PROJECT MANUAL

Volume 3 of 3
New Elementary School Construction Project
Technical Specifications
Divisions 2 through 16

ROOSEVELT II (HENRY) ELEMENTARY SCHOOL
NEW ELEMENTARY SCHOOL CONSTRUCTION PROJECT
(BID NO. F09-02 RE-BID)

1250 West 14th Street, San Bernardino, CA 92411

BID ISSUANCE SET

OWNER
SAN BERNARDINO CITY UNIFIED SCHOOL DISTRICT
777 North F Street, San Bernardino, CA 92410

ARCHITECT
PSWC GROUP
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CONSTRUCTION MANAGER
VANIR CONSTRUCTION MANAGEMENT, INC.
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RE-BID #F09-02 ROOSEVELT II (HENRY) E.S.

NEW CONSTRUCTION BID ISSUANCE SET 12/09/11

SECTION 00007

SEALS

DSA APPLICATION NO. 4-107199 **DSA FILE NO.** 36-55

ARCHITECT:

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BY: _____
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REGISTERED PROFESSIONAL ENGINEER
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STATE OF CALIFORNIA
License fee due 3-31-2000

BY: _____
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BY: _____
PETER A. KRAUT

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICES
04 107199
AC MF FLS NUTAN PATEL SS
DATE DEC 21 2007

ACS: M. Fennell
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Bid Issuance Set

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STATE OF CALIFORNIA

BY: _____

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DIV. OF THE STATE ARCHITECT
OFFICE OF REGULATION SERVICES

04 107199

AC MF FLS SS

DATE DEC 21 2007

Bid Issuance Set

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Geotechnical Investigation Report, dated March 5, 2007, by Converse Consultants

Water Service Atlas Maps

Mitigation Monitoring Report Program (CEQA Negative Declaration Requirements)

Southern California Edison Electrical Service Plan

SECTION 02230

SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

C. Removal of concrete and asphaltic concrete paving.

1.02 RELATED REQUIREMENTS

A. Section 01320 - Field Engineering.

B. Section 01500 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01570 - Storm Water Pollution Prevention Plan.

D. Section 02310 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

E. Section 02316 - Fill and Backfill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Vegetation removal limits.
   2. Areas for temporary construction and field offices.

1.04 QUALITY ASSURANCE

A. Clearing Firm: Company specializing in the type of work required.
   1. Minimum of three years of documented experience.

1.05 PROJECT CONDITIONS

A. Minimize production of dust due to clearing operations; use water if it does not result in flooding, sedimentation of public waterways or storm sewers, or other pollution. Comply with local building ordinances.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 02310 - Grading

PART 3 EXECUTION

3.01 SITE CLEARING

A. Comply with other requirements specified in Section 01700.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.02 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies and District; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.03 VEGETATION

A. Scope: Scarify ground to remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds. Scarify ground to 12 inches below grade and remove all deep root systems.

B. When and as directed by the Architect or Geotechnical Engineer, stockpile selected stripped soil materials for subsequent use in landscaping work.

C. Do not begin clearing until vegetation to be relocated has been removed.

D. Do not remove or damage vegetation beyond the limits indicated on drawings.
   1. 10 feet (3.1 m) each side of surface walkways, patios, surface parking, and utility lines less than 12 inches (305 mm) in diameter.
   2. 15 feet (4.6 m) each side of roadway curbs and main utility trenches.
   3. Exception: Specific trees and vegetation indicated on drawings to be removed.

E. Install substantial, highly visible fences at least 3 feet (1 m) high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.
   2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   3. Around other vegetation to remain within vegetation removal limits.
   4. See Section 01500 for fence construction requirements.

F. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

G. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
   2. Sod: Re-use on site if directed by the Architect or District; if not re-used, treat as specified for other vegetation removed.
   3. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

H. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.

I. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to District.
   1. All existing A.C. paving, concrete walkways, etc. indicated on the drawings to be removed shall be saw-cut at the extent of removal. All over saw-cut lines, chips at saw-cut areas shall be filled in with non-shrink grout. Where there are chips or cracks at saw-cut areas greater than 3 inches square, the Contractor must saw-cut to the next concrete joint line or minimum 12 inches beyond the last saw-cut line.

