A. Shop Drawings Reinforcement: Submit shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required and openings through concrete structures.

B. Design Mixes Submittal: Submit written reports of design mixes to the Architect of each proposed mix for each class of concrete within thirty-five (35) days after the issuance of the "Notice to Proceed", but no later than ten (10) days prior to the first scheduled concrete pour. Do not begin concrete production until all design mixes have been reviewed by the Architect and independent testing facility.
1. Separate submittal data shall be submitted for each mixture for the following:
a. Concrete Paving – Pedestrian, steps, curbs, walls and footings.
b. Concrete Paving – Vehicular.

C. Job-site Samples: Contractor shall pour concrete samples as indicated below for each concrete color and finish specified on Drawings for written approval from Owner’s Representative prior to installation as follows:
1. Two (2) foot by two (2) foot concrete flatwork.
2. Two linear feet by width and height detailed for each concrete wall specified to include decorative tile.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments.

D. Expansion Joint for flatwork that does not have a stamp pattern: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

E. Expansion Joint for flatwork with a stamp pattern: Use Form-A-Key (or equal) key lock system joint and stake manufactured of 24 gauge galvanized steel with dowel knock outs six (6) inches on center spacing shaped in the form of a constant tongue and groove key between adjacent concrete slab sections secured in place by 13 gauge HRPO steel stakes installed at 24" intervals conforming to ASTM A653 joint and ASTM A569 stakes.

F. Expansion Joint for poured-in-place walls: Asphalt impregnated felt fiber expansion material, one half inch (1/2") thick by full depth of concrete, in compliance with ASTM D1751.

G. Joint Filler: Self leveling Sikaflex -2c NS TG two component, traffic grade, polyurethane elastomeric joint sealant in accordance with Federal Specification TT-S-0227E. Color to match concrete color when cured. Verify color with Architect where two different concrete colors are adjacent to one another. Contractor shall include manufacturer recommended priming agent, BASF Primer 733 or equal.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars (Rebar): ASTM A 615, Grade 60, deformed, except #3 and smaller may be Grade 40. Test in accordance with Section 1903A and 1910A.2, 2019 C.B.C.

B. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type V, conforming to ACI 318-14 and test in accordance with Section 1903A, 2019 C.B.C.

B. Fly Ash or other pozzolan can be used as a partial substitute for ASTM 150 Portland cement as follows:
   1. Fly Ash conforming to ASTM C618, Class F, the maximum Loss on Ignition (LOI) shall be less than 3%. Class C is not permitted.
   2. Slag, Ground Granulated Blast Furnace Slag Cement (GGBFS) shall conform to ASTM C989 or AASHTO M 302 Grade 100 or 120.
   3. Silica Fume: ASTM C1240, Standard Specification for Silica Fume used in cementitious mixtures.
   4. High-Reactivity Metakaolin (HRM): ASTM C618, aluminosilicate pozzolan.

C. Water: Water used in mixing concrete shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials or other substances that may be deleterious to concrete or reinforcement and shall be tested and verified through ASTM C1602.

D. Admixtures: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
   1. Air-Entraining Admixture: ASTM C 260.

2. Water-Reducing Admixture: ANSI/ASTM C 494, Type A, and contain not more than 1% chloride ions.
3. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Crushed Aggregate Base Rock: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to Class II aggregate base per Caltrans Standard Specifications. Crusher-run stone or bank-run gravel will not be permitted.

F. Liquid Membrane-Forming Curing Compound: Liquid type membrane-forming curing compound complying with ASTM C-309, Type I, Class A unless other type acceptable to Architect. Comply with Volatile Organic Compounds (VOC) content limits, as required by Air Pollution Control Regulations on Architectural Coatings (less than 350 g/l).

G. Curing Methods:
1. Moist Curing: continuous misting, sprinkling or ponding.
2. Moisture-retaining cover curing: After wetting the concrete surface, cover with wet-curing blanket. Lay blanket in accordance with manufacturer's instructions, over-lapping edges and extending edges twelve (12) inches beyond area of concrete to be cured. Remove air pockets. Repair any holes or tears that occur using sheeting material and waterproof tape.
3. Compound curing: Apply specified curing compound as soon as final finishing operations are complete. Use as recommended by the manufacturer's written instructions.

H. Color Materials:
1. Liquid lamp black shall be default color for concrete flatwork not specified on drawings as "Natural" or "Colored". Add one pint of liquid lamp black per cubic yard of concrete flatwork.
2. Concrete specified as "Natural" shall have no color added. Unless specified otherwise on Drawings, concrete curbs, steps and walls to be "Natural".
3. Concrete specified as "Colored" shall be LM Scofield Systems Chromix Admixtures for Color-Conditioned Concrete and/or Scofield Integral Color SG Standard Grade, to include Standard Colors, Custom Colors and Special Order Colors for all concrete specified on drawing as "colored".
4. Colored and Patterned concrete shall be sealed per manufacturer with one of the following to be selected by Architect and Owner's Representative:
   a. Scofield Selectseal Plus (gloss finish).
   b. Cementone Clear Concrete Sealer (low gloss).
   c. Scofield Cureseal-W Concrete Curing Compound and Sealer (low gloss).
   d. Lithochrome Colorwax Concrete Curing Compound (color matched, natural finish).
   e. Colorcure Concrete Curing Compound and Sealer (color matched).
5. Contractor shall pour samples on site as necessary for Architect and/or Owner's Representative to select final color(s) for project.

I. Concrete Colors and Patterns:

1. Top Cast Concrete Finish: Dayton Superior, www.DaytonSuperior.com. Medium finish, No. Code 50, Etch Aggregate Size to Exposure, 1/8" to 3/8", package color canary green.
   a. Aggregate: Coordinate w/ Client for aggregate for selection of size and color of aggregate to achieve desired aesthetic effect.
   b. Curing/sealing compound: Dayton Superior Cure & Seal 1315 EF, Cure and Seal 25% J22UV and/or Ultra Seal EF, Face-Off as recommended by manufacturer.

2.4 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete. Use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Architect.

B. Comply with Section ACI 318-14. The compressive strength of concrete shall be proportioned by one of the following methods: Design Mix (Method B) or Pre-Test Mix (Method C).

C. Submit written reports to Architect of each proposed mix for each class of concrete at least 10 days prior to the first scheduled concrete pour. Do not begin concrete production until mixes have been reviewed by Architect.

D. Design mixes to provide normal weight concrete with the following properties:
   1. Concrete Paving – Pedestrian, steps, curbs, walls and footings:
      a. 3,000 psi 28-day compressive strength
      b. 0.60, maximum, water to cement (W/C) ratio
      c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
      d. Aggregate to be 1" maximum.
      e. 28-day shrinkage, SEAONC Method: 0.050 maximum.
   2. Concrete Paving – Vehicular:
      a. 4,000 psi 28-day compressive strength
      b. 0.50, maximum, water to cement (W/C) ratio
      c. Minimum cementitious content shall be 470 pounds, minimum, per cubic yard.
      d. Aggregate to be 1" maximum.
      e. 28-day shrinkage, SEAONC Method: 0.050 maximum.

E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in work.

F. Admixtures: Use only as indicated by approved design mix.

G. Mix as specified to be "natural", "colored" or add liquid lamp black per manufacturer recommendations.

H. Color for concrete specified as "colored": Color mixture as determined by manufacturer in accordance with color selected and sealed per manufacturer recommendations.

I. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
   1. All concrete: Shall be four (4) inches, plus or minus one (1) inch.

2.5 CONCRETE MIXES

A. Ready-Mix Concrete: Comply with ASTM C94. Measure, batch and mix concrete materials and concrete according to ASTM C-94. Furnish batch certificates, indicating project identification, name and number, date, mixture type, mixing time, quantity and amount of water added for each batch discharged and used in the Work to the Architect.

2.6 SACK FINISH MORTAR

A. Mortar shall be composed of Portland cement, sand, and water proportioned and mixed as specified in this Section 51-1.135.

B. Mortar shall be furnished and placed in recesses and holes, on surfaces, under structural members, and at other locations specified in these specifications, the special provisions or shown on the plans.

C. The proportion of cement to sand, measured by volume, shall be one to two (1:2) unless otherwise specified.

D. Materials shall conform to the provisions in Section 90, "Portland Cement Concrete."

E. The maximum size of sand shall not be larger than 0.5 of the size of the recess, hole or space where the mortar is to be placed.

F. The mortar shall contain only enough water to permit placing and packing.

G. Concrete areas to be in contact with the mortar shall be cleaned of all loose or foreign material that would in any way prevent bond between the mortar and the concrete surfaces and shall be flushed with water and allowed to dry to a surface dry condition immediately prior to placing the mortar.

H. The mortar shall completely fill and shall be tightly packed into recesses and holes, on surfaces, under structural members, and at other locations specified. After placing, all surfaces of mortar shall be cured by the water method as provided in Section 90-7, "Curing Concrete," for a period of not less than 3 days.

I. Keyways, spaces between structural members, holes, spaces under structural members and other locations where mortar could escape shall be mortar-tight before placing mortar.

J. No load shall be allowed on mortar that has been in place less than 72 hours, unless otherwise permitted by the Engineer.

K. All improperly cured or otherwise defective mortar shall be removed and replaced by the Contractor at the Contractor's expense.

L. Do not add liquid lamp black to sack finish nor to walls or curbs to receive sack finish.

2.7 WATERPROOF MEMBRANE

A. Rolled, self-adhering waterproof membrane, composed of nominally 56 millimeter thick layer of polymeric waterproofing membrane on a heavy duty, four-millimeter thick, cross-laminated polyethylene carrier film laminated together, MEL-ROL, product of W. R. Meadows/Seal Tight, or equal conforming to A.R.E.M.A. Specifications Chapter 29, Waterproofing.

PART 3 - EXECUTION

3.1 BASEROCK PLACEMENT

A. Place aggregate in maximum 6-inch layers and compact to specified density.

B. Level and contour surfaces to elevations and gradients indicated.

C. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

D. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

F. Tolerances:
1. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
2. Scheduled Compacted Thickness: Within 1/4 inch.
3. Variation From Design Elevation: Within 1/2 inch.

G. Field Quality Control:
1. Flatness: Compaction testing will be performed in accordance with ASTM D1557.
2. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.2 FORMS – FOR FLATWORK WITHOUT A STAMP PATTERN

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.

B. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent leakage of cement paste.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces or damage to cast-in-place concrete or adjacent materials. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood

inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

D. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items build into forms. Comply with ACI 347 and ACI 318-14 Section 26.11.

E. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement is required to eliminate mortar leaks and maintain proper alignment.

F. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.

3.3 FORMS AND EXPANSION JOINTS FOR CONCRETE FLATWORK WITH A STAMPED PATTERN

A. Form and expansion joint for concrete flatwork with a stamped pattern: Key Loc hardscape: Design, erect, support, brace and maintain formwork per Key-Loc Joint Manufacturer (Form-A-Key Products) recommendations and to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
   1. Stretch line over entire length of pour. Drive stakes at approximately 20 foot centers. Set stakes to finish floor elevation.
   2. Intermediate stakes are driven to the bottom of the line at approximately 2 foot centers.
   3. Hang Key-Lock Joint on stakes and push down. Key-Loc Joint automatically locks into place.
   4. Install “snap-in” joint splice for perfect alignment of joint ends.
   5. Install stake clip when it is necessary to pour on the stake side first.
   6. Knockouts are provided at 6” centers along Key-Loc Joint for rebar penetration. When Key-Loc is used as a shut-off, the knockouts shall be bent to 45 degrees into the pour to act as anchors.
   7. Place concrete in slab straight from ready-mix truck or by alternative means.
   8. The square top of the Key-Loc Joint serves as a screed rail for screeding and finishing the surface.

3.4 PLACING REINFORCEMENT

A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.

D. Place reinforcement to obtain at least minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

E. Where concrete is installed at door thresholds and/or transitions to building interior spaces, 24" length, #3 smooth rebar dowels shall be installed 12" into the new concrete paving and 12" into the adjacent building structure, spaced at 18" on center with a minimum of two in each location. Epoxy to secure end of dowel set into building and lubricate end cast into new concrete paving.

F. Where concrete is installed at door thresholds of modular buildings with steel framing, #5 rebar shall be welded securely to building floor plate, extending 12" into new concrete paving, spaced 18" on center with a minimum of two at each door threshold. Lubricate end cast into new concrete paving.

G. Where concrete is installed adjacent to concrete walkways that are part of the building structural pad, 24" length, #3 smooth rebar dowels shall be installed12" into the new concrete paving and 12" into the adjacent building structure pad, spaced at 18" on center spacing. Epoxy to secure end of dowel set into building structural pad and lubricate end cast into new concrete paving.

3.5 EXPANSION AND CONTROL JOINTS

A. Locate and install joints so as not to impair strength and appearance of the structure, and as acceptable to Architect.

B. Continue reinforcement across expansion and control joints or install smooth rebar dowels.

C. Control/score joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in two perpendicular directions, continuous and one third the depth of the slab.

D. Control/score joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install ½" radius score joints evenly spaced at a maximum of eight feet in on center. Align vertical wall score joints with horizontal paving joints whenever possible. Install ½" radius or chamfered edge at each side of joint as called for in drawings, continuous and 1 ½" in depth.

E. Expansion Joints (for walkways, steps, ramps and curbs): Unless shown otherwise on plan, install expansions joints where walkways meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Install ½" asphalt saturated felt expansion joint material 1/4" below the finish surface and continuously throughout the full depth of slab.

F. Expansion Joints (for walls, steps and vertical surfaces): Unless shown otherwise on plan, install expansions joints where walls meet existing or proposed structures and evenly spaced at a maximum of 24 feet in two perpendicular directions. Align vertical wall expansion

joints with horizontal paving joints whenever possible. Install ½" asphalt saturated felt expansion joint material ½" below the finish surface where ½" radius concrete edges are indicated and flush with base of chamfer where chamfer edges are indicated and continuously throughout the concrete section. Install ½" radius or chamfered edge at each side of joint as called for in drawings.

G. Joint Filler at concrete expansion joints:
   1. Joint Preparation: The depth of the joint filler should be one-half (1/2) the width of the joint and a maximum depth of one-half (1/2) inch, one quarter (1/4) inch minimum. Maintain joint depth by installing backer rod by compressing and rolling it into the joint channel per manufacturer.
   2. Surface Preparation: Remove all loose material from joints by wire brushing. Sandblast surfaces in contact with form-release agents. Fresh concrete must be fully cured. Laitance must be removed by abrading.
   3. Priming: Not necessary.
   4. Mixing: Pour entire contents of Component 'B' and Sikaflex – 2c NS TG Component into pail of Component 'A'. For tint base: add entire contents of Color-pak into pail and mix with a low speed drill (400-600 rpm) and Sikaflex paddle. Mix for 3-5 minutes to achieve a uniform color and consistency. Scrape down sides of pail periodically. Avoid entrapment of air during mixing. For pre-pigmented limestone base: mix with low speed drill and Sikaflex paddle without Color-pak.
   5. Application: Recommended application temperatures 40-100 ºF. Apply sealant to clean, sound, dry and frost-free substrates. Sikaflex-2c NS TG should be applied into joints when joint slot is at mid-point of its designed expansion and contraction. To place Sikaflex -2c NS TG, load directly into bulk gun or use a follower plate loading system. Place nozzle of gun into bottom of joint and fill entire joint. Keeping the nozzle deep in the sealant, continue with a steady flow of sealant preceding the nozzle to avoid air entrapment. Avoid overlapping of sealant to eliminate entrapment of air. Tool as required. Proper design is 2:1 width to depth ratio.
   6. Removal: Uncured material can be removed with xylene. Strictly follow solvent manufacturer's warnings and instructions for use. Cured material can only be removed mechanically. In case of spillage, wear suitable protective equipment, collect with absorbent materials and dispose of in accordance with current, applicable local, state and federal regulations.
   7. Refer to and follow manufacturer's complete literature, instructions and recommendations.

3.6 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

3.7 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in, in accordance with ACI 318-08. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood dorms immediately before placing concrete where form coatings are not used.

B. Coordinate the installation of joint materials with placement of forms and reinforcing steel.

C. General: Comply with ACI 304, and as herein specified.

D. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.

G. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" in to preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction (expansion) joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in proper position during concrete placement operations.

L. Cold Weather Placing: Do not place concrete when air temperature is below 40 degrees F., or expected to fall below within 24 hours. Comply with ACI 306.

M. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305.

N. Concrete flatwork over-pour: Over-pour is excess concrete spilling beyond the limits of the concrete forms. Contractor shall remove over-pour to allow for installation of tree root barriers, irrigation and similar landscape improvements.

3.8 FINISH OF FORMED SURFACES

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture impaired by form facing material used, with tie holes and defective areas repaired and patched and fine and other projections exceeding 1/4" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. For "as-cast" concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams, repair and patch defective areas with fins or other projections completely removed and smoothed

C. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 CONCRETE EXTERIOR FLATWORK FINISHES

A. Float Finish: Apply float finish to concrete slab surfaces to receive trowel finish and other finishes as hereinafter specified.

B. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

C. Round top edges of all exposed slabs, nosing, etc. with 3/8" radius edging tool, unless chamfered or otherwise noted.

D. Non-Slip Broom Finish (NSBrm-Fn): Unless specified otherwise, apply non-slip broom finish to exterior concrete walks, platforms, steps and ramps, and elsewhere as indicated. Slopes less than 6% shall have a medium broom finish. Slopes 6% and greater shall be heavy broom slip resistant. Concrete finish to be stable, firm and slip resistant per CBC section 11B-302 and 11B-403.

E. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with ACI 318.5.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days and above 50 deg. F.

C. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

D. Curing Method: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and/or by combinations thereof, at contractor's option except as noted during hot weather.

E. Cold Weather Requirements: Protect concrete from freezing conditions during the first seven (7) days after placement.

F. Hot Weather Requirements: When hot weather conditions will cause an evaporation rate exceeding 0.2 pounds of water per square foot per hour, as determined by Figure 2.1.5 of ACI 305, cure for initial 24 hours minimum by moisture retaining cover methods.

3.11 REMOVAL OF FORMS

A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.

B. Form removal shall comply with ACI 347 and ACI 318-14 Section 26.11.

3.12 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Architect.

3.13 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. Equipment and Enclosure Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.14 TOP CAST CONCRETE PATTERN

A. Review and follow manufacturer's recommendations for preparation.

B. Begin application while concrete slab is still wet and follow manufacturer's recommendations and specifications for "exposed aggregate concrete paving process". Contact Dayton Superior Technical Services at (866) 329-8724.

3.15 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Owner's Representative.

B. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with specified bonding agent. Place patching mortar, colored to match surrounding surfaces after bonding compound has dried. Surfaces exposed-to-view shall be sacked with colored mortar as directed by Owner's Representative.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner's Representative. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning.

D. Flush out form tie holes, fill with dry pack mortar.

E. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

F. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

G. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions. Color of repair shall match surrounding surface color.

H. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

I. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Owner's Representative.

J. Repair methods not specified above may be used, subject to acceptance of Owner's Representative.

3.16 WATERPROOFING SITE RETAINING WALLS

A. Contractor shall apply waterproof membrane to site retaining walls. Membrane shall continuously cover the surface in contact with soil, vertically from the footing to 2" above the finished grade level of the soil retained.

B. Prepare surface as recommended by manufacturer by filling cracks, priming, filling joint and voids, penetrations and corners.

C. Apply waterproof membrane as recommended by manufacturer.

3.17 SACK FINISH WALLS, STEP SEATING AND CURBS

A. Sack finish shall consist of filling holes or depressions in the surface of the concrete, repairing all rock pockets, removing fins, and removing stains and discolorations visible from traveled ways. Sack finish, unless otherwise specified, shall be considered as a final finish where designated on the plans and details.

B. Except as provided herein, form bolts and any metal placed for the convenience of the Contractor shall be removed to a depth of at least one inch below the surface of the concrete. All rock pockets and other unsound concrete shall be removed. The resulting holes or depressions shall be cleaned and filled with mortar. Form bolts projecting into the cells of box girders need not be removed unless deck forms are removed from the cells, in which case the bolts shall be removed flush with the surface of the concrete.

C. Mortar used to fill bolt holes shall conform to the provisions in this Section for "Mortar." Other depressions and pockets shall be filled with packed mortar as directed by the Architect and the mortar shall be cured in conformance with the provisions in this Section.

D. For exposed surfaces, integral concrete color (LM Scofield Chromix) cement shall be added to the mortar in an amount sufficient to result in a patch which, when dry, matches the surrounding concrete.

E. If rock pockets, in the opinion of the Architect, are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, the Architect may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

3.18 QUALITY CONTROL TESTING DURING CONSTRUCTION

A. The Owner will employ a testing laboratory to perform other tests and to submit test reports.

B. Reinforcing steel shall be supplied with heat number and mill analysis per ACI 318-14.

C. Shrinkage Limitation: All concrete shall meet drying shrinkage limitations as follows:

D. 0.032 percent at age 21 days, with tolerance of +25% for specimens taken during the course of the work.

E. The use of aggregates with a proven history of compliance with the above limitations will be accepted as fulfilling this requirement. In the absence of satisfactory evidence, the laboratory shall prepare specimens (4" x 4" prisms 10" gage length, ASTM C-878) and test for compliance prior to approval.

3.19 PROJECT CLOSE-OUT (not applicable)

END OF SECTION

SECTION 32 15 40 - CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

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

1.2 DESCRIPTION OF WORK:

A. The extent of work in this Section includes the provision and installation of the following paving materials, base foundations and appurtenances required for installation.

B. The general extent of work for this Section is shown on the drawings and includes, but is not limited to, the following:

1. Decomposed Granite.

1.3 QUALITY ASSURANCE:

A. All manufactured items shall be inspected and approved upon delivery.

B. Protect from damage and intrusion of deleterious materials during delivery, handling, storage, and installation.

1.4 SUBMITTALS:

A. Contractor shall submit a one (1) quart sample indicating variation of size and color of stone paving to be installed.

B. Contractor shall submit photographic image of large boulders to be installed.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Store stone paving material in a secure location. Coordinate with General Contractor for available stockpile location.

1.6 PROJECT CONDITIONS:

A. Protection of Work: Protect work from trespass until mortar has cured.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Decomposed Granite: Shall be California Gold fines, or equal, gold color and shall consist of crushed aggregate screenings free from clay lumps, vegetable matter and deleterious material. The portion retained on the No. 4 sieve shall have a maximum percentage of wear of 50 at 500 revolutions as determined by AASHTO T96-77. The portion passing

a No. 40 sieve shall have a maximum liquid limit of 25 and a maximum plasticity index of 7, as determined by AASHTO T89-81 and AASHTO T90-81. California Gold Decomposed granite available from Felton Quarry at (408) 335-3445.

B. Decomposed Granite Soil Binder: Organic soil binder shall be Stabilizer, or equal, consisting of non-toxic, colorless, odorless, organic powder from crushed seed hulls produced to bind decomposed granite or crushed 3/8" or ¼" minus aggregate screenings by Stabilizer Solutions, Inc. (602) 225-5900, www.stabilizersolutions.com.

C. Decomposed Granite Headerboard: Redwood header shall be construction heart redwood lumber, size per detail. Wood support stakes to be 2" by 2" by 16" length, nominal size. Use galvanized nails sized so as not to split wood and quantity as required to anchor edging securely in place.

D. Decomposed Granite Aggregate Base: Shall be coarse aggregate for regular weight concrete. Aggregate shall be hard, durable, uncoated, graded, cleaned and screened crushed rock or gravel conforming to Class II aggregate base per Caltrans Standard Specifications. Crusher-run stone or bank-run gravel will not be permitted.

E. Filter Fabric: Mirafe 140N Non-Woven Polypropylene Geotextile fabric for separation and drainage.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Preparation:

1. Grade and compact subgrade.

B. Aggregate Base Rock Placement:

1. Place aggregate in maximum 6-inch layers and compact to 95% relative density.

2. Level and contour surfaces to elevations and gradients indicated.

3. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.

4. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

5. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

C. Decomposed Granite Redwood Headerboard:

1. Layout perimeter edging as shown on drawing with smooth, continuous transitions horizontally and vertically.
2. Where landscape edging contacts adjacent paved surface, top of edging shall terminate flush with top of adjacent paving material.

3. Top of landscape edging shall be installed ½" above finish grade in turf areas, 1" above finish grade in shrub planting areas and flush with surface of decomposed granite fines.
4. Install per detail on drawings.

D. Filter Fabric (weed barrier):

1. Place weed barrier product throughout the proposed paving area, covering soil surface with edges over-lapping six (6) inches.
2. Staple to hold in place prior to placing decomposed granite.

E. Decomposed Granite:

1. Blending organic soil binder with decomposed granite:
   a. Blend 12 to 16 pounds (confirm with manufacturer for exact blend for particular application) of soil binder per 1-ton of decomposed granite or crushed 3/8" or ¼" minus aggregate screenings.
   b. Thoroughly and uniformly mix soil binder throughout decomposed granite or crushed 3/8" or ¼" minus aggregate screenings.
   c. Bucket blending is not acceptable. Blending with a rake and/or shovel is not acceptable.
   d. Blend material dry. Water will make material hard.
2. Install decomposed granite fines to a minimum depth of four inches, unless shown otherwise on details and drawings.
3. Install material in two-inch lifts.
4. Thoroughly water to compact each lift until the entire depth is moist.
5. Compact to 90% relative density after grading and wetting final lift.
6. Allow material to dry, then spike and mat drag to obtain the desired finish.
7. Note that precise grading is critical and is best accomplished with laser-equipped machinery.
8. At end of landscape maintenance period, re-apply decomposed granite to areas that have settled and smooth surface to uniform plane, flush with adjacent finish grade elevations.

END OF SECTION

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SECTION 32 16 00 - CURBS AND GUTTERS

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Construction of concrete curbs, gutters, walks, driveway cuts, pedestrian ramps and other concrete surfacing as required.

2. Concrete retaining wall.

B. Related work in other Sections:

1. Earthwork: Section 31 00 00.

2. Asphalt concrete paving: Section 32 12 16.

1.02 QUALITY ASSURANCE

A. Reference standards: The applicable provisions of the following govern the work of this section.

1. American Society for Testing Materials (ASTM).

a. A615: Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

b. C150: Portland Cement.

2. California Department of Transportation (CDT), Standard Specifications: Sections 51, 52, 73 and 90.

1.03 SUBMITTALS

A. If requested, submit mill test reports on the cement, reinforcement bars and aggregates, showing compliance with the respective specifications. The Owner's Testing Agency may make concrete test cylinders and slump tests as deemed necessary to determine compliance with Specifications.

2.00 PRODUCTS

2.01 PORTLAND CEMENT CONCRETE (PCC)

A. Concrete: Class A (6 sacks of cement per cubic yard of concrete) conforming to Section 90 of the CDT Standard Specifications.

B. Cement: Type II conforming to ASTM C150 as modified by Section 90 of the CDT Standard Specifications.

C. Aggregate: ¾" maximum size conforming to Section 90 of the CDT Standard Specifications.

D. Water: Clear and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.

E. Reinforcing Bars: ASTM A615, intermediate grade, deformed in accordance with Section 52 of the CDT Standard Specifications.

F. Filled Joints: Unless noted otherwise on the Drawings 1/2" thick, the full depth of the concrete section and conforming to Section 51 of the CDT Standard Specifications.

G. Joint Filler: bitumen-treated fiber board per CDT Standard Specifications, Section 51. Premolded expansion joint filler shall conform to the requirements in ASTM Designation D 1751 Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

H. Waterproof Joint Sealant: flexible polyurethane.

I. Carbon black shall be added to concrete for curbs, gutters and sidewalks as required to match existing work.

J. No admixtures will be allowed without Owner's Representative approval.

K. Maximum water cement ratio (w/c) of 0.50.

L. Maximum slump of 4".

M. Aggregate Base: Class 2 aggregate base, three quarter inch (¾") maximum size, as specified in Section 26 of the CalTrans Standard Specifications.

3.00 EXECUTION

3.01 CONCRETE CONSTRUCTION

A. Concrete shall be mixed in accordance with applicable provisions of Section 90 of the CDT Standard Specifications.

B. Construction of concrete substances shall conform to applicable provisions of Section 51 of the CDT Standard Specifications. Unless noted otherwise in these Specifications, exposed surfaces of structure shall have Class 1 surface finish.

C. Construct concrete curbs and sidewalks in accordance with applicable provisions of Section 73 of the CDT Standard Specifications.

D. Curing shall conform to applicable portions of Section 90 of the CDT Standard Specifications. Do not use pigment in curing compounds.

E. All work shall be subject to inspection. No concrete shall be placed until the Owner's Representative has approved the forms and reinforcement.

F. Place expansion joints on curbs, gutters and walks at 20' on center, adjacent to structures, and at all returns, and fill with joint filler. Score joints shall be formed at 10' on center; the score shall be 1" deep.

G. Do not drop concrete freely where reinforcing bars will cause segregation, nor more than 6'-0" vertically. Use spouts, elephant trunks, or other approved means to prevent segregation.

END OF SECTION 32 16 00

SECTION 32 17 23 - PAVEMENT MARKING AND ACCESSORIES

1.00 DESCRIPTION

A. Principal work in this Section:

1. Traffic control signs.

2. Stripes and pavement markings and removal of existing striping, if required.

3. Raised pavement markers.

B. Related work in other Sections:

1. Section 32 12 16: Asphalt concrete paving.

1.01 QUALITY ASSURANCE

A. Reference standards: Applicable provisions of the following govern the work of this Section as listed below:

1. California Department of Transportation (CDT)

a. Maintenance manual.

b. Standard Specifications: Sections 56, 82, 84, 85, 90, 91, 94 and 95.

c. Traffic manual: Chapters 4, 6, and 7.

B. Specifications, standards, tests and recommended methods cited herein from the following trade, industry and government organizations shall determine quantity and quality of materials and methods unless specifically designated otherwise.

1. The State of California Materials and Research Department.

2. The State of California Traffic Manual, latest edition.

3. The California Maintenance Manual, latest edition.

1.02 SUBMITTALS

A. Submit Product Data under 2.00 Products, certifying that each product complies with specified requirements.

2.00 PRODUCTS

2.01 TRAFFIC PAINT

slip-resistant, complying with CBC 11B-302.1, and

A. Paint shall be slip-resistant, complying with CBC 11B-302.1, and a good quality traffic paint conforming to or exceeding the standards set forth by Section 84 “Traffic Stripes and Pavement Markings”. Common brands are Kelly Moore, Crown Products, Desoto and Ennis.

B. Paint shall be thoroughly mixed prior to placing in painting equipment.

2.02 REFLECTORIZED MARKERS AND POSTS

A. Reflectorized metal markers, metal marker posts and mounting hardware shall be of the size, type and description noted on the plans and shall conform to the applicable requirements of Section 82 of the CDT Standard Specifications.

2.03 SIGNS

A. Sign posts:

1. Sign posts may be reused provided they are sandblasted or repainted to match the condition of new posts.

2. Unless otherwise indicated, new sign posts shall be 2" I.D. standard wall steel galvanized pipe with one end finished to receive mounting cap and fittings.

B. Concrete for sign post footings: Class B conforming to applicable requirements of Section 90 of the CDT Standard Specifications.

C. Hardware: Conforming to applicable portions of Section 56 of the Standard Specifications.

D. Sign panels, unless noted otherwise shall be of reflectorized porcelain enamel. They shall be of the size noted or when not specified they shall be the smallest available size. Submit shop drawings for approval prior to ordering signs.

2.04 PAVEMENT MARKERS AND ADHESIVES

A. Pavement markers: Section 85 "Pavement Markers". Adhesives shall conform to the provisions of Section 95-2.05 "Standard Set Epoxy Adhesive for Pavement Markers" of the CDT Standard Specifications.

3.00 EXECUTION

3.01 TRAFFIC PAINT AND GLASS BEADS

A. Types of traffic paint:

1. White:

a. Solid 4" line: Edge lines, regular parking stalls, and compact parking stalls.

b. Broken 4" line having 9' of stripe and 15' of gap: Travel lanes.

c. Solid 12" line: Stop bars and cross walks.

d. Pavement markings: Word markings, e.g., STOP, BIKE LANE, and symbolic markings, e.g., TURN ARROWS, HANDICAPPED EMBLEM.

e. Solid 8" line: Turn lanes.

f. Solid 2" line: Bike lanes.

2. Yellow:

a. Solid 4" wide double line: Centerline.

b. Solid 4" wide lines: Island markings, compact parking stalls and centerline striping.

c. Broken 4" line having 9' of stripe and 15' of gap: travel lanes.

3. Blue:

a. Solid 4" line: Accessible parking stalls.

b. Blue curb: Accessible parking stalls.

4. Red:

a. Red curb, No Parking.

B. Rates of application:

1. New surfaces shall have the traffic paint applied in two applications. The first or priming coat shall be in light applications without glass beads to seal the pavement. The second heavier coat of paint is the wearing surface and the rates of application are shown on Table 1.

2. Restriping where indicated on the drawings, shall coincide with the original painting and shall be applied in one application at the rates indicated in Table 1 (below).

3. Surfaces to be painted shall be clean and dry prior to painting. Allow ample time between the asphalt pavement seal coat and the initial painting application. Usually the drying time of the seal coat is approximately three to four days, depending upon weather conditions. There shall be a minimum drying time between paint applications of approximately 20 minutes.

4. Place glass beads on all traffic stripes and pavement markings except for the first or priming coat on new asphalt surfaces. Rates of application are shown in Table

1 below. Apply glass beads directly to the wet traffic paint with a method that provides uniform distribution. Do not apply glass beads to paint for parking stripes.

5. TABLE 1-Rates of Application

Solid Strip (4" Wide):

New surface (1st coat)	12-14 gallons per mile or 1 gallon per 125-150 SF of line.
2nd coat or restriping	16-18 gallons per mile or 1 gallon per 100-110 SF of line.
Glass beads with 2nd coat	Approx. 110 lbs/mile or 6 lbs/gallon of paint.

Pavement Markings:

New surface (1st coat)	Approx. 1 gallon per 200 SF of area.
2nd coat or restriping	1 gallon per 100 SF of area.
Glass beads with 2nd coat	6 lbs/gallon paint

6. Provide sufficient evidence to the Engineer that the quantity of paint specified has been applied to the job. Such evidence can be invoice tickets made out to the specific job, counting empty paint cans, or a method acceptable to the Architect.

7. Do not apply striping at temperatures below 40°F or if pavement surfaces are wet.

8. The alignment of striping shall be accurately laid out. Lines which do not conform to the alignment indicated, or which have a wavy appearance, shall be removed and replaced by the Contractor at his expense.

3.02 REMOVAL OF STRIPES

A. Remove existing stripes and pavement markings by sandblasting. Painting out black paint will not be allowed.

B. After removal of paint, apply fog seal coat of SS-1h emulsified asphalt per Section 94 of the ACDT Standard Specifications to asphalt surfaces affected by the removal operations. The fog seal coat must be given ample time to dry prior to the initial painting application.

3.03 TRAFFIC CONTROL SIGNS

A. Install signs in conformance with the Drawings, Details and the CDT Maintenance Manual.

3.04 PAVEMENT MARKERS

A. Install pavement markers in conformance with the applicable requirements of Section 85-1.06 of the CDT Standard Specifications except that sandblasting shall not be used. Use grinding or other approved methods for cleaning.

B. Do not install markers on asphalt concrete until at least 14 days after the seal coat has been placed.

C. Install markers to the lines indicated.

END OF SECTION 32 17 23

SECTION 32 18 13 - SYNTHETIC GRASS SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to the work of this section.

1.2 DESCRIPTION OF WORK:

A. The extent of work in this Section includes the provision and installation of the following synthetic grass paving materials, base foundations and appurtenances required for installation.

B. The general extent of work for the Section is shown on the Drawings and includes, but is not limited to, the following:

1. Synthetic grass surfacing (also referred to as Synthetic Turf).
2. Foam cushion.
3. Base preparation and installation.
4. Nailing board.
5. Perimeter concrete curb.

1.3 QUALITY ASSURANCE:

A. All manufactured items shall be inspected and approved upon delivery.

B. Coordinate all work with the work of other sections to avoid delay and interference with other work.

C. Protect from damage and intrusion of deleterious materials during delivery, handling, storage, and installation.

D. Installer’s Qualifications:

1. Successful experience in installation of synthetic grass surfacing of similar type to that specified, with a minimum of 25 projects completed within last 5 years.
2. Employ persons trained for installation of synthetic grass surfacing.
3. The synthetic grass installer must provide a list of references based on previous installations.

1.4 REFERENCES

A. Related Sections:

1. 32 13 13.1 Concrete Work (Landscape).

B. ASTM Standard Test Methods:

1. ASTM F1951-99 Standard Specification for Determination of Accessibility of Surface Systems Under and Around Playground Equipment.
2. ASTM D 2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials.
3. ASTM F 1292 - Standard Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment.
4. US Consumer Product Safety Commission (CPSC) Handbook for Playground Safety.

1.5 SITE INSPECTION

A. The inspection shall include a check for planarity. The finished surface shall not vary from a true plane more than 1/4" in 10 feet when measured in any direction. The Contractor shall provide all required tools and materials needed for the planarity check, which may include but not be limited to, a laser level, string line, straight edge and/or other assessment materials. The Contractor shall mark in the field any deviations from grade in excess of those specified above, as well as provide a marked up plan locating the deviations. The Contractor shall correct any deviations to the satisfaction of the Engineer and Synthetic Turf installer.

B. The compaction of aggregate base shall be 95% to Standard Proctor and surface tolerances shall not exceed ¼" over 10 feet.

C. When any or all corrective procedures have been completed, the finished sub-base surface must be re-inspected, with the same representatives attending the initial inspection. If required, additional repair and inspections are to be conducted until the subbase surface is deemed acceptable by the Owner's Representative and Synthetic Grass installer.

D. Commencement of work under this section shall constitute acceptance of the work completed under other sections, including acceptance of dimensions of the subbase.

1.6 ENVIRONMENTAL CONDITIONS

A. Install synthetic turf surfacing only when ambient air temperature is 35 F or above and the relative humidity is below 35% or as specified by the product manufacturer. Installation will not proceed if rain is imminent.

B. Install product only when prepared base is suitably free of dirt, dust, and petroleum products, is moisture free and sufficiently secured to prevent unwanted pedestrian and vehicular access.

C. Maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

1.7 QUALITY CONTROL

A. Prior to the beginning of installation, the Synthetic Turf Installer shall inspect the subbase. The installer will accept the sub-base in writing when the general contractor provides test results for compaction, planarity and permeability that are in compliance with the synthetic turf manufacturer's recommendations and as stated herein.

B. Remove defective Work, whether the result of poor workmanship, defective products or damage, which has been rejected by the Engineer as unacceptable. Replace defective work in conformance with the Contract Documents.

C. It is the installer’s responsibility to ensure that U.S. Product Safety Guidelines, ADA and referenced ASTM standards are complied with on playgrounds prior to installation, such as, but not limited to, safety fall zones are sufficient and fall heights are met.

1.8 SUBMITTALS:

A. Product Data: Submit manufacturer's technical data and color samples for review and selection.

B. Test Reports: Submit certified test reports from qualified independent testing agency indicating results of impact attenuation testing.

C. Maintenance Instructions: Submit manufacturer's maintenance and cleaning instructions.

D. Warranty: Submit manufacturer's standard warranty.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer. Inspect material in ensure nothing is broken, open or missing upon delivery to the project site. Adhesives shall arrive in dry, sealed containers.

B. Storage:

1. Store materials in accordance with manufacturer's instructions.
2. Adhesive: Store adhesive in a dry area at a minimum temperature of 50 degrees F (10 degrees C).
3. Store products in a location and in a position that protects them from crush damage or any other defects.

C. Handling: Protect materials during handling and installation to prevent damage and to safely to ensure their physical properties are not adversely affected and that they are not subject to vandalism or damage.

1.10 SYNTHETIC GRASS WARRANTY

A. Synthetic Grass Warehouse, Inc. (SGW) manufacturer’s warrants that if the synthetic turf grass it manufactured and supplies proves to be defective in materials or workmanship resulting in premature wear, during normal use of the product, within fifteen (15) years from the date of manufacture, or suffers significant fading, breakdown or degradation due to exposure to natural ultraviolet rays within the same fifteen (15) year period, SGW will, at its sole option either 1) repair or replace the affected area without charge to the purchaser, or 2) issue a credit equal to the cost of the synthetic grass material. For the purpose of this warranty the product shall be deemed to have failed in the ultra-violet stability if the original tensile strength of the product decreases by more than 50 percent.

B. Proration is a follows: years 1-8 (100%), years 9-12 (50%), years 13-15 (25%).

C. In the event that SGW elects to issue a credit in lieu of repair or replacement, said credit shall only apply to the affected area of the synthetic grass giving rise to the claim. The credit shall be issued to the retailer, as a percentage of the replacement cost of new synthetic grass of the

same or comparable quality. The credit will be good only toward the purchase of SGW synthetic grass. There will be no cash payment.

D. Warranty does not cover matting.

E. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

1.11 FOAM PAD WARRANTY

A. The Shock pad shall be covered by a 25-year limited warranty.

B. Submit Manufacturer Warranty and ensure that forms have been completed in Owner's name and registered with Manufacturer.

PART 2 - PRODUCTS

2.1 TURF SYSTEM – TIGER TURF

A. TigerTurf – Diamond Pro Fescue (or approved equal).

1. Manufactured by TigerTurf New US Ltd. (800) 464.0477, available through Synthetic Grass Warehouse, (800) 730-2675. www.syntheticgrasswarehouse.com.
2. Turf blades shall be 1.875 inch pile polyethylene monofilament with thatch construction, colors Field Green/Olive Green. Turf shall be designed specifically for landscape application.
3. Synthetic turf products shall be lead free, non-toxic and contain no RCRA hazardous waste heavy materials. Shall be UV stabilized, have no harmful environmental effects, and be non-flammable, ant-acid yarn resistant to chemical attack.
4. TigerTurf products meet the requirements for the American Society for Testing Materials F1292 certification. This testing certifies each of these products achieve the criteria for G-Max (shock) in addition to the Head Injury Criterion score, which measures the impact severity quantifying the risk of head trauma.
5. Product Manufacturer shall be a member of The International Play Equipment Manufacturers Association (IPEMA), a non-profit membership trade association. This organization serves all playground equipment industry manufacturers and provides third-party product certification services for American public play equipment and surface materials. IPEMA promotes safety and in-depth information regarding issues affecting the playground equipment and surfacing industry. Product shall be certified IPEMA to ASTM F1292.
6. Yarn characteristics:
   Type: Monofilament PE with thatch
   Composition/structure: Polyethylene.
   Denier: 10,800/5,000
   Colors: Field Green/Olive Green
7. Turf characteristics:
   Pile/Face Weight: Approximately 75 ounces
   Pile height: Approximately 1.875 inches
   Maching Gauge: 3/8 inch

Thatch Color: Brown

8. Manufactured Rolls:
   Width: 15 feet
   Length: 100 feet.
   Shipping weight: 1209 pounds (approximate weight)
   Roll diameter: 24 inches
   Total product weight: approximately 116 ounces per square yard.
9. Particulate Infill:
   Type: Quality infill
   Height: Approximately .5 inch to .75 inch
   Colors: Green.
   For IPEMA Certification, infill must be 2 pounds per square foot of Envirofill, or approved equal, distributed by Synthetic Grass Warehouse, www.syntheticgrasswarehouse.com, (800) 730-2675. Infill shall be non-toxic, lead-free product with smooth surface, infused with Microban antimicrobial protection to prevent growth of mold and mildew.
10. Drainage rate:
    30+ inches of rain per hour per square yard.

2.2 SYNTHETIC GLUE MATERIAL

A. Adhesive products shall be Nordot 34G, Mapei 2K, Turf Claw, hot melt technology or equivalent as approved by the engineer.

B. Any adhesive products required for the installation of a proposed turf system shall be purpose-suited to the system. The material and application methods shall be as recommended by the adhesive manufacturer.

C. Disposal of adhesive containers and unused adhesives as well as any fees resulting from such disposal shall be the responsibility of the Contractor.

2.3 FOAM PAD

A. Schmitz Foam Products, ProPlay shock pad, puzzle shape edges for interlocking pads and no glue required, with vertical drainage characteristics. Contact local representative Gary Carr at (208) 720-7266, g.carr@schmitzfoam.com.