J. Regardless of what extent of removal for concrete walkways as indicated on the drawings, saw-cutting shall be done along an existing control or weaken joint. This means if 20 feet of concrete is to be removed and the nearest control or weaken joint is 22 feet away, then 22 feet of concrete must be removed in the event there are no control or weaken joints existing. Obtain approval from the Architect prior to commencement of said work.

3.04 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

3.05 OFFSITE WORK

A. Clean haul roads on and off site to a distance of three miles from the site or as directed by the Architect and or resident inspector.

B. "Clean" herein refers to properly remove dirt clods, flocks, tree branches and other items which may fall off the hauling equipment or be "tracked" off the site.

END OF SECTION

SECTION 02310

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures and building pads.

C. Topsoil and finish grading.

1.02 RELATED REQUIREMENTS

A. Section 02230 - Site Clearing.

B. Section 02315 - Excavation.

C. Section 02316 - Fill and Backfill: Filling and compaction.

D. Section 02910 - Landscaping.

E. Section 02915 - Irrigation System.

1.03 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.04 QUALITY ASSURANCE

A. Perform Off-site Street Improvement Work in accordance with State of California, Highway Department (CALTRANS) standards.

1.05 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, and other features to remain as a portion of final landscaping.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: See Section 02316.

B. Other Fill Materials: See Section 02316.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Notify utility company to remove and relocate utilities.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Section 02316 for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL and STOCKPILING

A. Stockpile topsoil to be re-used on site; remove remainder from site.

B. Stockpile subsoil to be re-used on site; remove remainder from site.

C. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 12 inches (304 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 12 inches (304 mm).

E. Place topsoil in areas indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil to thickness indicated.

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants and buildings spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Roll placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 0.10 foot (1-3/16 inches) (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 0.04 foot (1/2 inch) (13 mm).

C. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.

D. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

3.07 FIELD QUALITY CONTROL

A. See Section 02316 for compaction density testing.

3.08 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02315

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Soil removal from surface of site.

B. Section 02310 - Grading: Grading.

C. Section 02316 - Fill and Backfill: Fill materials, filling, and compacting.

1.03 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

B. Protect plants, lawns, and other features to remain.

C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

1.04 REFERENCES

A. California Building Code (CBC), Part 2, Chapter 18 - Foundation and Retaining Walls.

B. California Building Code (CBC), Part 2, Chapter 33 - Sitework, Demolition and Construction.

C. Geotechnical Investigation Report No. 04-81-156-03, dated November 20, 2006, by Converse Consultants, 10391 Corporate Drive, Redlands, CA, 909-796-7675.

1.05 SUBMITTALS

A. Test and Inspection Reports.
   1. In accordance with Section 01400, submit Verified Report complying with CBC, Section 3301.

1.06 PROJECT CONDITIONS

A. Dust Control:
   1. Use all means necessary to control dust on and near the work, and on and near off-site borrow areas.
   2. Thoroughly moisten surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

B. Protection:
   1. Comply with CBC, Section 3303, Protection of Pedestrians During Construction or Demolition.
   2. Provide and maintain planking and protection for walks, curbs, drains, and trees and boxing around corners of building walls to prevent damage by trucking, grading, and other operations.
   3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
   4. Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
   5. Keep adjacent streets and drives clean of any dirt created by earthwork operations.

C. Underground Utilities: Buried utility lines may exist. If such are encountered, notify Architect and follow his direction for preservation, relocation or demolition or as indicated on the drawings.
   1. Cooperate with District and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
   2. Do not interrupt existing utilities serving facilities occupied and used by District or others, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided or notify the District and Architect 72 hours prior to any utility disconnect or disconnection. If Contractor fails to give 72 hours notice to the District and Architect and disconnects that portion or all portions of the utilities servicing the existing facilities which causes downtime and damage to the existing facilities, the Contractor shall pay for all downtime and damages incurred for failure of notification.
   3. Contractor shall give 72 hour advanced notification of disconnection of any or all utilities to District and Architect, and the length of time of disconnection. If disconnection of any utility shall extend longer than a 24 hour period, the Contractor shall provide temporary utilities for said utility disconnected for said time of disconnection.
   4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

D. Use of Explosives:
   1. The use of explosives will not be permitted.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 02310 for additional requirements.