1. The XPE foam flakes shall be sourced from clean post-industrial (pre-consumer) waste.
2. The XPE foam flakes shall be closed-celled; the bonding of the XPE foam flakes shall be open to water infiltration.
3. The XPE foam flakes shall be thermally bonded to a PES spunbond textile, with a mass of 70 g/m².
4. The shock pad shall be manufactured in panels of 7.5’ x 3.08’
5. The shock pad sheets shall contain expansion slots (to the plane), to take in thermal expansion.
6. The shock pad shall meet or exceed all performance properties listed in TABLE 1 of this section.

B. Foam Pad for Turf Grass Area: ProPlay Sport – 20, 20 millimeter thick foam padding.

TABLE 1 – ProPlay Sport - 20			
REQUIRED PERFORMANCE PROPERTIES FOR SYNTHETIC TURF SHOCK PAD			
PROPERTY	STANDARD	UNIT	TYPICAL VALUE
Thickness [1]	EN 1969	mm / in.	20 / 0.79
Mass per unit area		lb / square foot	.61
Tensile strength [2]	EN 12230	psi	38
Compressive strength @ 25% deflection Thickness after 72-hour recovery	ASTM D 3575	psi inches	12 0.79
Compressive strength @ 50% deflection Thickness after 72-hour recovery	ASTM D 3575	psi inches	49 0.79
Water flow rate under 2” hydraulic head	ASTM D 4491	gpm / ft2	15
Water permeability by permittivity	ASTM D 4491	gpm / ft2	5.9
Hydraulic transmissivity [3]	ASTM D 4716	gpm / ft	10
Water infiltration rate	EN 12616	in/hr.	Greater than 1000
Gmax / Impact attenuation [4]	ASTM F355	-	80-110
Thermal conductivity	EN 12667	W/m.K	0.03
[1] at a load of 2 kPa [2] tensile stress by tensile strength and product thickness [3] by in-plane flow rate at a hydraulic gradient of 0.005 (slope = 0.5%) and a load of 2 kPa [4] with typical turf system [5] by product dimensions			

C. Foam Pad for Turf Grass Area: ProPlay 25, 25 millimeter thick foam padding.

TABLE 1 ProPlay – Sport 25			
REQUIRED PERFORMANCE PROPERTIES FOR SYNTHETIC TURF SHOCK PAD			
PROPERTY	STANDARD	UNIT	TYPICAL VALUE
Thickness [1]	EN 1969	mm / in.	25 / 1.06
Mass per unit area		lb / square foot	1.22
Tensile strength [2]	EN 12230	psi	38
Compressive strength @ 25% deflection Thickness after 72-hour recovery	ASTM D 3575	psi inches	16 1.06
Compressive strength @ 50% deflection Thickness after 72-hour recovery	ASTM D 3575	psi inches	79 1.06
Water flow rate under 2” hydraulic head	ASTM D 4491	gpm / ft2	14.7
Water permeability by permittivity	ASTM D 4491	gpm / ft2	8.0
Hydraulic transmissivity [3]	ASTM D 4716	gpm / ft	155
Thermal conductivity	ASTM C 177	BTU/h.ft.f	0.03
Force Reduction {4}	AAA	%	70
Vertical Deformation	AAA	MM	11
[1] at a load of 2 kPa [2] tensile stress by tensile strength and product thickness [3] by in-plane flow rate at a hydraulic gradient of 0.005 (slope = 0.5%) and a load of 2 kPa [4] with typical turf system			

2.6 HEADERBOARD/PERIMETER NAILING BOARD: Recycled plastic nominal 2” by 4” continuous Bend-a-Board or equal.

2.7 CONCRETE PERIMETER PAVING: Refer to 32 13 13.1 Landscape Concrete and 32 11 23 Aggregate Base Course.

2.8 CLASS 2 PERMEABLE AGGREGATE BASE ROCK: Recycled permeable product composed of ¾’ crushed concrete and minimal fine stones allowing it to be water permeable, meeting CalTrans specification for permeable class 2 base rock., available from Lyngso Garden Materials, Inc., (650) 364-1730, www.lyngsogarden.com.

2.9 ¼” MINUS QUARRY FINES: Graniterock of equal crushed granite. Material shall be ¼” minus and well graded to provide compaction and contain no large aggregate. Contact Southside Sand & Gravel (831) 630-3200.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the synthetic turf system is to comply with the manufacturer’s recommendations, requirements and the reviewed and approved shop drawings.

B. Perform all work in strict accordance with the Contract Documents and the manufacturer’s specifications and instructions. Only those skilled technicians proposed in the bid phase are to be assigned to this project by the Contractor.

C. The designated Supervisor for the Synthetic Turf Installer must be present during any and all construction activity associated with the field installation, including testing, cleanup and training.

D. All products and equipment are to be from sources approved by the authorized turf manufacturer and conform to the specifications.

3.2 BASEROCK

A. Class 2 aggregate baserock shall be carefully placed and compacted over the subgrade to the grades and elevations shown on the drawings. If the thickness of the planned bottom rock exceeds 6 inches, the rock shall be placed in horizontal layers not exceeding 6 inches and each layer compacted to 92 percent relative compaction with a vibratory smooth drum roller.

B. Install class 2 permeable aggregate baserock over the perforated drain pipe, minimum 12” wide area, to allow for drainage. Compact to 75% relative compaction.

C. Should any segregation of the material occur, during any stage of the stockpiling, spreading or grading, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further separation.

D. Final bottom rock grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.08 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is recommended.

E. The top surface of the bottom rock shall be sloped as shown on the drawings.

F. Bottom rock grades shall be completed by the Contractor and inspected by the Owner prior to commencing with the subsequent work items.

3.3 ¼" MINUS QUARRY FINES

A. The quarry fines shall be carefully placed using a self-propelled paving machine in order to minimize segregation.

B. Should any segregation of the material occur, during any stage of the work, the Contractor shall immediately remove and dispose of segregated material and correct or change handling procedures to prevent any further segregation.

C. The finished surface shall be compacted to 92 percent relative compaction with a vibratory smooth drum roller to provide a non-yielding, smooth, flat surface.

D. Final quarry fines grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.02 feet in 10 feet in any direction. Laser grading is recommended.

E. The top surface of the quarry fines shall be sloped as shown on the drawings.

F. All quarry fines grades shown on the drawings shall be completed by the Contractor and inspected by the Owner prior to commencing with the subsequent work items.

G. A small trial area (15 feet square, minimum) of quarry fines shall be installed prior to installing the complete surface. The Contractor's Synthetic Turf Installer shall observe the placement and compaction of quarry fines in the trial area and determine whether the surface is suitable to install the synthetic turf. The Contractor shall modify installation procedures and/or material used until the Contractor's Synthetic Turf Installer is satisfied.

H. Field percolation testing shall be conducted by the Contractor. The Contractor shall correct the quarry fines layer, at no cost to the Owner, if the minimum percolation requirement is not achieved.

3.4 FOAM CUSHION INSTALLATION

A. Install ProPlay Sport 20 foam pad where there is no fall zone indicated in the turf grass area. Install ProPlay 25 foam pad where there is a vertical fall zone of four (4) feet high and less within the turf grass fall zone area. Contractor shall adjust the elevation of the baserock beneath the foam pads so the finish surface of the padding is flush and uniform.

B. The Contractor and the Installer shall handle the shock pad with caution to ensure it is not damaged in any way. Precautions shall also be taken to prevent damage to the sub-base during the installation of the material.

C. Shock pad is installed as a series of interlocking panels per the instructions provided by the manufacturer

D. Shock pad shall be installed with geotextile side up.

E. Detailed installation guidelines (e.g. installation manual) shall be requested by shock pad Installer and provided by shock pad manufacturer

F. Coordinate installation of foam pad with the synthetic turf installation as required to conform to both manufacturer warranties.

3.5 PERIMETER NAILER INSTALLATION

A. Install recycled plastic perimeter nailer board in concrete band,5/8” below adjacent concrete finished surface. Secure in place with 3/8” galvanized steel expansion bolts spaced 24” o.c.

3.6 TURF INSTALLATION

A. Install synthetic turf system in accordance with the manufacturer’s written installation instructions.

B. Turf shall be attached to the perimeter edge as shown in the construction plans and as per the manufacturer.

C. All seams shall be brushed thoroughly before infill materials are installed.

D. All terminations shall be as detailed and approved in the shop drawings.

3.7 INFILL INSTALLATION

A. The synthetic turf shall be thoroughly brushed prior to installation of infill materials to remove wrinkles.

B. Turf shall remain free draining at all times before, during and after the infill materials are installed.

C. Broadcast infill uniformly over the synthetic turf at a minimum rate of two (2) pounds per square foot.

D. Comb to set infill.

3.8 CLEANING AND COMPLETION

A. Protect all installed work from other construction activities as installation progresses.

B. The Contractor shall keep the area clean throughout the construction period and free from the installation process, including track surfaces.

C. Upon completion of the installation, thoroughly clean surfaces and site of all refuse resulting from the installation process, including track surfaces.

D. Any damage to existing fixtures or facilities resulting from the installation of the synthetic turf system shall be repaired to original condition at the Contractor’s expense prior to Substantial Completion and commencement of the Warranty Period.

E. A punch list will be written by the Owner’s Representative at the conclusion of the project. Installation project deficiencies must be remedied by the Contractor prior to the issuance of a certificate of Substantial Completion.

F. Contractor to provide a written acceptance by the Turf Manufacturer that the turf and base system is installed in accordance with their recommendations prior to final completion.

TESTING SERVICES INC

TEST REPORT

CLIENT:

Company:	Synthetic Grass Warehouse	**Report Number:**	67702A
Address:	1400 N. Daly Street	**Lab Test Number:**	2824-8895
	Anaheim, CA 92806	**Test Completion Date:**	6/10/2016
		Report Date:	6/14/2016
		Page:	1 of 1
Requested By:	Brad Neubauer		

TEST MATERIAL:

Material Type:	Synthetic Turf with infill						**Date Received:**	5/26/2016	
Material Condition:	**EXCELLENT:**	XXX	**GOOD:**		**POOR:**		**REJECTED:**		
Identification	Diamond Pro 80								
Infill System:	2.5 lbs/ft² 20/40 Silica Sand								

TESTING METHODS REQUESTED:

Testing Services Inc. was instructed by the client to test for the following...			
Standard:	ASTM E648	**Test Method:**	Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

SAMPLING PLAN:

Sampling Date:	**5/26/2016**

- Specimen sampling is performed in the sampling department at TSI.
- The sampling size of specimens is determined by the test method requirements.
- In the event a specific sampling size is not called for, a determination will be made based on previous testing experience, and approved for use by an authorized manager.
- All samples are subjected to the outside environmental conditions of temperature and relative humidly.
- Sample requiring pre-determined exposure to specified environmental conditions based on a specific test method, take place in the departments in which they are tested

DEVIATION FROM TEST METHOD:

State reason for any Deviation from, Additions to, or Exclusions From Test Method.
None

TEST SUMMARY:

TEST METHOD	TEST DESCRIPTION	TEST RESULT	
ASTM E648-15e1	Critical Radiant Flux	Specimen #1	0.26 W/cm²
		Specimen #2	0.21 W/cm²
		Specimen #3	0.27 W/cm²
		Average	**0.25 W/cm²**
	NFPA Classification	**Class II**	

Mounting Board: Calcium Silicate Board
Conditioning: 96 hours @ 70°F 50% RH
Adhesive: n/a
Calibration Curve: 350R
Loose Laid in Tray Fitted for RP Chamber Carriage
Radiometer #: 5356

Uncertainty:
We undertake all assignments for our clients on a best effort basis. Our findings and judgments are based on the information to us using the latest test methods available.
TSI can only ensure the test results for the specific items tested.
Unless otherwise noted in the deviations sections of this report, all tests performed are in compliance with stated test method.

Test Report Approval:
Erle Miles, Jr. VP, Testing Services Inc

TSi Accreditation: Our laboratory is accredited by the US Dept of Commerce, National Institute of Standards and Technology: ISO/IEC 17025:2005.
Our code # is: NVLAP 100108-0. TSi is a certified independent testing laboratory by the Synthetic Turf Council

Form:	Rev:	Revision Date:	Page **1** of **1**
Release Date:	Control Type: Electronic – Expires 24 hours after this date: Jun. 15, 16 Printed copies are uncontrolled		

PO Box 2041
Dalton, GA 30722-2041
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tsioffice@optilink.us

.

END OF SECTION

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SECTION 32 18 16.13 - PLAYGROUND PROTECTIVE SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Poured-in-Place Playground Surfacing System: Super-7 (when aromatic urethane for the top surface is specified) with a 7-year warranty & Extreme-10 (when aliphatic urethane for the top surface is specified) with a 10-year warranty.

B. Related Sections:

1. Drawings and general provisions of Contract, including General and Supplementary Conditions, apply to work of this section.
2. Specification Section 11 68 16 Play Structures.
3. Specification Section 32 13 13.1 Concrete Work (Landscape).

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C1028 Standard Test Method for Determining the Static Coefficient of friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method – This standard replaces ASTM D2047.
2. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
3. ASTM D624 Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
4. ASTM D2859 Standard Test Method for Flammability of Finished Textile Floor Covering Materials.
5. ASTM E303 Standard Test Method for Measuring Surface Frictional Properties using the British Pendulum Tester.
6. ASTM F1292 Standard Specification for Impact Attenuation of Surfacing Materials within the Use Zone of Playground Equipment.
7. ASTM F1951 Standard Specification for Determination of Accessibility of Surface Systems under and around Playground Equipment.
8. ASTM F2479-12 Standard Specification for Purchase, Installation and Maintenance.

1.03 SYSTEM DESCRIPTION

A. TotTurf® Supreme poured in place rubber playground surfacing shall consist of a polyurethane binder mixed with 100% recycled, shredded tire buffings which will make up the Cushion Layer. The Cushion Layer is capped with TPV (Thermal Plastic Vulcanized) granules mixed with an Aliphatic binder creating the Wear Course. Robertson Industries Inc. surfaces comply with ADA and CPSC guidelines as well as ASTM Standards. TotTurf® is certified by IPEMA, a third party testing organization for playground surfaces and equipment.

B. Performance Requirements:

1. Area Safety: Poured in place within playground equipment use zones shall meet or exceed the performance requirements of the CPSC, ADA and Fall Height Test ASTM F1292-13. The surface must yield both a peak deceleration of no more than 200 G-max and a Head Injury Criteria (HIC) value of no more than 1,000 for a head-first fall from the highest accessible portion of play equipment being installed as shown on drawings. IPEMA certification is required. (ASTM F1292-13 section 4.3.3: The laboratory test used to determine critical fall height shall have been conducted on surfacing material samples identical in design, materials, components, and thickness and manufactured as the installed playground surface).
2. Accessibility: NOTE: Children's outdoor play areas shall be in compliance with the Uniform Federal Accessibility Standards 9UFAS) FED-STD-795 and the Architectural and Engineer Instructions (9AEI) Design Criteria. The requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) 28 CFR Part 36 that provide equal or greater accessibility than the requirements of UFAS must also be met in children's outdoor play areas.
3. TotTurf® Supreme poured in place surfaces intended to serve as accessible paths of travel for persons with disabilities shall be firm, stable, and slip resistant, and shall meet the requirements of ASTM F195-14 and ASTM F1292-13.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Submittal Procedures.

B. Product Data: Submit manufacturer's product data and installation instructions available on website www.totturf.com.

C. Verification Samples: Submit manufacturer's standard verification samples of 3" x 3" minimum in size.

D. Certifications: A signed statement from the manufacturer of the poured in place surfacing attesting that all materials under this section shall be installed only by the Manufacturer's Trained Installers.

E. A signed statement by an authorized official certifying that the surfacing system meets the requirements of ASTM F1292-13 for a head-first fall from the highest accessible portion of the specified playground equipment.

E. Closeout Submittals: Submit the following:

1. Warranty documents specified herein.

1.05 QUALITY ASSURANCE

A. Qualifications: Utilize an installer approved and trained by the manufacturer of the playground surfacing system, having experience with other projects of the scope and scale of the work described in this section and shown on Drawings.

B. International Play Equipment Manufacturers Association (IPEMA) certified.

1.06 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at a minimum temperature of 40 degrees F (4 degrees C) and a maximum temperature of 90 degrees F (32 degrees C).

1.07 PROJECT/SITE CONDITIONS

A. TotTurf® Supreme poured in place surfacing must be installed on a dry sub-surface, with no prospect of rain within the initial drying period, and within the recommended temperature range of the manufacturer. Installation in weather conditions of extreme heat, or less than 55°F, and/or high humidity may affect cure time and the structural integrity of the final product. Immediate surroundings of the site must be reasonably free of dust conditions as this could affect the final surface appearance. The manufacturer's Service Center Manager reserves the right to control the installation based on such factors without penalty to the company.

1.08 SEQUENCING AND SCHEDULING

A. Sequencing and Scheduling: TotTurf® Supreme poured in place surfacing shall be installed after all playground equipment, shade structures, signs and any other items within the surfacing area. Surface installation will be coordinated by a Robertson Industries Inc. representative.

1.09 WARRANTY

A. TotTurf® Supreme poured in place surfacing shall maintain required impact attenuation characteristics and be guaranteed against defects in workmanship and materials for a limited Five (5) year period or as specified and agreed upon per alternate contract. Warranty will be specific to maintenance requirements and performance standards of completed product.

PART 2 - PRODUCTS

2.01 POURED-IN-PLACE PLAYGROUND SURFACING SYSTEM

A. Safety Surfacing shall consist of both recycled and synthetic materials meeting the requirements of this specification. The type of safety surfacing shall be TotTurf® Supreme,

manufactured and installed by Robertson Industries Inc., a PLAYCORE company, Telephone 800-858-0519, or its Certified Installers.

2.02 PRODUCT SCOPE

A. Poured in Place Surface: The poured in place surface shall consist of 100 percent recycled shredded tire material mixed with a polyurethane binder and capped with a TPV granule mixed with an aliphatic binder.

B. It shall consist of a uniform material manufactured in such a way that the Wear Course meets the requirements specified herein for wear surface.

C. The type safety surfacing shall be a poured-in-place system and shall be indicated on the drawings.

2.03 CUSHION LAYER

A. Impact Attenuating Cushion Layer: Cushion Layer consists of shredded styrene butadiene rubber (SBR) and/or cryogenic crumb rubber and adhered with a 100% percent solids polyurethane binder to form a resilient porous material.

B. Strands of SBR may vary from 0.5 mm – 2.0 mm in thickness by 3.0 mm – 20 mm in length. Cushion material may have a 50% SBR Cryogenic Crumb Rubber (5-9 mesh) using a sieve analysis ASTM D5644 and a fiber content of .1% or less mixed in.

C. Foam or standard rubber granules are not to be permitted in a Cushion Layer.

D. Binder shall be between 10-14% percent of the total weight of the material, and shall provide 100% percent coating of the particles.

E. The Cushion Layer shall be compatible with the Wear Course and must meet requirements herein for impact attenuation.

2.04 WEAR COURSE

A. Wear Course shall consist of Thermal Plastic Vulcanized (TPV) granules with an Aliphatic binder formulated to produce an even, uniform, seamless surface up to 2000 square feet. (Contact sales representative for seamless pads over 2000 square feet).

B. TPV material shall be angular granules with a (Shore A) hardness of 65°A ±5 and particle size between .5-1.5 mm. Binder shall be 22-24% percent of the total weight of TPV material used in the wear surface, and shall provide 100% percent coating of the particles. No other granule sizes are acceptable.

C. Thickness of the Wear Course shall be ½” – 5/8” inch (minimum ½” inch, 12.7mm).

D. The Wear Course shall be porous.

E. See the TotTurf® Supreme PIP Specification for the TPV High Density wear resistant inserts under swings, slide exits, and high traffic areas.

2.05 BINDER

A. No Toluene Diphenyl Isocyanate (TDI) shall be used. Aliphatic urethane is to be used.

B. No filler materials shall be used in urethane such as plasticizers, and the catalyzing agent shall contain no heavy metals.

C. Weight of polyurethane shall be no less than 8.5 lbs/gal (1.02 Kg/1) and no more than 9.5 lbs/gal (1.14 Kg/1).

D. Manufacturer is permitted to modify the type of urethane required to match extreme weather conditions. Substitutions must be equal to or exceed Aliphatic quality.

2.06 MATERIALS

A. Wear Course – TotTurf® Supreme TPV Granules

Manufacturer:	Rosehill Polymers
As Distributed by:	Robertson Industries Inc. (800) 858-0519
Location Used:	Playground Area

B. Cushion Layer – TotTurf® Shredded SBR and/or Cryogenic Crumb Mixture

As Distributed by:	Robertson Industries Inc. (800) 858-0519
Location Used:	Playground Area

PART 3 EXECUTION

3.01 EXAMINATION

A. Substrate preparation must be in accordance with surfacing manufacturer's specification. New asphalt must be fully cured – up to 30 days. New concrete must be fully cured – up to 7 days.

B. Proper drainage is critical to the longevity of the Poured-in-Place surfacing system. Inadequate drainage will cause premature breakdown of the poured system in affected areas; and void the warranty.

C. Finished Grade/Slope: Verify that finished elevations of adjacent areas are as indicated on the architectural or site plans, that the appropriate sub-grade elevation has been established for the particular safety surface to be installed, and that the subsurface has been installed per architectural, site or equipment plans while meeting accessibility and use zones requirements.

D. Aggregate Sub Base: Tolerance of aggregate sub base shall be within 3/8" inch (10 mm) in 10' ft (3050 mm). Verify that aggregate sub base has been fully compacted. Per ADA

Guidelines: compacted Aggregate sub base – 4" inches of 3/4" inch minus irregular stone with fines compacted to 95% percent in 2" inch watered lifts.

E. Concrete Sub Base: Tolerance of concrete or bituminous sub base shall be within 1/8" inch (3.0 mm) in 10' feet (3050 mm). Per ADA Guidelines: Concrete a minimum of 3"– 4" inches at a minimum 2500 PSI. Concrete must cure for 7 days prior to application of cushion layer. Concrete must cure 28 days if wear course is to be applied directly to concrete surface. If Poured in Place surfacing is installed, verify that the Concrete Sub Base has cured (all areas appear white in color usually at 7 days) and that all concrete curing compounds and other deleterious substances that might adversely affect adhesion have been removed. Surface shall be clean and dry.

F. Asphalt Sub Base: Asphalt cure time requires 14 days. Once the new asphalt has cured, it must be pressure washed prior to the surfacing being installed. The contractor shall be responsible for flooding the pad to ensure proper slope and tolerance. Any areas holding enough water to cover a flat nickel shall be patched prior to the arrival of our installation crews.

G. Drainage: Verify that sub-surfacing drainage, if required, has been installed to provide positive drainage.

3.02 INSTALLATION

A. Poured in Place Surfacing: Components of the poured in place surfacing shall be mixed on site in a rotating tumbler to ensure components are thoroughly mixed and are in accordance with manufacturer's recommendations. Installation of surfacing shall be seamless up to 2,000 square feet per day and completely bonded to concrete of sub base. Material shall cover all foundations and fill around all elements penetrating the surface.

B. Cushion Layer: Whenever practical, cushion layer of surfacing material shall be installed in one continuous pour on the same day of up to 2,000 square feet. When a second pour is required, step the seam (see detail) and fully coat the step of the previous work with polyurethane binder to ensure 100% percent bond with new work. Apply adhesive in small quantities so that new cushion layer can be placed before the adhesive dries.

C. Wear Course: Wear Course must be TPV (Thermoplastic Elastomer Vulcanized) rubber granules. Wear surface shall be bonded to Cushion Layer. If necessary, additional primer will be used between the cushion layer and Wear Course. Apply adhesive to Cushion Layer in small quantities allowing the Wear Course to be applied before adhesive dries. Surface shall be hand troweled to a smooth, even finish. Except where the Wear Course is composed of differing color patterns, pour shall be continuous and seamless up to 2,000 square feet per day; (Contact sales representative for seamless installations in excess of 2000 square feet). Where seams are required due to color change, size or adverse weather, a step configuration will be constructed to maintain Wear Course integrity. The edge of initial pour shall be coated with adhesive and wearing surface mixture shall be immediately applied. Pads with multiple seams are encouraged to include a top coat of urethane before being placed into use. Butt joint seams are not acceptable except for repairs. Under

special conditions and with owners written approval seams may be permitted in same color pad. Consult with manufacturer for specific applications.

D. Thickness: Construction methods, such as the use of measured screeds or guides shall be employed to ensure that full depth or specified surfacing material is installed. Surfacing system thickness throughout the playground equipment use zone shall be as required to meet the impact attenuation requirements specified herein.

E. TotTurf Supreme Fall Height Requirements (Contractor shall confirm thickness is adequate for fall height from play apparatus):

Critical Play Height of Equipment:	Total System Depth:
Up to 4’	2”
Up to 5’	2.5”
Up to 6’	3”
Up to 8’	4”
Up to 9’	4.5”
Up to 11’	5”
Up to 12’	5.5”

Each system depth consists of the cushion material with ½” of TotTurf Supreme Granules on top.

3.03 CLEAN UP

A. Manufacturer’s installers shall work to minimize excessive adhesive on adjacent surfaces or play equipment. Spills of excess adhesive shall be promptly cleaned.

3.04 PROTECTION

A. The safety surface shall be allowed to fully cure in accordance with Manufacturer’s instructions. The surface shall be protected by the owner form all traffic during the curing period of 48 hours or as instructed by the Manufacturer.

3.05 MANUFACTURER’S SERVICES

A. For poured in place safety surfacing, a manufacturer’s representative who is experienced in the installation of playground safety surfacing shall be provided. The representative shall supervise the installation to ensure that the system meets the impact attenuation requirements as specified herein.

3.06 SECURITY AND WASTE DISPOSAL

A. Surface installation crew shall be responsible for the protection of surface during the installation process while on site only. Owner or general contractor shall be responsible for

the protection of the surface during the curing period upon completion of the installation and overnight during the installation. Owner or general contractor shall be responsible for having a dumpster on site for all waste and debris. Failure to provide security and a dumpster will result in additional cost.

3.07 UTILITIES AND ACCESS

A. Power and water must be available within 300 feet of installation. Site will require tractor-trailer access. In a case where tractor-trailer access is not possible, owner or general contractor shall be responsible for transporting materials from delivering carrier to the installation site.

END OF SECTION

SECTION 32 31 19 ORNAMENTAL METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes pre-manufactured ornamental metal fencing and gate systems, including concrete fence and gate post footings.

1.3 REFERENCES

A. ASTM International (American Society for Testing and Materials):

1. ASTM A 653: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc• Iron Alloy-Coated (Gal annealed) by the Hot-Dip Process.
2. ASTM A 924: Specification for General Requirements for Steel Sheet, Metallic• Coated by the Hot-Dip Process.
3. ASTM B 633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
4. ASTM C 33: Specification for Concrete Aggregates.
5. ASTM C 94: Specification for Ready-Mixed Concrete.
6. ASTM C 150: Specification for Portland Cement. American Welding Society (AWS).

C. California Building Code (CBC): California Code of Regulations, Title 24, Part 2.

D. National Association of Architectural Metal Manufacturers (NAAMM):

1. Metal Finishes Manual for Architectural and Metal Products.

1.4 PERFORMANCE REQUIREMENTS

A. Structural performance: provide ornamental metal fences and gates capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated-

1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on fence panel picket size and spacing, and on wind loads calculated based on requirements of the California Building Code using factors defined therein and applicable to local site conditions.
   a. Wind Speed: 85 mph.
2. Fence Panels (Typical Section Between Posts): Capable of supporting without deformation, a concentrated load of 500 LB/FT applied in the horizontal direction at mid-span between posts spaced at 8 feet apart.

3. Swing Gates: Capable of supporting a concentrated 200 LB/FT vertical load at the top corner strike side of the gate.

B. Thermal Movements: Provide ornamental metal fence and gate system that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degree F, ambient; 180 degree F, material surfaces.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions individual components and profiles, and finishes for ornamental metal fences gates.
1. Fence and gate posts, rails, pickets, and fittings.
2. Gates and hardware.

B. Shop Drawings: Show locations of fences, gates, posts, rails, pickets, details extended posts, gate swings, hardware, and accessories. Indicate materials, dimensions sizes, weights, and finishes of components. Include plans, gate elevations, sections, details post anchorage, attachment, bracing and other required installation and operational clearances.

C. Samples for verification: For each type of ornamental metal fence and gate indicated.

D. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. installer Qualifications: An experienced installer who has completed ornamental metal fences and gates similar in material, design, and extent to those indicated in this Project and whose work has resulted in construction with a record successful in-service performance.
1. Engineering Responsibility: Preparation of data for ornamental metal fences and gates, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
1. Include 10 foot length of fence and one gate complying with requirements.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Pre-Installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section for project meetings.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Ameristar; Montage Commercial, per drawings
2. Equal product in accordance with Division 1 requirements for product substitutions.

2.2 MATERIALS

A. Steel Sheet for Forming Fence Components: ASTM A 924.

1. Sheet to be zinc-coated (galvanized) on both faces to meet requirements ASTM A 653, G90 coating designation.

2.3 FASTENERS

A. General: Provide the following:

1. Galvanized Steel Components: Plated-steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
2. Dissimilar Materials: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring Ornamental Metal Fencing to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated, and capable of withstanding design loads.

C. Provide concealed fasteners for interconnecting fencing components and for attaching fencing and gates to other work, unless otherwise indicated.

1. Where exposed fasteners are unavoidable, provide manufacturer's tamper• resistant flat-head machine screws, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Seals for Picket/Rail Intersections: Manufacturer's standard PVC grommets for sealing top surface of horizontal rails where each vertical picket penetrates through rail.

1. Color: Match color of fencing components.

B. Decorative pattern along fence and gates:

1. 1 /8" thick steel spot welded to fence posts and pickets and gate vertical perimeter posts

C. Post Caps: Manufacturer's formed metal caps for closing off exposed open end at top of post. Finish and color to match post

1. Style: Flat top.

D. Welding Rods and Bare Electrodes: Select according to AWS specifications alloy welded.

E. Concrete: Normal-weight concrete with not less than 3000-psi compressive strength (28 days), 3-inch slump. Measure, batch, and mix according to ASTM C 94.

1. Portland cement: ASTM C 150, Type I or II

2. Aggregate: ASTM C33; 1-inch maximum size.

3. Water: ASTM C 94; potable.

2.5.1 FABRICATION

A. General: Fabricate ornamental metal fencing to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish and anchorage, but not less than that required to support specified design loads.
1. Provide manufacturer's standard system which includes the following features:
a. Allows variable pitch at rail/post connections to accommodate different ground slope conditions in the field.
b. Pickets are connected to rails with concealed galvanized steel retaining rod along length of rail, which passes through predrilled opening in each picket to lock picket into place or other means of connecting to allow variable between picket and rail to accommodate different ground slope conditions.

B. Fabricate ornamental metal fencing components from steel sheet, as follows:

1. Posts: Tubing formed from steel sheet, size as needed to withstand specified design loads, but not less than 3-by-3-inch square.

a. Wall thickness: 0.1046 inch (12 gauge) minimum, but not less than that required to withstand specified design loads.

2. Rails: Steel sheet formed into double-wall channel configuration, 1-3/4 inches by 1-3/4 inches; pre-punched to receive pickets; thickness as required to withstand specified design loads.

a. Wall thickness: 0.0713-inch (14 gauge) minimum, but not less than that required to withstand specified design loads.

3. Pickets: Tubing formed from steel sheet, 1-inch square; wall thickness as required to withstand specified design loads.

C. Pre-punch openings in horizontal rails to accept vertical pickets; openings to be spaced at 4.98 inches on center. Arrange pickets so that distance from centerline of post to first adjacent picket is equal at both ends of fence panel.

1. Install PVC grommet at top horizontal surface of rail where vertical pickets pass through rail.

D. Assemble sections of ornamental metal fencing in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

E. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1 /32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

F. Form work true to line and level with accurate angles and surfaces.

G. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap as required to receive finish hardware, screws, and similar items.

I. Welded Connections: Open components at connections provide close use fittings designed for this purpose. Weld all around at connections, including at fittings.

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 flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

J. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth rigid hairline joints.

K. Close exposed open ends of hollow pickets with manufacturer's standard PVC caps, flush with end of picket.

L. Provide brackets, flanges, miscellaneous fittings, and anchors to connect ornamental metal fencing to adjacent work, where indicated.

M. Provide inserts and other anchorage devices for connecting ornamental metal fencing to adjacent concrete or masonry work, where indicated. Fabricate anchorage devices capable of withstanding loads imposed by fencing. Coordinate anchorage devices with supporting structure.

N. Insert PVC caps into exposed open ends at top of pickets.

O. Install metal caps on exposed open ends at top of fence posts.

2.6 SWING GATES

A. Fabricate gates to comply with same requirements indicated for ornamental metal fencing in regards to design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support design loads.

1. Provide gusset plates or other reinforcing at connections as required.
2. Gate Opening Width: As indicated on drawings.
3. Hardware Mounting Plate: Provide 1/8-inch thick steel plate for mounting exit hardware.
4. Provide the following hardware:
   a. Hinges: Manufacturer's barrel hinges of size and quantity as required to support weight of gate and specified design loads.
   b. Self-Closing Hinges: 'SureClose READYFIT RF108S S 180' hydraulic hinge closer. Adjust and maintain spring hinges, so that from the open position of 70 degrees, the gate shall move to the closed position in 1.5 seconds minimum.
   c. Exit Hardware:
      i) Lockset: per drawings
      ii) Panic Hardware: Per drawing
      iii) Operable door hardware are installed within 34"-44" A.F.F.
      iv) Rim Cylinder: Per drawings
      v) Kickplate: Provide smooth, uninterrupted surface over the gate on both sides. Extend smooth surface for entire width of gate. Fabricate kickplate from 1/8 inch thick galvanized steel plate.
      vi) Cane Bolt (in service gates only): Provide cane bolt assembly with eyehole for padlock; designed to engage sleeve set in paving to secure gate(s) in open position at 180 degrees.

2. 7 FINISHES

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

B. Powder-Coat Finish: Prepare, treat, and coat galvanized metal to comply with coating manufacturer's written instructions and as follows:

1. Process:
   a. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.
   b. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
   c. Electrostatically spray-apply thermosetting epoxy powder coating base coat with a cured-film thickness not less than 2.0 mils.

d. Electrostatically spray-apply thermosetting polyester powder coating topcoat with cured-film thickness not less than 2.0 mils.

2. Salt and Spray Performance: No deterioration, loss of adhesion, or other effects after 3,500 hours of exposure, per ASTM B 117.

3. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, paving work, and other conditions affecting performance.

B. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and end and corner posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 ORNAMENTAL METAL FENCING INSTALLATION

A. General: Install ornamental metal fencing system in accordance with written instructions of manufacturer.

B. Where occurring along property line, install fencing on established boundary lines inside property line.

C. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil.

D. Post Setting: Set posts in concrete footings at indicated spacing.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

2. Concrete Footings: Place concrete around posts to dimension indicated and vibrate or tap for consolidation. Protect aboveground portion of posts from concrete splatter.

a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material.

E. Fence Panels: Install fence panels, consisting of horizontal rails and vertical pickets, spanning between fence posts. Set panels accurately in location, alignment, and elevation.

1. Where ground slopes, align horizontal rails to follow ground slope between posts, using adjustable rail/post connections.

3.4 ORNAMENTAL METALGATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 ADJUSTING

A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

END OF SECTION 32 31 19

SECTION 32 84 00 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Provide complete, automatically controlled, spray sprinkler, turf rotor, bubbler and/or drip underground irrigation system as shown on Drawings.

B. This Section includes but is not limited to: excavating, backfilling, finish grading, piping, valves, sprinklers, specialties, controls, and wiring for automatic control irrigation system.

C. Related Sections include the following:

1. 32 90 00 Planting.
2. 01 56 39 Temporary Tree and Plant Protection.

1.3 DEFINITIONS

A. Certified Landscape Irrigation Auditor (CLIA): a person certified to perform landscape irrigation audits by the Irrigation Association Certification Board.

B. Lateral (Circuit) Piping: Downstream from control valves to sprinklers, rotors, emitters and specialties. Piping is under pressure during flow.

C. Mainline Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. The following are industry abbreviations for plastic materials:

1. ASME: American Society of Mechanical Engineers.
2. ASTM: American Society for Testing and Materials.
3. AWG-UF: American Wire Gauge - Underground Feeder
4. NFPA: National Fire Protection Association.
5. PSIG: Pounds per Square Inch Gauge.
6. PVC: Polyvinyl Chloride Plastic.
7. SDR: Standard Direct Ratio.
8. V: Volt

1.4 PERFORMANCE REQUIREMENTS

A. Location of Sprinklers, Rotors, Emitters and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent, head to head, water coverage of turf and planting areas indicated with uniform coverage and minimum over-spray onto paving and no spray onto buildings and structures.

B. Minimum Working Pressures: The following are minimum rated pressure requirements for piping, valves, and specialties, unless otherwise indicated:

1. Irrigation Main Piping: 200 psig.
2. Lateral (Circuit) Piping: 150 psig.

C. Irrigation Schedule: In accordance with DSA Title 24, Part 1 – Outdoor Water Use Requirements, Contractor shall prepare two (2) – three (3) irrigation schedules, one for plant establishment, one for the established landscape and one for temporarily irrigated areas if applicable. Each schedule shall indicate the number of gallons used and shall target the Estimated Total Water Use (ETWU) and not exceed the Maximum Applied Water Allowance (MAWA) calculated on the Irrigation Plan "California Water Efficient Landscape Worksheet." Irrigation Schedule shall be submitted at substantial completion. After acceptance of substantial completion, Contractor shall laminate schedule in plastic and place in controller enclosure prior to final completion and end of maintenance. In preparing the Irrigation Schedule, the Contractor shall consider the following:

1. Irrigation interval (days between irrigation).
2. Irrigation run times.
3. Number of cycle starts to avoid runoff.
4. Amount of applied water scheduled to be applied on a monthly basis.
5. Application rate setting.
6. Root depth setting.
7. Plant type setting.
8. Soil type.
9. Slope factor setting.
10. Shade factor setting.
11. Irrigation uniformity or efficiency setting.

1.5 SUBMITTALS

A. Product and Project Data: With-in 14 days after award of the contract, furnish the Owner's Representative with submittal data on all items intended for installation. Substitute equipment or material installed without the approval of the Owner's Representative will be removed and replaced with specified items at this Contractor's expense. Submit manufacturer's technical data and installation instructions for irrigation components conforming to requirements of Submittals, Shop Drawings and Product Data. Include pressure ratings, rated capacities, and settings of irrigation components. Submittal shall include the following:

1. Backflow device including cage and/or blanket.
2. Main, lateral (circuit) and sleeving pipe.
3. Pipe fittings, primer and cement.
4. Tracer wire and/or warning tape.
5. Isolation valves.
6. Remote control valves.
7. Valve boxes.
8. Sprinklers, rotors, bubblers, drip emitters.
9. Swing joints.
10. Tree bubbler drain tubes.
11. Controllers. Include wiring diagrams, enclosures and mounting methods.
12. Control wires. Include splice kits and conduit.
13. Valve identification tags.
14. Irrigation Wiring Diagram: Contractor shall prepare and submit an irrigation wire diagram showing location of control wire, common wire, spare control wire and spare common wire with quantities noted at each run shown on copy of irrigation plan in a legible size and format.
15. Irrigation installation firm qualifications in accordance with “quality assurance”.
16. Name and contact information of certified irrigation auditor performing the irrigation audit for this project for landscape projects of 2,500 square feet and larger.

B. Coordination Drawings: During the course of construction, maintain orderly set of irrigation drawings and details on project site during installation of irrigation system. Record daily changes showing piping and major system components. Measure and neatly record dimensions for all mainlines, control wire runs, and all other pertinent information facilitating maintenance and extension of the irrigation system to within one (1) foot horizontally and six (6) inches vertically. Indicate interface and spatial relationship between piping, system components, adjacent utilities, and proximate structures. Up to date coordination drawings shall be available for review prior to meetings with the Owner’s Representative.

C. Submittals at Substantial Completion:

1. Irrigation Record Drawings. Contractor shall record information gathered on “Coordination Drawings” onto a clean set of Irrigation Plans for documentation of as-built conditions.
2. Controller Legend: Upon approval of record drawing submittal, prepare two (2) legible, reduced to 11” by 17” in size, non-fading, waterproof copies of the Record Irrigation Drawings, laminated between two (2) .020 mm (minimum) plastic sheets, printed on front side only. Attach one (1) copy to door of controller or enclosure and deliver one (1) copy to Owner. Plan sheet shall include the following information:
    a. Installing Contractor’s company name, phone number and address.

b. Color coded zone identification by valve.

c. Zone start time.

d. Zone water duration.

e. Type of planting irrigated.

f. Valve size, station numbers and controller designations.

3. For landscapes 2,500 square feet and larger, Contractor shall retain the services of a third party Certified Landscape Irrigation Auditor to perform a landscape irrigation water audit and prepare an irrigation audit report compliant with MWELO 492.12 including, but not limited to inspection, system tune-up, system test with distribution uniformity, correcting over-spray or run-off and configuring controllers with application rate, soil type, plant factors, slope, sun exposure and other factors necessary for accurate programming. Submit preliminary report at substantial completion, allow for adjustments during maintenance and submit report confirming irrigation installation is compliant with DSA MWELO at final completion.

4. Submit Irrigation Schedule for review and approval in accordance with DSA Title 24, Part 1 at substantial completion. Once approved, laminate in plastic and place inside controller enclosure for final completion at end of maintenance period.

5. Contractor shall provide the owner with one (1) quick coupler key with hose swivel per each five (5) quick couplers.

6. Irrigation System Leak Test Results.

7. Irrigation backflow preventer certification.

8. Central control installation certification from a factory authorized representative.

9. Booster pump installation certification from factory-authorized representative.

10. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in "Closeout Procedures," include data for the following:

a. Automatic-control valves.

b. Sprinklers, rotors and/or emitters.

c. Controllers.

1.6 QUALITY ASSURANCE

A. Governing Agency Requirements:

1. For projects subject to review and approval by local governing agencies, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance at a minimum and shall conform to local codes and/or ordinances, whichever may be more stringent.

2. For projects under review of DSA, Contractor shall comply with the State of California Model Water Efficient Landscape Ordinance requirements at a minimum.

B. Installer Qualifications:

1. Experience: The irrigation installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
2. Licensure: The irrigation installation firm shall hold a current, active C27 "Landscaping Contractor" license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
3. Supervision: The irrigation installation firm shall have a qualified and experienced irrigation technician on site during irrigation installation.
4. Drip Irrigation: The irrigation installation firm shall have contracted for and successfully complete construction of a minimum of five (5) drip irrigation installations within the past five (5) years of similar size and complexity.

C. Manufacturer Qualifications: Provide underground irrigation system as a complete unit. Each type component produced by a single acceptable manufacturer, including heads, valves, controls and accessories.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Pipe crossings beneath fire Lanes: Comply with NFPA 24-10, Depth of Cover at Fire Access Lanes.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in "Project Management and Coordination".

G. All work and materials shall be in strict accordance with the latest rules and regulations of the State Fire Marshal, Safety Orders of the Division of Industrial Safety, California Electrical Code, California Administrative Code, part 4, Title 24, "Basic Mechanical Regulations" and other applicable state or local laws or ordinances. Nothing in these drawings or specifications is to be construed as permitting work which does not conform to the codes or regulations.

H. Contractor shall provide all licenses, fees and other charges required for completion of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of water service.

2. Do not proceed with interruption of water service without Owner's Representative's written permission.

B. Interruption of Existing Irrigation Service: Do not interrupt existing to remain irrigation service. Prior to demolition work and prior to beginning irrigation work, review project site and meet with Owner Representative to review locations and connections of existing to remain irrigation system. Coordinate with General Contractor to ensure existing irrigation remains in place and operable through the duration of construction. In the event existing irrigation is shut off or damaged during construction, contractor shall provide temporary connections or modifications to continue water service to existing to remain planting material or turf to maintain in a healthy growing condition throughout construction. In the event water service is not available, contractor shall apply water through manual delivery means as necessary. Obtain approval from Owner's Representation two days in advance of any planned disruptions in water service.

1.9 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.10 MAINTENANCE

A. Irrigation maintenance shall coincide with planting maintenance, refer to Specification 32 90 00 "Planting". In the event planting is not part of this work, maintenance shall begin at written approval from Owner's Representative of substantial completion, run ninety (90) calendar days and until receipt of Owner's Representative's written acceptance of completion of punch list items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Use new materials of brands shown or Drawings, specified herein or approved equal.