C. Locate, identify, and protect utilities that remain and protect from damage.

3.02 EXCAVATING

A. In all excavation work, conform with requirements contained in Geotechnical Investigation Report.

B. Underpin adjacent structures which may be damaged by excavating work. Comply with CBC Section 3301, Protection of Adjoining Property.

C. Excavate to accommodate new structures and construction operations. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and inspection. In excavating for footings and foundations, do not disturb bottom of excavation. Hand trim to final grade just before concrete is placed.

D. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

E. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces. Comply with applicable codes, regulations, and local building ordinances. Maintain shoring and bracing in excavations regardless of time period excavations will be open.

F. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.

G. Do not interfere with 45 degree bearing splay of foundations.

H. Cut utility trenches wide enough to allow inspection of installed utilities. Excavate bottom of trenches uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim using a laser level, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe.

I. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; over-excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction from the Architect. Correction of over-excavation work shall be performed by the Contractor at his own expense.

J. Grade top perimeter of excavation to prevent surface water from draining into excavation.

K. Remove excavated material that is unsuitable for re-use from site.

L. Dewatering:
   1. Dewatering for structures and pipelines shall commence when water is first encountered and shall be continuous until such time as excavation is dry enough to continue operations.
   2. No concrete footings, floor or pipes shall be laid in water, nor shall water be allowed to rise over them until the concrete or mortar has set at least eight hours, unless otherwise directed by the Architect.
   3. Water shall not be allowed to rise around pipes until jointing compound in the joints has set hard and there is no danger of flotation.
   4. Dispose of the water from the Work in a suitable manner without damage of adjacent property. No water shall be drained into Work built or under construction. Water shall be disposed of in such a manner as to not be a nuisance or a menace to public health and safety.

M. Stockpile excavated material to be re-used in area designated on site in accordance with Section 02310 or as directed by the Architect. Place, grade and shape stockpiles for proper drainage.

N. Remove excess excavated material from site unless otherwise directed by the Architect.

3.03 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

END OF SECTION

SECTION 02316

FILLING AND BACKFILLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, site structures, and utilities within the building.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Site grading.

B. Section 02315 - Excavation: Removal and handling of soil to be re-used.

C. Section 03300 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.

B. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2000a.

C. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.

D. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

E. California Building Code (CBC), Part 2, Chapter 18A - Foundation and Retaining Walls.

F. California Building Code (CBC), Part 2, Chapter 33A - Sitework, Demolition and Construction.

G. Geotechnical Investigation Report No. 04-81-156-03, dated November 20, 2006, by Converse Consultants, 10391 Corporate Drive, Redlands, CA, 909-796-7675.

1.04 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Indicated on drawings.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary and approved by the District, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.

3. Protect stockpiles from erosion and deterioration of materials.

C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Natural material used for structural backfill may be selected from the excavation but must be accepted as satisfactory backfill material by the Geotechnical Engineer. No unacceptable material shall be used in fills.

B. General Fill: Subsoil excavated on-site.
1. Graded.
2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
3. Conforming to ASTM D 2487 Group Symbol CL.

C. Concrete for Fill: Lean concrete.

D. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
1. Grade in accordance with ASTM D 2487 Group Symbol GM.

E. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
1. Grade in accordance with ASTM D 2487 Group Symbol SW.

F. Topsoil: Friable loam; imported borrow.
1. Select.
2. Graded.
3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
4. Conforming to ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 02310 for additional requirements.

C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

D. Verify structural ability of unsupported walls to support imposed loads by the fill.

E. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.

3.02 PREPARATION

A. Scarify subgrade surface to a depth of 8 inches (203 mm) to identify soft spots.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

A. Conform to Geotechnical Report. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Acceptance by Geotechnical Engineer and/or District Inspector of construction below finish grade including, where applicable, damp proofing, water-proofing, and perimeter insulation.
   2. Inspection, testing, approval, and recording locations of underground utilities.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
   5. Removal of trash and debris.
   6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Fill to contours and elevations indicated using accepted materials.

C. Fill up to subgrade elevations unless otherwise indicated.

D. Employ a placement method that does not disturb or damage other work.

E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

F. Maintain optimum moisture content of fill materials to attain required compaction density. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
   1. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   2. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing, until moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.

H. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

I. Slope grade away from building minimum 2 1/2 inches in 10 ft (63.5 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

J. Correct areas that are over-excavated.
   1. Corrective work shall be at the Contractor's expense.
   2. Load-bearing foundation surfaces: Fill with concrete or as directed by the Structural Engineer.
   3. Other areas: Use general fill, flush to required elevation, compacted to minimum 90 percent of maximum dry density.

K. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under slabs-on-grade and similar construction: 90 percent of maximum dry density.
   2. Under paving: 95 percent of maximum dry density.
   3. At other locations: 90 percent of maximum dry density.

L. Reshape and re-compact fills subjected to vehicular traffic.

3.04 FILL AND COMPACTION AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Under Interior Slabs-On-Grade:

1. Use granular fill.
2. Depth: 6-inches (100 mm) deep.
3. Compact to 90 percent of maximum dry density.
4. Cover with sand.
   a. Depth: 4 inches (102 mm).
   b. Compact to 90 percent of maximum dry density.

C. At Foundation Walls and Footings:
1. Use general fill.
2. See Geotechnical Report Design Parameters.
3. Do not backfill against unsupported foundation walls.
4. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

D. Over Subdrainage Piping at Foundation Perimeter and Under Slabs:
1. Drainage fill and geotextile fabric: Section 02620.
2. Cover drainage fill with general fill.
3. Fill up to subgrade elevation.
4. Compact to 90 percent of maximum dry density.

E. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
1. Bedding: Use sand.
2. Cover with sand to six inches above top of pipe, conduit or duct bank.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch (200 mm) lifts to 90 percent of maximum dry density.

F. Inside Planter Boxes:
1. Use granular fill, 4 inches (100 mm) deep.
2. Cover with geotextile fabric.
3. Cover with sand, 2 inches (50 mm) deep.
4. Finish with topsoil, to within 2 inches (50 mm) of planter rim, lightly tamped.

G. At Lawn Areas:
1. Compact subsoil to 90 percent of its maximum density before placing fill.
2. Use topsoil.
3. Fill up to finish grade elevations.
4. Compact to 90 percent of maximum dry density.
5. See Section 02310 for topsoil placement.

H. At Planting Areas Other Than Lawns:
1. Use topsoil.
2. Fill up to finish grade elevations.
3. Compact to 90 percent of maximum dry density.
4. See Section 02310 for topsoil placement.

I. At French Drains:
1. Use granular fill.
2. Fill up to 8 inches (200 mm) below finish grade.
3. Compact to 90 percent of maximum dry density.

J. Under Exterior Concrete Paving:
1. Compact subsoil to 90 percent of its maximum dry density before placing fill.
2. Use 4-inch layer of sand at exterior slabs-on-grade and walkways.
3. Fill up to four inches (102 mm) below finish paving elevation unless noted otherwise on the drawings.
4. Compact to 90 percent of maximum dry density.
5. Use granular fill at exterior slabs intended for vehicular traffic.
6. Fill up to five inches below finish paving elevation unless noted otherwise on the drawings.
7. Compact to 90 percent of maximum dry density.

K. Under Monolithic Asphalt Concrete Paving:
   1. See Geotechnical Report Design Parameters.
   2. Fill up to subgrade elevation.
   3. Maximum compacted depth of each lift: 8 inches (200 mm).
   4. Compact to 95 percent of maximum dry density.

3.05 TOLERANCES

A. Top of Surfaces Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
   1. Grassed Areas: Finish areas to within not more than one (1) inch above or below the required finish grade elevations.
   2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than one-half (1/2) inch above or below the required subgrade elevation. Slope all drainage away from building.
   3. Concrete Pavements: Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than one-half (1/2) inch above or below the required subgrade elevation.
   4. Asphalt Concrete Pavement: Finish area to the minimum depth of the sub-base to be applied as indicated on the drawings or in these specifications.
   5. Planting Areas: Finish areas to six inches below finish grade elevations as shown to receive topsoil.

B. Top of Surface or Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/4 inch when tested with a 10 foot straight edge.

3.06 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.