B. Use existing materials if shown on Drawings.

C. Substitution of sprinklers, rotors, drip, valves and controllers will not be allowed due to variation in flows, precipitation rates, friction losses, and sizing and maintaining consistency with client equipment standards.

2.2 PIPES, TUBES, AND FITTINGS

A. Above Grade Irrigation Mainline: steel pipe, ASTM A 53/A 53M, Schedule 40, Type S or E, Grade A or B, galvanized with threaded ends.

1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe with threaded ends.

2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.

3. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.

4. Cast-Iron Flanges: ASME B16.1, Class 125.

5. Cast-Iron Flanged Fittings: ASME B16.1, Class 125, galvanized.

B. Mainline piping (unless specified otherwise on Drawings):

1. Class 200 (C900), gasketed, purple reclaimed water PVC pipe, ASTM D-2241, NSF approved (size 6” and larger).

2. Class 315 purple reclaimed water PVC pipe, ASTM D-2239, NSF approved (2-1/2” to 4”)

3. Schedule 40 purple reclaimed water PVC pipe, ASTM D-1785, NSF approved (2” and smaller).

4. Fittings to be schedule 80 PVC.

5. Six (6) inch and larger pipe to be secured with Lemco stainless steel LB series joint restraints or approved equal.

C. Lateral piping (unless specified otherwise on Drawings):

1. Schedule 40 purple reclaimed water PVC pipe, ASTM D 2466, NSF approved.

2. Fittings to be schedule 40 PVC.

D. Sleeves (unless specified otherwise on Drawings):

1. For irrigation piping, use schedule 40 PVC pipe, NSF approved, two, three (3) inch minimum size for irrigation piping.

2. For irrigation wiring, use schedule 40 PVC pipe, UL listed, NEMA TC-6, ANSI/UL651, ASTM F512, for outdoor, direct bury applications, PVC, two (2) inch minimum size.

3. Fittings to be schedule 40 PVC.

2.3 VALVES:

A. BACKFLOW PREVENTION DEVICE: As indicated on the Drawings installed using above grade steel pipe.

B. QUICK-COUPLERS: As indicated on the Drawings.

C. VALVE BOXES:

1. In paved areas, use Christy concrete utility box, size as required.

2. In planting areas, use Christy plastic underground enclosure. Boxes shall have locking lid, bolt and washer, size as required, color to be green in turf areas and black in planting areas, and purple for recycled water systems.

3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.

4. Valve box lids shall be labeled “IRRIGATION”.

D. PULL BOXES AND SPLICE BOXES:

1. In paved areas, use Christy concrete utility box, size as required.

2. In planting areas, use Christy plastic underground enclosure. Boxes shall have locking lid, bolt and washer, size as required, color to be green in turf areas, black in planting areas, and purple for recycled water systems.

3. Valve boxes to be rectangular for remote control valves and ball or gate valves and round for quick coupling valves.

4. Valve box lids shall be labeled “IRRIGATION”.

E. WIRE MESH AT VALVE BOXES: ½ inch by ½ inch, 16 gauge, galvanized wire mesh hardware cloth.

F. VALVE IDENTIFICATION TAGS: Shall be plastic yellow in color for potable water systems and purple in color for recycled water systems with 1 1/8” stamped black letters indicating controller/station number.

G. SAND BACKFILL: shall consist of natural sand, manufactured sand, existing of native material, or combinations thereof, and shall conform to ASTM c-40 organic impurities, ASTM d-2419 sand equivalent and a pH value between 4.5 and 9.

H. VALVE BOX ROCK: shall be ¾” or smaller drain rock or pea gravel unless specified otherwise on Drawings.

I. VALVE BOX SUPPORT BRICK: shall be common red brick unless specified otherwise on Drawings.

2.4 AUTOMATIC CONTROL SYSTEM:

A. CONTROLLER: As indicated on Drawings.

B. AUTOMATIC CONTROLLER GROUNDING: Contractor shall install grounding recommended by manufacturer for installation method detailed on this project.

C. WIRING: All 24 v line to be #14-1 awg-uf. Control wire insulation to be red in color and spare wire to be yellow in color. 24 v common wire to be #12-1 awg-uf, insulation to be white in color and spare common insulation shall be black in color.

D. SPLICING MATERIALS: manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

E. CONNECTORS: Shall be or 3M “DBY” connectors or equal.

2.5 TRACER WIRE/DETECTABLE WARNING TAPE:

A. Install tracer wire or detectable warning tape as indicated on Drawings.

B. Tracer Wire: #8 solid Bare Copper Wire.

C. Detectable Warning Tape: Electronically detectable plastic tape with metallic core, Terra Tape D, manufactured by Griffolyn Co., or equal, two (2) inches in width, continuously imprinted “caution buried water line”.

2.6 CONCRETE THRUST BLOCKING:

A. Shall be clean, Portland cement concrete, cast in place, five sacks of cement per cubic yard mixture with a 28-day compressive strength of 2,500 psi.

2.7 SPRINKLERS, DRIP SYSTEM, BUBBLERS, EMITTERS:

A. As indicated on Drawings.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 "Earthwork" for excavating, trenching, and backfilling.

B. Install piping and wiring in sleeves under sidewalks, roadways, and parking lots, and under or through footings and building walls.

1. Install piping sleeves by boring or jacking under existing paving if possible.
2. Install a minimum of two (2) three (3) inch diameter sleeves in each location for irrigation piping and a minimum of one (1) two (2) inch diameter electrical conduit sleeving in each location for irrigation wire.
3. Sleeves shall extend twelve (12) inches beyond edges of paving and walls with ends capped.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Mainline Piping: Minimum depth of 24 inches below finished grade to top of pipe.
2. Lateral Piping: Minimum depth of 18 inches below finished grade to top of pipe.
3. Sleeves containing control wires, mainline and/or lateral piping beneath standard paving: Minimum depth of 24 inches from finish surface to top of sleeve.

4. Sleeves containing control wires, mainline and/or lateral piping beneath vehicular paving including fire lanes/emergency vehicle access (EVA): Minimum depth of 36 inches from finish surface to top of sleeve.

5. Drip Irrigation: Install drip and/or emitter lines and tubing as detailed on Drawings.

D. Excavate trenches with vertical sides, uniform bottom, free of deleterious materials, and wide enough for pipes to lay side by side, fully supported on bottom. Minimum 3" clearance between pipes. Twelve (12") inch minimum width for mainlines and six (6") inch minimum width for lateral lines.

E. Trenches with pressure pipe and control wiring to be backfilled with sand to 6 inches minimum above top of pipe. Continue backfilling in 6 inch layers with soil free of rocks or waste materials. Compact soil to a density equal to the surrounding undisturbed soil, but not less than 90%. Any subsequent depressions shall be filled at the Contractor's expense. Particular attention is directed to firmly tamp and moistening around sprinkler heads and quick-couplers.

1. For irrigation pipes three (3) inches and larger in size, install additional six (6) inch depth sand beneath piping.

F. Trenches and backfill installed under paving, asphalt concrete or concrete shall be backfilled with sand and compacted in layers equal in density to the adjacent undisturbed soil or to 90% compaction, using manual or mechanical tamping devices. All trenches shall be left flush with the adjoining grade.

1. The Contractor shall set in place, cap and pressure test pressurized mainline under paving prior to the paving installation.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Owner's Representative's approval before excavation.

3.3 PIPING APPLICATIONS

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control valve boxes and above ground may be joined with flanges instead of joints indicated.

C. Aboveground Irrigation Main Piping: Use any of the following piping materials for each size range:

1. NPS 4 and Smaller: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.

2. NPS 5 and Larger: Steel pipe; malleable-, gray-, or cast-iron fittings; and threaded joints.

D. Underground irrigation main piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, Schedule 40 PVC solvent-weld.

E. Underground Irrigation Lateral (Circuit) piping shall be purple recycled water pipe, polyvinyl chloride (Type I) plastic pipe PVC 1120 and NSF approved, schedule 40 PVC solvent-weld.

F. Mainline pipe sizes 6” and larger shall use gasketed pipe with bell fittings. Where solvent weld joints are required, contractor shall additionally install concrete thrust blocking.

G. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

H. Mainline Fittings and Couplings: Schedule 80, PVC pipe, solvent weld up to 4” and gasketed with bell fittings 6” and larger pipe.

I. Risers to Aboveground Sprinklers and Specialties: ASTM A-120 Schedule 40 galvanized steel pipe with 150 lb. banded galvanized malleable iron fittings.

J. Double Swing Joint Assembly (unless specified otherwise on Drawings):

1. Install per manufacturers recommendations.
2. Install double swing joint at all sprinkler heads and quick couplers.
3. Elbows shall be PVC Class 1220, Schedule 40.
4. Install as follows:
    a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
    b. Screw on elbow and a 6 inch long nipple.
    c. Screw on another elbow and a 2 inch long nipple and install riser vertically to head, or quick coupler valve.
    d. Swing joint must offset to the right.

K. Sleeves: Schedule 40 PVC pipe and socket fittings; and solvent-cemented joints.

L. Transition Fittings: Use transition fittings for plastic-to-metal pipe connections according to the following:

1. Couplings:
    a. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
    b. Underground Piping NPS 2 and Larger: AWWA transition coupling.
2. Fittings:
    a. Aboveground Piping: Plastic-to-metal transition fittings.
    b. Underground Piping: Union with plastic end of same material as plastic piping.

M. Dielectric Fittings: Use dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:
    a. NPS 2 and Smaller: Dielectric couplings or dielectric nipples.

b. NPS 2-1/2 and Larger: Prohibited except in valve box.

2. Above ground Piping:

a. NPS 2 and Smaller: Dielectric unions.

b. NPS 2-1/2 to NPS 4: Dielectric flanges.

3. Piping in Valve Boxes or Vaults:

a. NPS 2 and Smaller: Dielectric unions.

b. NPS 2-1/2 to NPS 4: Dielectric flanges.

4. Dielectric fittings are specified in Division 22 Plumbing.

3.4 VALVE APPLICATIONS

A. Backflow Prevention Devices:

1. New and relocated backflow devices must be tested at time of installation. Contractor shall have test performed by a Certified Backflow Tester who has a current State of California Contractor's license C-36 or General Contracting License.

2. For new backflow preventer installation, a Certified Tester shall test and provide results and certification to the Owner's Representative within five (5) days of the date of testing and to provide any testing data or certification required by the local water provider. A Department of Public Health sticker shall be place on backflow device before the system is accepted by the Owner's Representative.

3. Install per local codes and water purveyor requirements.

4. A Department of Public Health sticker shall be placed on backflow device before the system is accepted by the Owner's Representative.

B. Underground Gate/Ball Valves: Install in control-valve box as detailed on drawings.

C. Underground, Manual Control Valves: Install in manual control-valve box as detailed on drawings.

D. Remote Control Valves: Install in control-valve box as detailed on drawings.

E. Drain Valves: Install in control-valve box as detailed on drawings.

F. Install each valve in a separate valve box (unless noted otherwise in Drawings and details) and in appropriate locations as shown on Drawings. Allow 12 inches between valve boxes and between valve boxes and walls or walks or landscape edges. Boxes shall be arranged perpendicular and parallel to each other and aligned in a row.

3.5 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings. Piping shown on drawings is diagrammatic. General arrangement of piping shall be followed as near as practical. Where piping is shown running continuously in paving and adjacent to planting area, intent is to install piping within planting areas where practical.

B. Install pipe sleeves at all points where pipes pass through concrete, asphalt or masonry. In footings, allow 1 inch clearance around pipe, and in other locations allow ½ inch. Each end of sleeve shall extend 6 inches beyond edge of paving or structure above. Provide removable non-decaying plug at each end of sleeve to prevent intrusion of earth and debris.

C. If drain valves are used, install piping at minimum uniform slope of 0.5 percent down toward drain valves.

D. Install piping free of sags and vertical bends.

E. Install groups of pipes parallel to each other, spaced to permit valve servicing.

F. Install fittings for changes in direction and branch connections. Pipe bending shall not exceed manufacturer recommended radii.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Install dielectric fittings to connect piping of dissimilar metals.

I. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

J. Lay piping on solid sub-base, fully and evenly supported by bedding, uniformly sloped without humps or depressions.

K. Install PVC piping in dry weather when temperature is above 40 degrees F (5 degrees C). Allow joints to cure at least 24 hours at temperatures above 40 degrees F (5 degrees C) before testing unless otherwise recommended by manufacturer.

L. Snake pipe a minimum of one (1) additional foot per one hundred (100) feet of pipe to allow for expansion and contraction.

M. Cap or plug openings as soon as lines have been installed to prevent intrusion of debris.

N. Thrust Blocking: Install concrete thrust blocking, at a minimum, on pressurized mainline three (3) inches and four (4) inches in size at changes in direction, connections or branches from mainline and dead ends and as necessary to prevent pipe movement thrusts created by internal water pressure. Concrete shall be placed directly on the fitting perpendicular to the line of thrust and also against the undisturbed earth. The amount of concrete shall be in accordance to the pressure, angle and soil type. Refer to pipe manufacturer for calculating exact size of thrust blocking material, 2019 CPC and IAPMO installation standards.

O. Joint Restraints: Install joint restraints per manufacturer recommendations on pressurized mainlines six (6) inches and larger at changes in direction, connections or branches from mainline and dead ends and as necessary to prevent pipe movement thrusts created by internal water pressure.

P. After installation of pipe lines and sprinkler risers, and prior to installation of sprinkler heads, automatic valves and quick couplers, thoroughly flush all lines with a full head of water to remove any foreign material, scale, sediment, etc.

3.6 TRACER WIRE

A. Install as detailed along all new irrigation mainline piping on bottom of trench, carefully run to avoid stress from backfilling and shall be continuous throughout the mainline pipe runs. Fasten tracer wire to mainline at eight (8) foot intervals with tape. Take precautions to ensure tape is not damaged or misplaced during backfill operations.

B. Tracer wire shall follow mainline pipe and branch lines, originating in irrigation valve box at gate, ball or remote control valve located closest to irrigation point of connection and run to ball, gate and/or remote control valves at the end of mainline runs or shall loop entire system where mainlines are looped.

C. Record locations of tracer wire origin and terminations on project record drawings.

3.7 DETECTABLE WARNING TAPE

A. Install tape with printed side up, directly over mainline pipe and on top of sand backfill, 18 inches below grade. Take precautions to ensure tape is not damaged or misplaced during backfill operations.

3.8 JOINT CONSTRUCTION

~~A. Refer to Division 22 Section "Piped Utilities -- Basic Materials and Methods" for basic pipe joint construction.~~

B. Install threaded pipe joints as follows:

1. Use pipe joint sealant for all plastic to plastic and plastic to steel joints, do not apply to sprinkler inlet ports.
2. For PVC, hand tighten only. Do not over tighten threaded joints. Thread until fitting stops, then add a half turn.
3. Use pipe joint compound and/or Teflon tape for all steel to steel joints.

C. Install gasketed joint per manufacturer recommendations (printed on pipe material) and using the lubricant supplied with the pipe.

3.9 SPRINKLER INSTALLATION

A. Locate part-circle sprinklers to maintain a minimum distance of six (6) inches from adjacent paving and edges and twelve (12) inches clearance from walls, fences and other structures, unless otherwise indicated on Drawings.

B. Spray sprinklers shall not be installed less than 24” from non-permeable surfaces unless the adjacent non-permeable surface is constructed to drain entirely to the landscape area.

C. Swing Joint Assembly:

1. Install triple swing joint at all sprinkler heads and quick couplers.
2. Elbows shall be PVC Class 1220, Schedule 40.

3. Install as follows:
    a. Screw 2 inch long nipple horizontally into plastic tee or ell at lateral line.
    b. Screw on elbow and a 6 inch long nipple.
    c. Screw on another elbow and a 2 inch long nipple.
    d. Screw on another elbow and install riser vertically to head, or quick coupler valve.
    e. Swing joint must offset to the right.

D. Sprinkler Installation:
1. Install sprinklers heads as shown on drawings and details.
2. Install plumb to finish grade.
3. Tool tighten all sprinkler body covers and nozzles.

3.10 DRIP/EMITTER INSTALLATION

A. Minimum cover sub-surface drip tubing: Drip and/or emitter lines shall be installed as detailed on Drawings and below the mulch top dressing layer.

B. Minimum cover of tubing to individual shrubs: Shrub bubbler tubing shall be installed to a depth of (4) inches and rising to the surface at target shrub rootball. No more than one (1) inch of tubing shall be exposed at shrub rootball.

C. Backfill after lines have been reviewed, tested for leaks and approved by Owner's Representative.

D. Assembling drip system shall keep pipe and tubing free from dirt and debris, pipe ends shall be cut square, deburred and cleaned.

E. Flush piping prior to installing remote control valve assembly (control zone kit assembly).

F. Follow manufacturer recommendations.

3.11 AUTOMATIC-CONTROL SYSTEM INSTALLATION:

A. Exact location of controllers shall be reviewed and approved by Owner's Representative.

B. Provide connection to nearest available 110 volt electrical service.

C. Prior to installation of hardscape, coordinate and install electrical supply and control wire conduit, size and quantity as required for each controller and spare wiring. Install pull boxes and conduit from clock location.

D. Contractor shall install grounding system per manufacturer recommendations.

E. Control wiring shall be neatly coiled beneath controller terminal strip and labeled with corresponding station number. Controller terminal strip cover plate shall fasten securely in place.

F. Contractor is responsible to provide fully automatic system operated by specified controller(s). Contractor shall install quantity of red wiring equal to the number of stations on the specified irrigation controller(s), plus five (5) yellow spare control wires for each controller, a common white wire and a spare common black wire. Example, 24 station clock shall have 24 control wires, 5 spare control wires and 2 common wires installed with mainline and running through all associated valve boxes. Wires shall be installed per plans and details from remote control valve(s) to controller(s).

G. Example of mainline that is not looped and terminates in 3 locations with a 24 station clock and 18 stations used:

1. Wire quantities shall be:
    - 18 red control wires for stations 1-18
    - 6 red control wires for un-used stations 19-24
    - 1 white common wire
    - 1 black spare common wire
    - 5 yellow spare wires
2. Wire runs:
    - 18 red control wires (stations 1-18) shall run from controller to corresponding valve.
    - 6 red control wires (un-used stations 19-24) shall run from controller and loop through each valve box associated with that controller.
    - 1 white common wire shall run from controller and connect to each valve associated with that controller.
    - 1 black spare common wire shall run from controller and connect to each valve associated with that controller.
    - 5 yellow spare control wires shall run from controller and loop through each valve box associated with that controller.
3. Contractor shall label all wires with water-proof marking with corresponding station number or as spare control wire, spare common wire or spare stations 19-24.

H. Wiring path is not shown on drawings and shall run from specified controller(s) to irrigation pull box if shown, then to the nearest irrigation mainline location, follow mainline (existing and/or new) to each remote control valve. Indicate wire location on record drawings where it does not follow mainline. Common and spare wires shall loop through entire system. Wiring may be shown on drawings only where required for future irrigation extensions.

I. Wiring may be shown on drawings only where required for future irrigation extensions.

J. Irrigation Central Control system is standard for this project.

K. Irrigation Central Control System must be compatible with owners central control software and hardware. Contractor shall ensure controller communicates properly with project central computer and receives daily downloads for weather updates.

3.12 CONNECTIONS/ELECTRICAL WIRING

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Ground equipment according to Division 26 Section.

C. Connect wiring according to Division 26 Section.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. 24 volt splices to be made with 3M Co. #3577 splice kit, as to manufacturer’s instructions. Splices to be made only at valve box or pull box.

3.13 REMOTE CONTROL VALVE WIRING

A. Wires shall be installed in gray UL approved electrical conduit between controller and pull box. Pull box to be located in ground nearest controller. Top of box to be flush with finish grade.

B. Provide separate irrigation wire sleeves under concrete or asphalt for irrigation wires, size and quantity as required, three (3) inches minimum in diameter, 24” minimum cover in planting areas and 36” minimum cover under fire lanes and pavements.

C. Wires from the pull box to remote control valves shall be direct burial. The wiring shall be bundled and secured to the lower side of the irrigation pipe at ten (10) foot intervals with plastic electrical tape. Sufficient slack shall be left in the wire to provide for expansion and contraction.

D. Provide 24 inches excess of coil of control wires in each 100 feet of run to controller.

E. Provide 24 inches excess of coil of control wires in each valve box and pull box.

F. Control wires to be buried a minimum of 24 inches below finish grade.

G. Wiring shall be tested for continuity, open circuits and unintentional grounds prior to connecting to equipment.

H. Install irrigation wire splice boxes where wire splices are necessary.

3.14 LABELING AND IDENTIFYING

A. Valve Identification Tags: Install valve identification tag on each remote control valve with corresponding controller station number.

3.15 FIELD QUALITY CONTROL

A. Manufacturer's Field Service for irrigation pumps and central control systems: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including mounting, electrical connections, water connections, grounding and proper communication on site, with hand-held remotes and with central

computer software. Make repairs and/or adjustments as recommended. Submit factory-authorized service representative's written approval of installation at Substantial Completion.

B. After substantial completion, for landscapes 2,500 square feet and larger, Contractor shall schedule an Irrigation Audit to be performed by a third-party certified landscape irrigation auditor. Contractor shall make necessary adjustments, if any, during maintenance period and provide written certification of installation from certified landscape irrigation auditor as part of final completion and end of maintenance.

C. Perform the following field tests and inspections in the presence of the Inspector and/or Owner's Representative with 72 hours advance notice. Contractor shall record date, time, names of those present and results and submit to Owner's Representative prior to requesting substantial completion review:

1. Leak test of pressurized mainline: After installation of mainline and prior to installing remote control valves, quick coupling valves or other valve assemblies and prior to backfilling trenches, test the mainline for leaks as follows:

   a. Testing shall occur with trenches open. Center load piping with small amounts of backfill between fittings to prevent pipe displacement, arching or slipping. Fittings to be visible for testing.

   b. Exercise care in filling the system with water to prevent excessive surge pressure and water hammer

   c. Test pressurized mainline piping under hydrostatic pressure of 125 psi for eight (8) continuous hours, minimum. Coordinate with Owner's Representative for initial observation of beginning test and observation after test. Install two (2) pressure gauges at opposite ends of mainline system. Pressurize system up to a minimum of 125 psi the day preceding the scheduled test and verify the pressure is holding at both ends. Inspect system early the following day in the presence of the Owner's Representative and note pressure. One hour later, verify pressure has not dropped more than five (5) psi in the presence of the Owner's Representative.

   d. Correct deficiencies revealed by test and repeat pressure test to the satisfaction of the Owner's Representative.

2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.

3. Coverage Test: When the irrigation system has been completed, the Contractor, in the presence of the Architect and Owner's Representative, shall perform a Coverage Test to determine if the coverage of water is complete and adequate, the sprinkler heads and/or emitters function according to manufacturers' data and according to the intent of the construction documents. Replace irrigation components not performing satisfactorily and/or respace sprinklers and/or nozzles and/or emitters as necessary to provide complete irrigation coverage of plant material.

   a. For new turf areas, Contractor shall demonstrate irrigation coverage over amended soil and prior to installation of sod and/or seeded turf.

4. Substantial Completion Review: At substantial completion of this Section, work shall be reviewed for conformance with the Drawings and Contractor shall make recommended repairs and/or corrections in a timely manner and prior to final completion.

   a. At substantial completion, contractor shall submit Certified Landscape Irrigation Auditor preliminary report on irrigation system for landscapes 2,500 square feet and larger.

   b. At substantial completion, Contractor shall submit documentation per 1.5 “submittals at substantial completion” to Architect for review and acceptance.

   c. At substantial completion, Contractor shall deliver spare parts to District Representative per 1.5 “Submittals at substantial completion”.

5. Final Completion Review: After substantial completion repairs and/or corrections have been completed and at the end of the maintenance period, work shall be reviewed for final completion and approved by Owner’s Representative in writing.

   a. At final completion, for landscapes 2,500 and larger, Contractor shall submit Certified Landscape Irrigation Auditor final report confirming irrigation installation is compliant with DSA MWELO requirements.

3.16 CLOSING IN UN-INSPECTED WORK

A. The Contractor will pay all costs necessitated by required opening, restoration and correction of all work closed in or concealed before inspection, testing as required, and approval by authorized inspections.

3.17 STARTUP SERVICE

A. Verify that controllers are installed and connected according to the Contract Documents.

B. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections.

C. Complete startup checks according to manufacturer's written instructions.

3.18 MAINTENANCE SCHEDULE

A. Fine tune and adjust irrigation system weekly coinciding with the landscape and/or turf planting maintenance period.

B. Adjust settings of controllers within WELO water budget and with seasonal changes.

C. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

D. Adjust sprinklers so they will be flush with, or not more than 1/2 inch above, finish grade.

E. Fill irrigation trenches due to settling.

3.19 CLEANING

A. Completely flush dirt and debris from piping before installing sprinklers and other devices.

B. After completion, cleanup and remove all resultant debris from site.

3.20 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controller and automatic control valves. Refer to “Demonstration and Training."

3.21 GUARANTEE (Project Close-out Item)

A. Furnish a written Guarantee to the Owner, dated from the date of Final Acceptance, against defective workmanship, materials or components and guaranteeing repair or replacement for a period of 1 year; further guarantee restoration of all damage caused by leaks in the Irrigation System for a like period.

B. Guarantee that the entire installation was made in accordance with the drawings, specifications and manufacturer’s recommendations, using designated materials and installation procedures.

C. Submit duplicate copies of the Guarantee for approval by the Owner’s Representative. Approval is mandatory before final payment and acceptance.

D. The guarantee for the irrigation system shall be made in accordance with the form attached at the end of this Section. The guarantee form shall be retyped onto the Contractors letterhead and contain the information shown.

GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler 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 defects in materials and workmanship which may develop during the period for one (1) year from the date of acceptance 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 a reasonable time, as determined by the Owner, after receipt of written notice.

The Owner reserves the right to make temporary repairs as necessary to keep the irrigation system and equipment in operating conditions. This shall not relieve the Contractor of his responsibilities under this Guarantee.

In the event of failure to make such repairs or replacements within a reasonable time after receipt of written notice form the 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:_____

Location:_____

_____

Name of Contractor:_____

Signed: (Authorized Signature)_____

Print Name of Authorized Signature_____

Address:_____

_____

Phone:_____ Date of Acceptance:_____

END OF SECTION

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SECTION 32 90 00 - PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Trees.
2. Shrubs.
3. Ground cover.
4. Vines.
5. Edgings.
6. Planters.
7. Bio-retention Basin.

B. Related Sections include the following:

1. Specification Section 01 56 39 “Temporary Tree and Plant Protection”.
2. Specification Section 31 05 13 “Earthwork” for excavation, filling and rough grading and for subsurface aggregate drainage and drainage backfill materials.
3. Specification Section 32 84 00 “Planting Irrigation”.

1.3 DEFINITIONS

A. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.

D. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

E. On-site Topsoil: Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, micro-organisms, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil analysis laboratory.

F. Planting Soil: On-site topsoil, import topsoil or manufactured topsoil.

G. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

H. Plant material: Exterior plants contained within the planting plan legend in categories of Trees, Shrubs, Vines, Perennials, Annuals and/or Ground Covers.

I. Substantial completion for landscape and irrigation: Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.

J. Final completion for landscape and irrigation: Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

1.4 SUBMITTALS

A. Product, Material Data and/or Samples: For each type of product specified. Submit manufacturer’s technical data and installation instructions for landscape products conforming to requirements of Submittals, Shop Drawings and Product Data to include, but not be limited to:

1. Samples for the following:
    a. Organic mulch top dressing (1/2 c.f. each)
    b. Edging materials and accessories, of manufacturer's standard size, to verify color selected.
2. Manufacturer's certified analysis for standard products.
3. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
4. Planting soil amendments as recommended by soil analysis laboratory.
5. Qualification Data: For landscape Installer in compliance with “Quality Assurance”.

B. Plant Materials List: Submit confirmation from supplier 30 days prior to planting that all plant material has been ordered.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner’s Representative upon delivery.

D. Qualification Data: For landscape Installer prior to performing work.

E. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: The landscape installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.

2. Licensure: The landscape installation firm shall hold a current, active C27 “Landscaping Contractor” license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.

3. Supervision: The landscape installation firm shall have a qualified and experienced landscape technician on site during landscape installation.

B. Soil Analysis Laboratory Qualifications: Testing laboratory shall be Lucchesi Plant and Soil Consulting, LLC., www.lucchesiconsulting.com,(408) 337-2575, or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: Furnish soil analysis by a qualified soil analysis laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity (CEC) or total exchangeable cations (TEC); sodium absorption ratio; deleterious material; pH; soluble salts, boron, mineral and plant-nutrient content of planting soil.

1. Report suitability of planting soil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.

D. Protect existing to remain and newly installed lawn and/or landscape areas from damage or trespass by maintaining construction fencing during construction and maintenance.

E. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

1. Selection of exterior plants purchased under allowances will be made by Owner’s Representative, who will tag plants at their place of growth before they are prepared for transplanting.

F. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12 inches above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

G. Observation: Owner’s Representative may observe trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality. Owner’s Representative retains right to observe trees and shrubs

further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Owner's Representative of sources of planting materials 30 days in advance of delivery to site.
2. Prior to Owner's Representative review of plant material, trees shall be neatly spaced approximately 5' apart (minimum) to allow for access in and around each tree and far enough to visually review each tree canopy without obstruction from other tree and/or shrub canopies.

H. Pre-installation Conference: Conduct conference at Project site with General Contractor and/or Owner's Representative to comply with requirements "Project Management and Coordination."

I. Protect all planting areas from trespass or damage by installing temporary barriers or protective fencing during construction. Barrier and/or fencing material and installation method shall be approved by Owner's Representative prior to installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Notify Owner's Representative fourteen (14) days prior to anticipated plant material delivery to schedule review of plant material prior to installation.

B. Do not prune trees and shrubs before delivery, except as approved by Owner's Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.

C. Handle planting stock by root ball.

D. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1. Do not remove container-grown stock from containers before time of planting.
2. Water root systems of exterior plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.7 PROJECT/SITE CONDITIONS

A. Prior to placing topsoil, Contractor shall collect and submit soil samples representative of on-site topsoil and/or import topsoil proposed for use in all planting and lawn areas to a soil analysis laboratory for analysis and soil amending recommendations. Submit test results analysis and recommendations to Owner's Representative for review and approval prior to beginning work.

B. Weather Limitations: Proceed with planting only when weather conditions permit.

C. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns, unless otherwise acceptable to Owner's Representative.

1. When planting trees and shrubs after lawns, protect lawn areas and promptly repair damage caused by planting operations.

D. Irrigation system shall be installed and operative before beginning planting operation.

E. Contractor shall protect new plantings and/or delay planting in event of forecasted freezing temperatures.

1.8 WARRANTY

A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner or users, or incidents that are beyond Contractor's control.

1. Warranty Period for Trees, Shrubs, Vines, Lawns and Ground Covers: One year from date of Final Completion.

2. Remove dead exterior plants immediately. Replace immediately unless required to plant in the succeeding planting season.

3. Replace exterior plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

4. A limit of one replacement of each exterior plant will be required, except for losses or replacements due to failure to comply with requirements.

1.9 MAINTENANCE

A. Plant Material and Planting Areas: Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting basins, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Refer to "Maintenance Schedule."

1. Maintenance Period: Ninety (90) days from date of Owners Representative's written approval of Substantial Completion of the planting and irrigation.

2. In the event plant material fails during the maintenance period due to Contractor negligence, the maintenance period shall extend until 90% of the plant material is established as determined by the Owner's Representative.

PART 2 - PRODUCTS

2.1 TREE, SHRUB AND VINE MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees and shrubs of sizes and grades complying with ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Owner's Representative, with a proportionate increase in size of roots or balls.

C. Label at least one tree and one shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

D. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

E. Provide plant material as specified on the Drawings including size, genus, species and variety.

2.2 SINGLE-TRUNK AND MULTI-TRUNK TREES

A. Trees: Single-trunk or multi-trunk trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

1. Branching Height: typical of tree species and container size, single trunk unless specified as multi-trunk on Planting Plan Legend. Select branching height in accordance with planting location. Low branching trees shall not be planted in conflict with pathways, driveways and/or structures.

2. Single-stem trees shall have straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

3. Multi-stem trees shall branch naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1.

2.3 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.4 PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud and bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, remove dead flowers.

2.5 TOPSOIL

A. Prior to placing bid, Contractor to coordinate with General Contractor, Demolition and/or Grading Contractors and verify quantity and source of planting soil for all planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of twelve (12) inches of planting soil in all landscape planting areas and any raised planters and rough grading in accordance with these specifications, details, notes, grading and drainage plans.

B. Coordinate with General Contractor, Demolition and/or Grading Contractors for removal and replacement of lime treated soils and replacement with planting soil prior to planting to depth required to remove lime treatment. In event trees are planted in lime treated soils,

trees shall have a minimum six (6) inch layer of planting soil below their rootball to provide a suitable substrate to root into for establishment.

C. On-site topsoil: Re-use existing topsoil or existing surface soil, top twelve (12) inches excavated and stockpiled on-site. Verify suitability of existing and/or stockpiled surface soil to produce planting soil by submitting a sample to a soil analysis laboratory. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 5.5 to 7.5 (5.8 to 7.8 for predominantly California native plant species), representative of productive soils in the vicinity, a range of 4 to 15 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR) shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm. Fine gravel (2-5 mm) and coarse gravel (5-12 mm) content shall not exceed 30%.

D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:

1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.

2.

Class	Particle size range	maximum, %	minimum, %
Coarse Sand	0.5 – 2.0 mm	15	0
Silt	.002-.05 mm	30	10
Clay	<.002 mm	25	10
Other Classes			
Gravel	2-13 mm	15	0
Rock	½-1 inch	5% by volume with	none >1 inch
Organic		15	4

3. Chemistry – Suitability Considerations

Salinity: Saturation Extract Conductivity (ECe)
Less than 3.0 dS/m @ 25 degrees C.
Sodium: Sodium Adsorption Ratio (SAR)
Less than 6 ppm
Boron: Saturation Extract Concentration
Less than 1.00 ppm
Reaction: pH of Saturated Paste: 5.5 – 7.5 without high lime content.

4. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.

5. Soil Analysis: Contractor shall submit to the Owner's representative for approval, certification from an agricultural soils analysis laboratory that the import topsoil provided conforms to the specifications prior to delivery of import or placement on on-site topsoil. Soil analysis shall have been performed on import topsoil source within the previous year.

2.6 BIO-RETENTION BASIN

A. Refer to civil drawings for construction of bio-retention basin swales.

B. Line bio-retention basin swale with Lenox Blend soil mixture available from LH Voss Materials, Inc. 2445 Del Vista Monte, Concord, CA 94520, www.lhvoss.com, (800) 660-8677, Rob Hawkins x 108, Butch Voss x 109. Depth shall be a minimum of 18" unless specified otherwise within plans and/or details.

2.7 FERTILIZER AND SOIL AMENDMENTS

A. Contractor shall collect and submit sample of proposed planting soil, representative of the top eight (8) inches of planting soil, to a locally known soil analysis laboratory, soil analysis laboratory for analysis and amendment recommendations. Sample shall be representative of typical on-site topsoil proposed for use in planting areas.

B. If import topsoil is proposed, import topsoil sample shall be submitted to a soil analysis laboratory locally known for analysis, amendment recommendations and installation recommendations.

C. Contractor shall provide soil analysis laboratory, the following information when submitting soil for analysis:

1. Project type (public school, commercial building, etc.).
2. Anticipated maintenance (regular, low, none, etc.).
3. Irrigation water source (potable or recycled).
4. Proposed plant material type such as California native plants, turf, shrub and ground covers.
5. Copy of this specification.

D. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.

E. Nitrogen Stabilized Organic Amendment: 0-1/4 inch nitrogen-stabilized organic amendment contributing at least 270 pounds of organic matter per cubic yard. Consider using Composted Greenwaste Organic Soil Amendment, such as Z-Best Organic Compost from Zanker Landscape Materials (www.zankerlandscapematerials.com) or equal, if recommended by soil analysis laboratory. Compost shall be obtained from a supplier participating in the Seal of Testing Assurance (STA) program of the U.S. Composting Council.

1. In order to comply with MWELO 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than 6% of organic matter in the top six (6) inches are exempt from adding compost.
2. Nitrogen stabilized sawdust shall not be used.

F. Soil Preparation: The following materials and quantities are given for bidding purposes only and Contractor shall amend soil using products, quantities and methods specified by soil analysis laboratory.

1. Nitrogen stabilized organic amendment.
2. All-purpose granular fertilizer (6-20-20).
3. Soil sulfur.

G. Planting Tablets: 21 gram controlled release fertilizer supplying nitrogen for up to 1 ½ years and 20-10-5 content.

H. Backfill Mix: Shall be a mixture of on-site or import topsoil, nitrogen stabilized organic amendment and fertilizer. For bidding purposes, backfill mix shall include 2/3 topsoil and 1/3 nitrogen stabilized organic amendment with 6-20-20 granular fertilizer, quantity per manufacturer, according to container or root stock size, mixed thoroughly.

2.8 MULCHES

A. Due to variation in mulch sizes, Contractor shall remove large bark mulch in excess of approximately ¾" x ½" x 6" in size of 2.5 cubic inches in volume.

B. Organic Mulch for non-bio-retention planting areas: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of organic bark from Republic Services (contact Michael Cappello, Compost Solutions Representative at (408) 618-4773), Pro-Chip decorative mulch, Republic Services, Newby Island Recyclery, Milpitas, CA (408) 945-2836. Color to be mahogany. Submit sample to Owners Representative's for review and approval.

C. Organic Mulch for Bio-retention basin swales: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of organic shredded cedar bark from Pacific Landscape Supply (209) 593-1199, www.pacificlandscapesupply.com, or equal. Submit sample to Owners Representative's for review and approval.

2.9 HERBICIDES

A. Pre-emergent: Ronstar-G, or approved equal.

B. Selective and non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

C. Contact Owner and obtain School District, Local, State and Federal policies and procedures for regulating application of chemical controls. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.

2.10 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated Douglas Fir or Lodgepole Pine, free of knots, holes, cross grain, and other defects, two (2) inches in diameter by length required, and pointed at one end.

B. Guy and Tie Wire: ASTM A 641/A 641M, Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch in diameter.

C. Guy Cable: 5-strand, 3/16-inch- diameter, galvanized-steel cable, with zinc-coated turnbuckles, a minimum of 3 inches long, with two 3/8-inch galvanized eyebolts.

D. Tree Ties: Z-Strap tree ties, or equal, made of one (1) inch wide by on-quarter (1/4) inch thick, black recycled tire rubber with pre-punched nail holes. Contact Sullivan & Mann Lumber Company, Inc. (800) 847-6562 (www.sullivanandmann.com).

E. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.11 LANDSCAPE EDGINGS/HEADERBOARD

A. Wood Strip Edging, unless indicated otherwise on Drawings, shall be as follows:

1. Species: Construction Heart Redwood, size per detail.

2. Stakes: Construction heart redwood, size per detail, with galvanized nails for anchoring edging.

3. Splice Plate: Same species as edging, 1 by 6 by 24 inches long in nominal size, with galvanized nails for securing in place.

2.12 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to planting areas.

2.13 POTTING SOIL

A. Potting soil shall be Supersoil® or equal potting soil, blend of organic materials, natural and traditional fertilizers, formulated for outdoor container plants with no fertilizing required for up to ninety (90) days after planting.

2.14 MISCELLANEOUS PRODUCTS

A. Tree Trunk Guard: nine (9) inch high by four (4) inch diameter plastic, corrugated tube, Arbor Guard + or equal.

B. Tree Root Barriers: 18” high by 24” wide, interlocking panels of not less than 0.080” (2.032 mm) thickness, black in color, at least 50% recycled material, injection molded plastic product for linear applications with ultra-violet inhibitors with anti-lift ground lock tabs, vertical root deflecting ribs and double top edge consisting of two parallel, horizontal ribs on the top.

C. Jute Netting: Biodegradable in two (2) to three (3) years from installation, absorbing water four to five times fabric weight, open area 60% to 65%, available in rolls four (4) feet in width. Use galvanized steel staples as recommended by manufacturer to secure netting in place.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive exterior plants for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

3.2 PREPARATION

A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

C. Install protective barriers and/or fencing as necessary.

D. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides, pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.

E. Do not excavate, place soils or amend soils during wet or saturated conditions.

F. If lime treated soils have not been removed from proposed planting areas, remove and replace with acceptable topsoil.

G. Verify depth of planting soil in proposed planting areas. If depth of planting soil is less than twelve (12) inches in depth, install additional planting soil to ensure twelve (12) inch minimum depth of topsoil.

H. Import topsoil Installation:

1. Remove and disposed of stones larger than one (1) inch in any dimension, vegetation and foreign inorganic material from surface to receive import topsoil.

2. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported planting soil layer to subgrade.

3. Place planting soil on loosened material in four (4) inch layers. Crossrip first import planting soil layer to a depth of eight (8) inches and blend import planting soil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate soil and compact to 85% density.

4. Continue placement of planting soil after blending first layer with native soil in four (4) inch layers and rolling lightly to consolidate and compact each layer of soil and compact to 85% density.

5. Place topsoil to the lines and grades in accordance with grading Drawings.

I. Verify rough grading is completed to proper slopes and elevations.

J. Verify installation of topsoil to a minimum depth of twelve (12) inches and rough grading is completed to proper slopes and elevations.

3.3 SOIL AMENDING AND FINE GRADING (Amend per Soil analysis laboratory recommendations. The following amendment recommendations are given for bidding purposes only.) Contractor shall prepare and amend soil over entire planting areas and as recommended for backfill at individual planting pits.

A. Soil Preparation: Loosen subgrade of planting beds by crossripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.

B. Soil Amending: (Amend per soil Analysis laboratory recommendations. The following recommendations are provided for bidding purposes only. Contractor shall amend soil for over-all preparation and amendment recommendations and for planting pit preparation, amendments and backfill) Add the following and thoroughly till into the top eight (8) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.

1. 6 cubic yards nitrogen stabilized organic amendment per 1,000 square feet.
2. 14 pounds all-purpose granular fertilizer (6-20-20) per 1,000 square feet.
3. 15 pounds soil sulfur per 1,000 square feet.

C. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges.
There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.

1. In planting areas, set finish grade of soil two (2) inches below adjacent paved surfaces, utility boxes, tops of curbs, and the like to allow for installation of organic mulch top dressing above.
2. Regrade as necessary to restore grades and drainage patterns after installation of plant material.

3.4 BIO-RETENTION SOIL AND INSTALLATION

A. Preparation:

1. Prior to installation of bio-retention soil, protect native soil at excavated bio-retention area from compaction by preventing traffic and installing a fence or covering with plywood.
2. Protect bio-retention soil stockpile from compaction and contamination from foreign matter by covering with a protective tarp.
3. Verify installation of subsurface and surface drainage with Civil Engineer prior to placing bio-retention soil.
4. Drainage should be directed away from bio-retention soils until upslope areas are stabilized and compacted.

B. Bio-Retention Soil Mixing and Placing:

1. Do not excavate, place soils or amend soils during wet or saturated conditions.
2. Operate equipment adjacent to bio-retention area and not in bio-retention area to avoid compaction.
3. If machinery must operate in the bio-retention area or adjacent planting area, use light weight, low ground-contact pressure equipment.
4. Where bio-retention soil meets native soil, rip or scarify the bottom native soils of the bio-retention area to a depth of four (4) inches.
5. If mixing bio-retention soil and amendments on-site, use an adjacent impervious area or plastic sheeting to prevent intrusion of foreign material.
6. Place bio-retention soil in 12” lifts. Do not place or work bio-retention soil if it is saturated or raining.
7. Allow bio-retention soil lifts to settle naturally, boot pack (walk around to compact) lifts to achieve 85% compaction or compact by lightly watering until soils are just saturated and allow bio-retention soils to dry between lifts.
8. Verify bio-retention soil elevations comply with grading design prior to applying mulch or installing plants.
9. After all lifts are placed, wait three (3) days to check for settlement, and add additional bio-retention soil as needed.

3.5 EDGING/HEADERBOARD INSTALLATION

A. Redwood Headerboard: Install wood headers or edgings where indicated. Anchor with wood stakes spaced per detail, driven at least 1 inch below top elevation of header or edging. Use 2 galvanized nails per stake to fasten headers and edging; length as needed to penetrate both members and provide 1/2-inch clinch at point. Chamfer top of stakes as indicated on detail and pre-drill stakes if needed to avoid splitting.