B. Subgrades and fill layers will be inspected by the Geotechnical Engineer before further construction work is performed. Test of subgrades and fill layers will be performed as follows:
   1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Architect.
   2. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 2000 sq. ft. of paved areas or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2000 sq. ft. of overlaying building slab or paved area, but in no case less than three tests.
   3. Foundation Wall Backfill: Take at least two field density tests, at locations and elevations as directed.

C. If subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no additional cost to the District. Provide corrective work at the direction of the Geotechnical Engineer.

D. Compaction density testing will be performed on compacted fill in accordance with ASTM D 1556.

E. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 1557 ("modified Proctor").

F. Proof roll compacted fill at surfaces that will be under slabs-on-grade and paving.

3.07 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

1. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances and to include weathering of the soil. The depth of removal and recompaction shall be determined by the Geotechnical Engineer and Architect.

B. Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.08 CLEAN-UP

A. Surplus excavated materials shall be disposed of off-site, except approved excavation material which may be used for mounding, top soil, or other conditions approved by the Geotechnical Engineer and Architect.

B. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 02317

TRENCHING FOR SITE UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Trenching, backfilling and compacting for utilities and storm drains outside the building to utility main connections or specified Points of Connection (P.O.C.).

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Site grading.

B. Section 02315 - Excavation: Building and foundation excavating.

C. Section 02316 - Fill and Backfill: Backfilling at building and foundations.

D. Section 15145 - Plumbing Piping.

1.03 REFERENCES

A. Geotechnical Investigation Report No. 04-81-156-03, dated November 20, 2006, by Converse Consultants, 10391 Corporate Drive, Redlands, CA, 909-796-7675.

B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

C. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

D. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2006.

E. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

G. ASTM D 5268 - Standard Specification for Topsoil Used for Landscaping Purposes; 2007.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

C. Verify that survey bench marks and intended elevations for the Work are as indicated.

D. Protect plants, lawns, rock outcroppings, and other features to remain.

E. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. General Fill: Subsoil excavated on-site.
   1. Graded.
   2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
   3. Conforming to ASTM D2487 Group Symbol CL.

B. Concrete for Fill: Lean concrete, 2500 psi minimum.

C. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
   1. Grade in accordance with ASTM D2487 Group Symbol GW.

D. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
   1. Grade in accordance with ASTM D2487 Group Symbol SW.

E. Topsoil: Friable loam; imported borrow.
   1. Select.
   2. Graded.
   3. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
   4. Conforming to ASTM D2487 Group Symbol OH.

2.02 SOURCE QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Excavate bottom of trenches uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim using a laser level, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe.

G. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.

H. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.

I. Remove excavated material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site.

K. Remove excess excavated material from site.

3.03 PREPARATION FOR UTILITY AND DRAIN PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.04 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Employ a placement method that does not disturb or damage other work.

C. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

D. Maintain optimum moisture content of fill materials to attain required compaction density.

E. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.

F. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

G. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.

H. Compaction Density Unless Otherwise Specified or Indicated:
   1. 95 percent of maximum dry density.

I. Reshape and re-compact fills subjected to vehicular traffic.

3.05 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Use general fill unless otherwise specified or indicated.

B. Utility Piping, Conduits, Duct Bank,, and storm drains:
   1. Bedding: Use sand, 4-inches deep, minimum.
   2. Cover with sand twelve-inches above top of pipe, conduit, duct bank or drain.
   3. Fill up to subgrade elevation.
   4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.

3.06 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field inspection and testing.

B. Perform laboratory material tests in accordance with AASHTO T 180, Method A.

C. Perform in-place compaction tests in accordance with the following:
   1. Density Tests: ASTM D 2922.
   2. Moisture Tests: ASTM D 3017.
   3. Calibration shall be performed for each nuclear gauge on a weekly basis to confirm the accuracy of nuclear density gauge moisture readings.

D. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor").

E. If tests indicate work does not meet specified requirements, remove work, replace and retest.

F. All compaction tests performed on trench backfill shall be plotted and individually numbered on a set of Record Drawings.

G. Frequency of Tests: Test frequency shall include at least one test per 200 linear feet of trench length and every two feet vertically starting two feet above the pipe, but not less than two tests per trench.

3.07 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

SECTION 02361

SOIL TREATMENT FOR TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 REFERENCE STANDARDS

A. California Code of Regulations (CCR), Title 3, Division 6, "Pesticides and Pest Control Operations".

B. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; United States Code; 1947 (Revised 2001).