3.6 PLANT MATERIAL EXCAVATION

A. Lay out individual tree and shrub locations and areas for multiple exterior plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner’s Representative's acceptance of layout before planting. Make minor adjustments as required.

B. Lay out exterior plants at locations directed by Owner's Representative. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

C. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately planting pit sizes as indicated on planting details.

2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots.

3. Set rootball onto compacted native soil so that rootball sits one (1) inch above adjacent finish grade.

D. Obstructions: Notify Owner's Representative if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

E. Drainage: Notify Owner's Representative if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

F. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.7 PLANT MATERIAL PLANTING

A. Place planting tablets in hole about one (1) to two (2) inches away from root tips. Refer to manufacturer's recommendation for exact quantity, but not less than:

Plant size	Quantity	Plant size	Quantity
1 gallon container	1	7 gallon container	5
2 gallon container	2	15 gallon container	8
3 gallon container	3	24" box container	20
5 gallon container	3	36" box container	30

B. Carefully remove root ball from container without damaging root ball or plant.

C. Set container grown planting stock plumb and in center of pit or trench with top of root ball one (1) inch above adjacent finish grades. Face plant material for best appearance.

D. Place amended backfill mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly.

E. Finish placing remainder of backfill mix. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil.

3.8 TREE AND SHRUB PRUNING

A. General Tree Pruning Procedures:

1. Prune trees according to ANSI A300 (Part 1). Prune trees for long term structural integrity.

2. Cut branches with sharp pruning instruments; do not break, tear or chop. Pruning Standards: Prune trees according to ANSI A300 (Part 1).

3. Do not apply pruning paint to wounds.

B. Pruning Goals (Prune as per the following and under the direction of a Certified Arborist):

1. Prune trees to remain to compensate for root loss caused by construction damage. Provide subsequent maintenance during landscape irrigation and planting maintenance period and until "final completion" as recommended by Certified Arborist.

2. Prune to remove dead wood, promote proper structure, thin and open canopy and for general health for the specific tree species.

3. Prune for clearance from structures, pathways and driveways and streets and for a balanced canopy.

C. Shrubs, Vines and Ground Covers:

1. Prune, thin and shape shrubs according to standard horticultural practices.

2. Prune to remove injured or dead branches from shrubs.

3.9 GUYING AND STAKING

A. Upright Staking and Tying: Unless detailed otherwise, use a minimum of 2 stakes of length required to penetrate at least six (6) inches below bottom of backfilled excavation and to extend at least 72 inches above grade. Set vertical stakes and space to avoid penetrating root balls or root masses. Brace tree stakes with wood horizontal bracing screwed in place. Support trees with two rubber tree tie sections at contact points with the tree trunk installed in a "figure 8" wrap. Allow enough slack to avoid rigid restraint of tree. Trim stakes below tree canopy and to matching heights. Unless indicated otherwise on Drawings, use the number of stakes as follows:

1. Use 2 stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper.

2. Use 3 stakes for trees more than 12 feet high and greater than 2-1/2 inches in caliper. Space stakes equally around trees.

B. Guying and Staking: Guy and stake trees exceeding 14 feet in height and more than 3 inches in caliper, unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30 inches long, driven to grade.

1. For trees more than 6 inches in caliper, anchor guys to pressure-preservative-treated deadmen 8 inches in diameter and 48 inches long buried at least 36 inches below grade. Provide turnbuckles for each guy wire and tighten securely.

2. Attach flags to each guy wire, 30 inches above finish grade.

3. Paint turnbuckles with luminescent white paint.

3.10 TREE ROOT BARRIERS

A. Install root barriers where trees are planted within six (6) feet of any pavement or structures.

B. A linear root barrier shall be installed flush with the vertical edge of pavement or structure, one half (1/2) inch below the top of the pavement and shall extend six (6) feet in each direction for a total of twelve (12) feet in length. Contractor shall remove concrete spillage if necessary to install barrier flush against vertical concrete edge.

3.11 TREE TRUNK GUARD:

A. install to protect newly planted tree trunks planted in lawns according to manufacturer recommendations.

3.12 RAISED PLANTERS

A. Fill raised planters with amended planting soil. Place planting soil in twelve (12) inch deep, compacted layers to 85% relative density to an elevation of four (4) inches below the top of the raised planter (unless detailed otherwise on Drawings).

3.13 POTTERY, PLANTING CONTAINERS AND/OR PREFABRICATED PLANTERS

A. Fill pottery, planting containers and prefabricated planters with potting soil. Compact in twelve (12) inch lifts and fill to three (3) inches of the top of the planter.

3.14 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants spaced as indicated on planting legend.

B. Dig holes large enough to allow spreading of roots, and backfill with planting soil.

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

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

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.15 PRE-EMERGENT

A. Apply pre-emergent herbicide per manufacturer recommendations in new planting areas.

3.16 JUTE NETTING

A. Install jute netting on slopes exceeding 3:1 ratio slope. Apply jute netting after preparing planting soil for planting and fine grading. Secure jute netting starting at the top of the slope by laying six (6) inches of fabric below grade to a minimum depth of six (6) inches. Roll jute netting down slope and terminate where grade becomes level by folding six (6) inches of fabric underneath. Overlap seems four (4) to six (6) inches. Secure in place using staples placed eighteen (18) inches on center spacing. After completion of planting operations, install top dressing/mulch as specified herein.

3.17 PLANTING BED MULCHING

A. Apply three (3) inch minimum thickness of organic mulch, unless specified otherwise on Drawings, continuously throughout planting areas. Do not place mulch within two (2) inches of stems and six (6) inches of tree trunks.

3.18 CLEANUP AND PROTECTION

A. During exterior planting, keep adjacent paving and construction work area in a clean and orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation. Treat, repair, or replace damaged exterior planting.

C. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

3.19 MAINTENANCE SCHEDULE

A. Protection: Protect work from damage, erosion and trespass. Maintain temporary fencing and/or barriers in proper condition. Remove temporary fencing and/or barriers prior to final completion and at end of maintenance period.

B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis each week. Adjust and repair the irrigation system and its components as necessary for plant establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.

C. Fertilizing (confirm with soil analysis laboratory recommendations): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.

D. Weed Control: Maintain planting beds (planted or not) in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. (Contractor shall obtain written approval from project owner prior to application of herbicide) No herbicide shall be used without the Owner Representative’s prior consent. Use only approved herbicides, use in accordance with manufacturer’s recommendations and per Pest Control Advisor’s recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions.

E. Disease, Pest and Insect Control: Disease, pest (including, but not limited to, birds and rodents) and insect damage shall be controlled by the use of fungicides, insecticides pesticides, poisons and/or mechanical means. (Contractor shall obtain written approval from

project owner prior to application of fungicides, insecticides or pesticides or mechanical methods). Review and perform weekly during maintenance period.

F. Plant Material: Maintain trees, shrubs and other plants by pruning, cultivating and weeding as required for healthy growth. Restore planting pits as necessary. Tighten and repair stake supports and reset trees and shrubs to proper grades or vertical position as required. Review and perform weekly during maintenance period.

G. Organic Mulch: Re-apply organic mulch top dressing after initial settling and again prior to end of maintenance to ensure specified depth is achieved.

H. End of maintenance shall be reviewed and approved in writing by Owner's Representative. Upon approval, Contractor shall notify Owner's Representative in writing when maintenance is complete with a date which maintenance transfers to Owner.

3.20 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION

A. Owner's Representative shall inspect and approve the following prior to proceeding with subsequent work:

1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.

2. Layout: Layout of all plants, headerboard and other major elements shall be directed and/or approved by Owner's Representative.

3. Substantial Completion Review: At substantial completion of this Section, work shall be reviewed for conformance with the Drawings and Contractor shall make recommended repairs and/or corrections in a timely manner.

4. Final Completion Review: After substantial completion repairs and/or corrections have been completed, work shall be reviewed for final completion and approved by Owner's Representative in writing.

B. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.

C. Contractor shall remove protective fencing and/or barriers prior to final completion review.

END OF SECTION

SECTION 32 92 00 - TURF PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Sodding.

B. Related Sections include the following:

1. Specification Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.
2. Specification Section 31 00 00 "Earthwork" for excavation, filling and backfilling, and rough grading.
3. Specification Section "Subdrainage" for subsurface drainage.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Import Topsoil: Shall be obtained from a local source and coming from a site with similar soil characteristics as the project site. Topsoil shall be fertile, friable, natural loam surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones and rocks and other extraneous or toxic matter harmful to plant growth.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending nutrients, minerals, soils or sand with stabilized organic soil amendments to produce surface planting soil capable of sustaining plant growth.

D. Planting Soil: On-site topsoil, import topsoil or manufactured topsoil.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath topsoil.

F. On-site Topsoil: Naturally occurring, on-site, surface soil, usually occurring in the top four (4) to twelve (12) inches of original, undisturbed surface soil containing organic material, necessary nutrients and minerals to sustain plant growth and be approved to sustain plant life by an approved soil and plant lab.

G. Substantial completion for landscape and irrigation: Work shall be considered substantially complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications with only minor adjustments required and approval has been submitted in writing by Owner's Representative.

H. Final completion for landscape and irrigation: Work shall be considered complete when irrigation, planting, turf planting and seeding are installed correctly per plans and specifications and the maintenance period has been completed per plans and specifications and approval has been submitted in writing by Owner's Representative.

1.4 SUBMITTALS

A. Product and Material Data: For each type of product specified. Submit manufacturer's technical data and installation instructions for landscape products conforming to requirements of Section 01 33 00 Submittal Procedures to include, but not be limited to:

1. Analysis of proposed soil amending materials by soil analysis lab made according to methods established by the Association of Official Analytical Chemists, where applicable.
2. Samples for Verification: For each of the following:
   a. Soil conditioner (1/2 c.f. each).
3. Certification of turfgrass sod, identifying source, including name and telephone number of supplier.
4. Material Test Reports: For on-site topsoil, import topsoil and/or manufactured soil proposed for use on this project.
5. Planting soil amendments as recommended by soil testing lab.

B. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer shall be delivered to Owner’s Representative upon delivery.

C. Qualification Data: For landscape Installer prior to performing work.

D. Planting Schedule: Indicating anticipated planting dates for turf installation.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: The turf installation firm shall have contracted for and successfully completed construction of a minimum of five (5) California public school district construction projects, approved by the Division of the State Architect (DSA), within the past five (5) years of similar size, complexity, budget and scope.
2. Licensure: The turf installation firm shall hold a current, active C27 “Landscaping Contractor” license classification by the California State License Board that has been consistently active for at least five (5) years and that has not been suspended or revoked.
3. Supervision: The turf installation firm shall have a qualified and experienced turf technician on site during turf installation.

B. Soil Analysis Lab Qualifications: Testing lab shall be Lucchesi Plant and Soil Consulting, LLC., www.lucchesiconsulting.com, (408) 337-2575 or approved equal independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

A. Soil Analysis: Furnish soil analysis by a qualified soil analysis laboratory stating:

1. Percentages of organic matter.
2. Gradation of sand, silt, and clay content.
3. Cation exchange capacity (CEC) or total exchangeable cations (TEC).
4. Sodium absorption ratio.
5. Deleterious material.
6. pH.
7. Soluble salts, boron, mineral and plant-nutrient content.
8. Report suitability of planting soil for plant growth.
9. State recommended quantities of nitrogen, phosphorus and potash nutrients and soil amendments to be added to produce a satisfactory planting soil.

B. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section “Project Management and Coordination.”

C. Protect all lawn areas from damage or trespass by maintaining construction fencing during construction and maintenance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in Turf Producers International's (TPI) "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding."

1.7 SCHEDULING

A. Planting Restrictions: Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Sodded Lawns: Maintenance period shall be a minimum of ninety (90) days from date of Owner’s Representative written approval of Substantial Completion and when there are no visible joints or bare patches, roots are thoroughly knit to the soil and lawn appears to be uniformly healthy and green in color.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and spraying for insects and disease and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Implement pest management as necessary to controls pests, including gophers.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and/or maintain temporary piping, hoses, and lawn-watering equipment as necessary to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of mulch.
2. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

D. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one third (1/3) of grass height. Remove no more than one third (1/3) of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow and edge before turf reaches three and one-quarter (3-1/4) inches high.
2. Cut to two and one-half (2-1/2) inches high.
3. Remove all clippings.

E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to lawn area.

F. Maintain protective barriers in place, erect and secure and clear of lawn edges to allow for uniform growth and for trimming and so as not to block irrigation spray pattern.

1.9 WARRANTY

A. All work executed under this Section shall be warranted free of defects and poor workmanship for a period of one (1) year after date of Final Completion.

B. Turf planting shall be warranted to be in healthy and thriving condition during Warranty period, except for defects resulting from neglect by Owner, abuse or damage by others, or unusual phenomena or incidents which are beyond Contractor’s control.

C. Repair and/or re-sod turf areas not in vigorous condition immediately upon notification by Owner’s Representative during Warranty period.

PART 2 - PRODUCTS

2.1 TURFGRASS SOD

A. Turfgrass Sod: Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with TPI's "Specifications for Turfgrass Sod Materials" in its "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Not less than 2 years old, free of weeds and undesirable native grasses and machine cut rolls to pad thickness of 5/8 inch.

B. Turfgrass Species: Sod of grass species as follows, with not less than 90 percent germination, not less than 95 percent pure seed, and free of weed seed:

1. Sod variety:
   a. 90/10 Tall Fescue blend of 90% tall fescue and 10% bluegrass.

b. Available through Delta Bluegrass Co., www.deltabluegrass.com, (800) 637-8873.

C. Delivery, Storage and Handling: Sod shall be harvested, delivered and installed within a period of 24 hours. Sod shall be kept moist, fresh and protected at all times.

2.2 PLANTING SOIL

A. Prior to placing bid, Contractor to coordinate with General Contractor, Owner, Demolition and/or Grading Contractors and verify quantity and source of planting soil for turf planting areas. Identify Contractor responsible for stockpiling on-site topsoil and/or acquiring import planting soil and installing a minimum of six (6) inches of planting soil in turf planting areas and rough grading in accordance with these specifications, details, notes, grading and drainage plans.

B. Coordinate with General Contractor, Owner, Demolition and/or Grading Contractors for removal and replacement of any lime treated soils and replacement with planting soil prior to planting turf to depth required to remove lime treatment.

C. On-site topsoil: Reuse existing topsoil or existing surface soil, top twelve (12) inches, excavated and stockpiled on-site. Verify suitability of stockpiled surface soil to produce planting soil by submitting a sample to a soil testing laboratory. Acceptable on-site topsoil shall be ASTM D 5268, pH range of 5.5 to 7.5, representative of productive soils in the vicinity, a range of 4 to15 percent organic material content; free of stones one (1) inch or larger in any dimension, roots, plants, sod, clay lumps and other extraneous materials harmful to plant growth. Sodium absorption rate (SAR) shall not exceed 5.0, conductivity of the saturation extract solution shall not exceed 3.0, and boron concentration in the saturation shall not exceed 1.0 ppm. Fine gravel (2-5 mm) and coarse gravel (5-12 mm) content shall not exceed 30%.

D. Import Topsoil: Supplement with imported or manufactured topsoil from off-site, local sources, when quantities of on-site topsoil are insufficient. Do not obtain topsoil from bogs or marshes. If soil is obtained from agricultural land, Contractor shall submit proof soil is nematode free. Import topsoil shall meet the following requirements:

1. USDA Classification of fraction passing 2.0 mm sieve: sandy loam, sandy clay loam or loam.

2.

Class	Particle size range	maximum, %	minimum, %
Coarse Sand	0.5 – 2.0 mm	15	0
Silt	.002-.05 mm	30	10
Clay	<.002 mm	25	10
Other Classes			
Gravel	2-13 mm	15	0
Rock	½-1 inch	5% by volume with none >1 inch	
Organic		15	0

3. Chemistry – Suitability Considerations

Salinity: Saturation Extract Conductivity (ECe)
Less than 3.0 dS/m @ 25 degrees C.

Sodium: Sodium Adsorption Ratio (SAR)
Less than 6.00 ppm.
Boron: Saturation Extract Concentration
Less than 1.00 ppm.
Reaction: pH of Saturated Paste: 5.5 – 7.5 without high lime content.

4. Soil to contain sufficient quantities of available nitrogen, phosphorus, potassium, calcium and magnesium to support normal plant growth. In the event of nutrient inadequacies, provisions shall be made to add required materials prior to planting.
5. Soil testing: Contractor shall submit to the Owner's representative for approval, certification from an agricultural soils testing laboratory that the import topsoil provided conforms to the specifications prior to delivery of import or placement of on-site topsoil. Soil testing shall have been performed on import topsoil source within the previous year.

2.3 FERTILIZER AND SOIL AMENDMENTS

A. Contractor shall collect and submit two samples of proposed planting soil, representative of the top eight (8) inches of planting soil, to the locally known soil analysis lab for analysis and amendment recommendations. Soil samples shall be taken from proposed planting areas or topsoil source. Sample shall be taken to a depth of 8 inches. Contractor shall amend per soil testing laboratory recommendations. Soil amendments in this specification are provided for bidding purposes only.

B. If import topsoil is proposed, import topsoil sample shall be submitted to a soil analysis laboratory locally known for analysis, amendment recommendations and installation recommendations.

C. Contractor shall provide soil analysis laboratory, the following information when submitting soil for analysis:

1. Project type (public school, commercial building, etc.).
2. Anticipated maintenance (regular, low, none, etc.).
3. Irrigation water source (potable or recycled).
4. Proposed plant material type such as ornamental or sport turf.
5. Copy of this specification.

D. Fertilizers: All fertilizers shall be of an approved brand with a guaranteed chemical analysis as required by USDA regulations and shall be dry and (except for plant tabs) free flowing.

E. Nitrogen Stabilized Organic Soil Amendment: 0-1/4 inch nitrogen-stabilized organic amendment contributing at least 270 pounds of organic matter per cubic yard. Consider using Composted Greenwaste Organic Soil Amendment, such as Z-Best Organic Compost from Zanker Landscape Materials (www.zankerlandscapematerials.com) or equal, if recommended by soil analysis laboratory. Compost shall be obtained from a supplier participating in the Seal of Testing Assurance (STA) program of the U.S. Composting Council.

1. In order to comply with MWELO 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into

the soil. Soils with greater than 6% of organic matter in the top six (6) inches are exempt from adding compost.

2. Nitrogen stabilized sawdust shall not be used.

F. Soil Preparation: The following materials and quantities are given for bidding purposes only and Contractor shall amend soil using products, quantities and methods specified by soil analysis laboratory.

1. Nitrogen stabilized organic soil amendment.
2. Starter fertilizer, XB Best 6-20-20 or 6-24-24.
3. Soil sulfur.

2.4 HERBICIDES

A. All herbicides shall be approved by the District prior to use.

B. Contractor shall contact Owner's Representative prior to application of herbicides for Owner's policies, rules and regulations pertaining to herbicide application.

C. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove broad-leaf weeds from existing turf.

D. Non-selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application to remove herbaceous vegetation in areas indicated.

2.5 WATER

A. Water shall be suitable for irrigation and free from ingredients harmful to sodded areas.

2.6 LANDSCAPE EDGINGS/HEADERBOARD

A. Wood Strip Edging: Of sizes shown, and as follows:

1. Wood Material: Construction heart redwood, 2 by 6 in size, length as required.
2. Stakes: Construction grade, rough sawn, wood, 2 by 2 by 16 inches long in nominal size, with galvanized, wood, screws for anchoring edging to wood strip edging.

2.7 TEMPORARY FENCING

A. Fencing to be 6' high, lightweight, chain link fabric and galvanized pipe panels fastened together with saddle clamps. Fence support shall be on-grade concrete blocks and/or steel flange type footings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Planting operations shall be performed when weather and soil conditions are suitable for planting.

3.2 PREPARATION

A. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

B. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

C. Install protective temporary fencing at perimeter of sod turf work area with a gate for construction and maintenance access. Gate shall be secured in the closed position when work is not being performed. Examine work to be performed and irrigation spray locations and install fencing in optimal location to minimize disruption to turf spray locations and for ease of sod installation and maintenance.

1. Fence shall be installed prior to beginning turf planting and irrigation work.
2. Fence shall be removed after sod has established and can tolerate normal school sport and play activities and prior to end of maintenance.

D. Contact and obtain Owner's Representative, Local, State and Federal policies and procedures for regulating application of fertilizers, fungicides, insecticides, pesticides and herbicides. Contractor shall comply with all applicable policies and/or procedures for application, posting and notifications.

E. Import Planting Soil Installation:

1. Remove and dispose of stones larger than one (1) inch in any direction, vegetation and foreign inorganic material from surface to receive import topsoil.
2. Scarify or plow the subgrade by crossripping or equivalent to a minimum depth of four (4) inches until it is loose and uncompacted to provide bonding of imported topsoil layer to subgrade.
3. Place topsoil on loosened material in six (6) inch layers. Crossrip first import topsoil layer to a depth of eight (8) inches and blend import topsoil with loose native surface soil. Roll lightly with appropriate lawn roller to consolidate topsoil and compact to 85% density.
4. Continue placement of import topsoil after blending first layer with native soil in six (6) inch layers and rolling lightly to consolidate and compact each layer of topsoil.
5. Place topsoil to the lines and grades in accordance with grading Drawings.

F. Verify installation of planting soil to minimum depth of six (6) inches and rough grading completed to proper slopes and elevations.

G. Verify lime treated soils have been removed and replaced with acceptable planting soil.

3.3 SOIL AMENDING AND FINE GRADING (Amend per Soil-Testing Laboratory recommendations. The following recommendations are given for bidding purposes only.)

A. Prior to disturbing soil, apply non-selective herbicide to eradicate vegetation. Select herbicide(s) most appropriate for vegetation to remove. Follow manufacturer's

recommendation for complete kill prior to continuing work, approximately two (2) days. Re-apply in event herbicide is washed off by rain or water and as required for complete eradication of vegetation.

B. Soil Preparation: Loosen subgrade of planting beds by crossripping or equivalent cultivation to a minimum depth of ten (10) inches. Remove stones larger than one (1) inch in any dimension and sticks, roots, rubbish, and other extraneous matter in the top six (6) inches of soil and legally dispose of them off Owner's property.

C. Soil Amending: (Amend per Soil-Testing Laboratory recommendations. The following recommendations are provided for bidding purposes only.) Add the following and thoroughly till into the top six (6) inches of planting soil at the following rates per 1,000 square feet. Till planting soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Float, rake and roll all planter areas to establish finished grades, maintaining drainage patterns and swales for grading and drainage plans, creating smooth, uniform surface plane.

1. 6 cubic yards nitrogen fortified organic soil amendment.
    a. In order to comply with MWELO 492.6, 3. (C). Soil Preparation, Mulch and Amendments, at a minimum, compost shall be applied at a rate of four (4) cubic yards per 1,000 square feet of permeable area incorporated to a depth of six (6) inches into the soil. Soils with greater than six percent (6%) organic matter in the top six (6) inches are exempt from adding compost.
2. 14 pounds all-purpose granular fertilizer (6-20-20).
3. 15 pounds soil sulfur.

D. Fine Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Refer to civil grading plans and conform to designed grades, drainage patterns, swales, and ridges. There shall be no areas that hold water or drain toward buildings or structures, unless designed per civil grading plans.

1. In sodded turf areas, one (1) inch below adjacent paved surfaces, utility boxes, tops of curbs, etc.

E. Moisten prepared lawn areas before planting if planting soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil conditions.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

G. Compact soil to 85% density.

H. Apply starter fertilizer at manufacturer recommended rates.

3.4 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to subgrade or sod during installation. Tamp and roll lightly to ensure contact with subgrade,

eliminate air pockets, and form a smooth surface. Work sifted planting soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across angle of slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
3. Hold sod clear of all tree trunks and tree staking, create a circular edge 12” clear of all tree trunks.

C. Saturate sod with fine water spray within two hours of planting. During first week, water daily or more frequently as necessary to maintain moist planting soil to a minimum depth of 1-1/2 inches below sod.

3.5 MAINTENANCE SCHEDULE

A. Protection: Protect work from damage, erosion and trespass. Maintain temporary construction fencing in proper condition until sod has established.

B. Water: Contractor shall be solely responsible for ensuring that all planting is sufficiently watered to promote vigorous growth. Test and inspect irrigation system on a regular basis, each week during plant establishment and monthly thereafter. Adjust and repair the irrigation system and its components as necessary for turf establishment and growth and for watering efficiency. Check and adjust any obstructions to emission devices.

C. Fertilizing (confirm with soil analysis lab recommendations): Immediately after completion of planting, fertilize landscape areas with ammonium sulfate (21-0-0) fertilizer at a rate of five (5) pounds per 1000 square feet. Fertilize with specified fertilizer after 45 days, prior to end of maintenance period. After landscape becomes well-established, fertilize in fall and spring with (16-6-8) commercial fertilizer at a rate of six (6) pounds per 1000 square feet.

D. Weed Control: Maintain planting beds (planted or not) in a weed-free condition to be performed weekly during maintenance period. Weeding may be done manually or by the use of selective herbicides. (Contractor shall obtain written approval from project owner prior to application of herbicide) No herbicide shall be used without the Owner Representative’s prior consent. Use only approved herbicides, use in accordance with manufacturer’s recommendations and per Pest Control Advisor’s recommendations. If selective herbicides are used, extreme caution shall be observed so as not to damage any other plants. Spraying shall be done only under windless conditions. Review and perform weekly during maintenance period.

E. Lawns: Maintain lawns by watering, fertilizing weeding, trimming, mowing and other operations such as rolling, re-grading and replanting as required to establish a smooth, acceptable lawn, free of weeds, bare spots and rocks. All lawn areas shall be mowed regularly when grass reaches a height of three and one-quarter (3-1/4) inches and a minimum of two (2) days prior to end of maintenance period.

F. Disease, Pest and Insect Control: Disease, pest (including moles, gophers and geese) and insect damage shall be controlled by the use of fungicides, insecticides, pesticides or poisons. Contractor shall obtain written approval from project Owner prior to application of fungicides, insecticides or pesticides and shall abide by all posting requirements prior to application. Review and perform weekly during maintenance period.

3.6 FIELD QUALITY CONTROL, SUBSTANTIAL COMPLETION AND FINAL COMPLETION

A. Contact Owner's Representative a minimum of 48 hours prior notice for review and approval of the following prior to proceeding with subsequent work:

1. Preparation: at completion of finish grading and prior to planting, grading tolerances and soil preparation shall be checked for conformance to Drawings and as specified herein.
2. Layout: Layout of sod, headerboard and other major elements shall be directed and/or approved by the Owner's Representative.
3. Substantial Completion Review (Pre-maintenance review): At substantial completion of this Section, work shall be reviewed for conformance with the Drawings. Written approval shall mark beginning of the maintenance period.
3. Final Completion Review: At the end of specified maintenance period, work shall be reviewed for conformance with Drawings including additional requirements stipulated during maintenance period shall be extended at Contractors sole cost as directed by the Owner's Representative.
4. Re-inspections required due to Contractor not being prepared or non-conformance to Drawings shall be back charged to the Contractor.

B. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities. Construction fencing shall be removed and any voids in sod due to construction fencing shall be repaired.

C. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory and upon written approval of Owner.

3.7 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures after grass establishment period.

END OF SECTION

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SECTION 33 00 00 - PIPED UTILITIES

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Connection to existing systems.

2. Pipe installation and connection to building stubouts.

B. Related work in other Sections:

1. Trenching, backfilling and compacting: Section 31 23 33.

2. Storm Drainage Utilities: Section 33 40 00.

4. Water Utilities: Section 33 10 00.

1.02 QUALITY ASSURANCE

A. Refer to specific utility Sections as noted above.

1.03 HANDLING

A. Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store plastic piping, insulation, joint materials, fittings, valves and rubber gaskets under cover out of direct sunlight. Do not store materials directly on ground. Keep interiors of pipes and fittings free of dirt and debris.

B. Handle pipe, fittings, valves and other accessories in such a manner as to ensure deliver to the trench in sound and undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make satisfactory repairs if coatings or linings are damaged. Carry pipe to the trench; do not drag it.

C. The pipe will be inspected at destination to assure compliance with specified requirements. Any pipe or couplings that are found to be defective or that do not meet the requirements of the Specifications shall be replaced. Rejection of 10% of any shipment shall be cause of, and will be considered sufficient reason for, rejection of the entire shipment.

2.00 PRODUCTS

A. Refer to specific utility Sections as noted above.

3.00 EXECUTION

A. Any connections to public improvements require notification of, and inspection by the City or Public Utility Company.

3.01 CONNECTION TO EXISTING SYSTEM(S)

A. Make connections to existing lines at a time which will cause a minimum of disruption to the existing system. Any service interruption(s) shall be coordinated with and approved by the Engineer. Overtime costs shall be paid for by the Contractor.

B. Contractor shall coordinate with and arrange for "hot" tap connections to existing mains by forces of the Water Service Agency. Owner will pay separately for work to be done by the Water Service Agency.

3.02 PIPE INSTALLATION

A. Laying and jointing of pipe and fitting shall be in accordance with the manufacturer's recommendations. Joint deflections shall not exceed the maximum recommended by the manufacturer. There shall be no shoulder or unevenness along the interior of the pipe at the shoulder joints.

B. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, valves, fittings or other appurtenances into trenches. Do not drag pipe with preformed rubber joint seals against trench walls and damage the seals.

C. Cut pipe accurately to measurements established at the site and work into place without springing or forcing. Do not use pipe or fitting that does not allow sufficient space for proper installation of jointing material.

D. Pipe fittings, valves and accessories shall be carefully inspected before and after installation and those found defective shall be replaced. Remove fins and burrs from pipe and fittings. Before the pipe is laid, the interior of the joint of the preceding pipe and fitting shall be carefully cleaned. After each section of the pipe has been laid to line and grade and jointed to the preceding section, and after jointing procedure has commenced, there shall be no movement of the pipe in subsequent operations.

E. Take care to place sand under the haunches on either side of the pipe. Lay bell and spigot pipe with the bell end pointing in the direction of laying. Drainage and sewerage pipe shall be laid uphill commencing at the lowest invert elevation. Grade the pipeline in straight lines, taking care to avoid the formation of any dips or low points. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints and couplings.

F. Before the Contractor leaves the work at any time, the pipe shall be securely closed at its open end. After the work is completed, the pipe shall be carefully and thoroughly cleaned of all refuse, earth or any objectionable material.

3.03 STRUCTURES AND APPURTENANCES

A. Structures and appurtenances shall be installed at the locations and to the lines and dimensions and/or as herein specified.

B. Valves shall be set plumb and valve boxes shall be centered over valve stems.

C. Connections in manholes shall be constructed with concrete channels directed toward the outlet pipe or as indicated on the plans.

D. Penetrations into manholes, vaults and building walls shall be by preformed breakout or coredrill holes. Breakout or coredrill holes in concrete structures shall be grouted all around to prevent groundwater infiltration.

END OF SECTION 33 00 00

SECTION 33 10 00 - WATER UTILITIES

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Water Service Connections.

B. Related work in other Sections:

1. Ductile Iron Pipe, (ANSI/AWWA)

2. Gate Valves, (ANSI/AWWA)

3. Fire Hydrants, (ANSI/AWWA)

4. Trenching, backfilling and compacting: Section 31 23 33.

5. Piped utilities: Section 33 00 00.

1.02 QUALITY ASSURANCE

A. Reference standards: The applicable provisions of the following govern the work of this Section:

1. American Water Works Association (AWWA) standards.

a. Sections C100 through C900.

2. National Fire Protection Agency (NFPA)

a. NFPA 24 Installation of Private Fire Service and Their Appurtances.

1.03 SUBMITTALS

A. Submit the following:

1. Product data for piping, valves, hydrants, backflow prevention devices, etc.

2. Shop Drawings for pre-cast concrete valve boxes, including frames and covers.

2.00 PRODUCTS

A. All products, materials and procedure shall comply with the Standards of the Water Service Agency. Agency standards shall govern in case of conflict.

B. All materials used or installed in the underground private fire service piping installation are to be new and comply with the Standard and Appendices of National Fire Protection Association pamphlet No. 24, except that piping materials and fittings shall also be limited to those listed by UL.

C. All fire protection improvements shall be subject to the review and approval of the Agency Fire Marshall.

D. Domestic service shall use Schedule 80 PVC or better.

2.01 GATE VALVES

A. All iron, bronze mounted, resilient sealed wedge type parallel seats, non-rising stem with square operating nut turned counter-clockwise to open in accordance with AWWA C509 and "O" ring packing. Gate valves 4" and larger shall have mechanical joint or flanged ends.

2.02 WATER VALVE BOXES

A. Provide a valve box for each buried valve. Water valve boxes shall be precast concrete with steel or cast iron traffic cover marked "WATER"; per new Water Service Agency Standards for valve boxes. Precast grade rings shall be used as required per Water Service Agency Standards.

2.03 DETECTOR CHECK VALVE

A. To be furnished by Contractor per Water Service Agency Standards.

2.04 POST INDICATOR VALVE (PIV)

A. Valve shall be UL listed, designed for use with indicator post, and have mechanical joint or flanged ends; Mueller P-2360 or equal per Fire Department Water Service Agency Standards.

2.05 INDICATOR POST

A. UL listed and designed for use with indicator valve; Mueller A-20806, or equal per Fire Department Water Service Agency Standards.

2.06 FIRE DEPARTMENT CONNECTION

A. 4" x 2½" x 2½", UL listed, rough brass finish with hose threads conforming to the governing Fire Department's requirements. Fire Department connection shall be Potter Roemer 5761, or equal, per Fire Department and Water Service Agency Standards.

2.07 FIRE HYDRANTS

A. A wet barrel Clow 960 or equal, per Fire Department and Water Service Agency Standards.

2.08 SWING CHECK VALVE

A. Iron body, bronze mounted, UL listed, gravity operated and flanged ends; Mueller A-2120-6/A-2122-6 or equal per Water Service Agency Standards.

2.09 CORPORATION STOP VALVE

A. Service clamp shall be double strap-type of all bronze construction per Water Service Agency Standards.

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2.10 WATER METER

A. Water service shall be installed and meters furnished in accordance with Water Service Agency (latest Standard) "Domestic Water Meter" is not allowed because of fire flow requirements and minimum domestic water flows). All meters shall be furnished in accordance with Water Service Agency Standards unless approved otherwise by the Director of Maintenance Services.

B. Water meters: per Water Service Agency Standards.

C. A water meter box shall be provided for each water meter. Meter boxes shall be precast reinforced concrete box with concrete cover and removable concrete reading lid marked "WATER METER"; Christy B36 utility box with E70 lid or equal.

2.11 TRACER TAPE

A. A polyethylene tape shall be embedded in the trench 6" above non-metallic water lines to facilitate locating these pipes with a pipe detector. The tape shall be connected to all valves and be continuous between valves. The tape shall be 3" wide, blue and be marked "CAUTION WATER LINE BURIED BELOW". Either the tape shall contain a 0.35-mil thick metallic foil core (Terra-Tape D or equal) or a bare No. 8 copper wire shall be embedded in the trench with the tape and be connected to all valves.

3.00 EXECUTION

3.01 STRUCTURES AND APPURTENANCES

A. Structures and appurtenances shall be constructed and installed in accordance with the applicable sections of AWWA C600 and AWWA C603. Jointing of valves shall conform to applicable portions of AWWA C504 and AWWA C500 per Water Service Agency Standards.

B. Fire Service Assemblies shall be installed in accordance with Water Service Agency Standards.

C. All public and private service pipes, conduits and appliances uncovered due to work of the Subcontractor, whether within or without the property lines, shall be suitably supported, protected and maintained in operation and shall be protected against settlement when excavations are refilled.

D. Excavation, trenching, installation of underground piping and back-filling shall be in accordance with the Standard and Appendices of National Fire Protection Association Pamphlet No. 24, and local public authorities.

3.02 THRUST BLOCKS

A. Per Water Service Agency Standards.

B. All required thrust blocks are not detailed on the Drawings, but blocks shall be provided for all pressure pipe fittings, and at all other points where there is a possibility of putting a joint under pressure. Provide anchors and supports where necessary for fastening work into place. Make proper provisions for expansion or contraction of pipelines. Blocks shall be placed between solid ground and the pipe or fittings to be anchored as detailed on the drawings.

C. Backfilling operations may begin as soon as the concrete has set sufficiently to remain in position and withstand the weight of the earth. Concrete shall not be disturbed or pressure loaded for at least 5 days after placing.

3.03 TESTING AND DISINFECTION

A. Hydrostatic testing, disinfection, and flushing shall conform to the Standard Specifications of the Water Service Agency. Contractor shall be responsible for testing, disinfection and flushing of all main appurtenances and those portions of service line within his work. See Water Service Agency Standard.

B. In addition to normal testing, etc., fire service lines will, in addition, require testing and flushing per NFPA 24.

3.04 SANITIZATION

A. General:

1. All lines, mains and branches shall be sterilized by chlorination in accordance with AWWA C601 and as herein specified. Chlorine shall be a 1% solution (containing 10,000 parts per million available chlorine) or shall be obtained by use of dry chlorine in tablet form firmly attached to interior walls of the pipe.

2. The weight of chlorine or chlorine compound required to make a 1% chlorine solution is as follows:

Product	Amount of Compound	Quantity. of Water (Gallons)

High-test calcium Hypochlorite (65-70% C1)	1 lb.		7.50
Chlorinated Lime (32-35% C1)	2 lb.		7.50
Liquid Laundry Bleach (5.25% C1)	1 Gallon	4.25	
Liquid Chlorine (100% available chlorine)	0.62 lb.		7.50

3. The required concentration of chlorine in the pipe is 50 parts per million. This concentration may be attained by adding 5 gallons of the chlorine solution to 1,000 gallons of water.

4. The required concentration of chlorine in the mains may be obtained by the use of HTH tablets produced by Olin Mathieson in the following quantities:

HTH TABLE (70%) DOSAGE
Number of Tablets per Length of Pipe

	Diameter of Pipe				
Length of Section	4"	6"	8"	10"	12"
13'	1	2	3	3	5
18'	1	2	3	5	6
20'	1	2	3	5	7
30'	2	3	5	7	10
36'	2	3	5	8	12
40'	2	4	6	9	14
100'	4	9	15	23	30

B. Liquid chlorine solution method: All foreign matter shall be flushed from mains, branch runs, hydrant runs, and installed services. Liquid chlorine solution shall be introduced at appropriate locations to assure uniform distribution through the facilities at the proper concentration. Install copper service lines shall not be used to convey the concentrated solution to the mains. The sanitizing solution shall be retained in the facilities for a period of 24 hours after which each service, hydrant run, branch run and dead end shall be flushed until the residual chlorine is less than one part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

C. HTH tablet method: Tablets shall be fastened to the inside top surface of each length of pipe using hot tar of "Permatex No. 1" at time of pipe laying. Tablets shall not be available at any time for casual pilferage by the general public or by children. The new facilities are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run, and installed service. Water shall be retained for a period of 24 hours, after

which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

D. Bacteriological testing:

1. Samples shall be gathered and tests conducted at the Contractor's expense by a laboratory acceptable to Owner's Representative. Samples are to be taken at representative points as required by the Owner's Representative.

2. The new facilities shall remain isolated and out of service until satisfactory test results have been obtained which meet the requirement of the California Department of Public Health and until the Engineer has accepted the results as indicative of the bacteriological condition of the facilities. If unsatisfactory or doubtful results are obtained from the initial sampling, the chlorination process shall be repeated until acceptable test results are reported.

END OF SECTION 33 10 00

SECTION 33 40 00 - STORM DRAINAGE UTILITIES

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Storm drain pipe and appurtenances.

2. Concrete inlet and outlet structures, manholes, and miscellaneous drainage structures.

B. Related work in other Sections:

1. Trenching, Backfilling and Compacting: Section 31 23 33.

2. Piped Utilities: Section 33 00 00.

1.02 QUALITY ASSURANCE

A. Reference Standards: Applicable provisions of the following govern the work of this Section.

1. American Association of State Highways and Transportation Officials (AASHTO), M36.

2. American Society for Testing and Materials (ASTM):
   a. A74: Cast Iron Soil Pipe and Fittings.

   b. A615: Deformed and Plan Billet-Steel Bars for Reinforcement.

   c. B32: Solder Metal.

   d. C76: Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

   e. C150: Portland Cement.

   f. C478: Precast Reinforced Concrete Manhole Sections.

   g. C700: Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.

   h. D3030: Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.

3. California Department of Transportation (CDT), Standard Specifications: Sections 51, 52, 55, 66, 70, 72, 75 and 90.

1.03 SUBMITTALS

A. Submit the following:

1. Submit product data for drainage piping specialties.

2. Submit shop drawings for pre-cast concrete storm drainage manholes, catch basins, and cleanout boxes, including frames, covers, and grates.

2.00 PRODUCTS

2.01 REINFORCED CONCRETE PIPE (RCP)

A. Reinforced Concrete Pipe: ASTM C76 with tongue-and-groove or bell-and-spigot joints. Unless indicated otherwise on the Drawings, reinforced concrete pipe shall be of Class shown on the Drawings, 1350-D pipe. Joint grout shall conform to Section 65 of CDT Standard Specifications.

2.02 ASBESTOS-CEMENT PIPE (ACP)

A. Asbestos-cement storm drain pipe: Asbestos-Cement pipe is NOT allowed on this project.

2.03 CAST IRON PIPE (CIP)

A. Cast Iron Pipe and fittings: ASTM C74. Joints shall be rubber-gasket bell-and-spigot type.

2.04 POLYVINYL CHLORIDE PIPE (PVC)

A. Polyvinyl chloride pipe and fittings: ASTM D3034, SDR 35 with bell-and-spigot type rubber-gasket joints.

2.05 VITRIFIED CLAY PIPE (VCP)

A. Vitrified clay pipe fittings: ASTM C700, extra strength.

2.06 MANHOLES AND CATCH BASINS

A. Precast drainage structures: Section 70-1.02H of the CDT Standard Specifications and ASTM C478 and of size and shape indicated. Equivalent cast-in-place structures may be used at Contractor's option.

B. Frames and covers: Cast iron conforming to Section 55-2.03 and 75.1.02 of the CDT Standard Specifications. Manhole covers shall have 24" clear opening with the words STORM SEWER in letters not less than 2" high cast into the cover (except where grated covers are shown on the Drawings).

C. Grates for catch basins shall have reticulin bars suitable for use in area with bicycle and pedestrian traffic, ½" maximum gaps perpendicular to flow of traffic.

2.07 FILTER FABRIC

A. One of the following:

1. Mirafi 140N.
2. Typar 4 oz.
3. True Tex MG-100.
4. Bidim C-22.

2.08 PAINT

A. For exterior galvanized metal:

1. First coat: Zinc dust, zinc oxide primer house and trim paint.

2. Second coat: Type and color to match existing building walls and/or trim where applicable.

B. For exterior ungalvanized metal:

1. First coat: Rust Block primer.

2. Second coat: House and trim paint, type and color to match existing building walls and/or trim where applicable.

2.09 PORTLAND CEMENT CONCRETE

A. Concrete: Class A concrete conforming to Section 90 of the CDT Standard Specifications.

B. Cement: Type II cement conforming to ASTM Designation C150 as modified by Section 90 of the CDT Standard Specifications.

C. Aggregate: ¾" maximum size conforming to Section 90 of the CDT Standard Specifications.

D. Water: Clear and free from injurious amounts of oil, acid, alkali, organic matter or other deleterious substances.

E. Reinforcing bars: ASTM A615, intermediate grade, and deformed in accordance with Section 52 of the CDT Standard Specifications.

F. No admixtures will be allowed without Owner's Representative approval.

3.00 EXECUTION

3.01 PIPE INSTALLATION

A. Install in conformance with Section 33 00 00, Piped Utilities.

3.02 CAST-IN-PLACE CONCRETE

A. Mix concrete in accordance with standards for class B concrete per Section 90 of the CDT Standard Specifications.

B. Construction of concrete structures shall conform to applicable provisions of Section 51 of the CDT Standard Specifications. Unless noted otherwise in these Specifications, exposed surfaces of structure shall have Class 1 surface finish.

C. Curing shall conform to applicable portions in Section 90 of the CDT Standard Specifications. No pigment shall be used in curing compounds.

D. Work is subject to inspection. No concrete shall be placed until the Owner's designated representative has approved the forms and reinforcement.

END OF SECTION 33 40 00