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Application Instructions: Indicate caution requirements.

E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

F. Licenses: Submit current Pest Control Business License and Applicator Certificate.

G. Maintenance Data: Indicate re-treatment schedule.

H. Warranty: Submit warranty and ensure that forms have been completed in District's name.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Possess current Pest Control Business license issued by the California Department of Pesticide Regulation.
   2. Approved by manufacturer of treatment materials.
   3. Applicator to possess a current qualified applicator certificate (QAC) issued by the Dept. of Pesticide Regulation.
   4. Comply with requirement of CCR, Title 3, Division 6, Chapters 1 through 4.

1.05 REGULATORY REQUIREMENTS

A. Conform to California regulations for requirements for application and application licensing, and comply with EPA regulations.

B. Provide certificate of compliance from Dept. of Pesticide Regulation indicating approval of toxicants.

1.06 SEQUENCING

A. Apply toxicant immediately prior to installation of vapor barrier under slabs-on-grade.

1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

2.01 MATERIALS

A. Manufacturers:
   1. Bayer Environmental Science Corp; Product Premise 2: www.nobugs.com., Reg. No. 432-1331-AA.
   2. BASF Corporation, Inc.; Product - "Termidor SC", Reg. No. 7969-210-AA.
   3. Dow AgroSciences, LLC.; Product - "Dursban TC" Reg. No. 62719-47-ZB..
   4. Substitutions: See Section 01600 - Product Requirements.

B. Toxicant Chemical: EPA and California approved; synthetically color dyed to permit visual identification of treated soil.

C. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. In Crawl Spaces.
   3. At Both Sides of Foundation Surface.
   4. Soil Within 10 feet (3 m) of Building Perimeter.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 02510 3

WATER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic and irrigation water lines.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

B. Section 02317 - Trenching for Site Utilities: Excavating, bedding, and backfilling.

C. Section 02316 - Fill and Backfill: Bedding and backfilling.

D. Section 02511 - Fire Protection Water Line.

E. Section 02515 - Disinfection of Water Distribution System: Disinfection of site service utility water piping.

F. Section 02535 - Sanitary Sewer Piping.

1.03 REFERENCES

A. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

B. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

C. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

A. PVC Pipe: ASTM D 1785, Schedule 80.
   1. Fittings: ASTM D 2466, PVC.
   2. Joints: ASTM D 2855, solvent weld.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Valves Up To 3 Inches (75 mm): SBMWD standard.

2.03 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 02317.

B. Cover: As specified in Section 02317.

2.04 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

B. Backflow Preventer: San Bernardino Municipal Water Department (SBMWD) Standard Drawing No. W4.1.

C. Irrigation and Domestic Water Meters: SBMWD St'd. Dwg. No. W1.15.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. See Section 02317 for additional requirements.

C. Hand trim excavation for accurate placement of pipe to elevations indicated.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Install water distribution system in accordance with SBMWD St'd. Dwg. No. W1.4.

B. Maintain separation of water main from sewer piping in accordance with CPC code.

C. Group piping with other site piping work whenever practical.

D. Install pipe to indicated elevation to within tolerance of 5/8 inches (20 mm).

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Install access fittings to permit disinfection of water system performed under Section 02515.

H. Slope water pipe and position drains at low points.

I. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 02317.

3.05 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.06 SERVICE CONNECTIONS

A. Provide water service to SBMWD requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

3.07 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.

END OF SECTION

SECTION 02511 3

FIRE PROTECTION WATER LINE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe and fittings for site water lines including fire water lines.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete for thrust restraints.

B. Section 02317 - Trenching for Site Utilities: Excavating, bedding, and backfilling.

C. Section 02316 - Fill and Backfill: Bedding and backfilling.

D. Section 02510 - Water Distribution.

E. Section 02515 - Disinfection of Water Distribution System: Disinfection of site service utility water piping.

F. Section 02535 - Sanitary Sewer Piping.

1.03 REFERENCES

A. ASTM D 1784 - Standard Specificaiton for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (PVC) Compounds.

B. ASTM D 1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2006.

C. ASTM D 2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2006.

D. ASTM D 2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2002).

E. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 1998 (Reapproved 2005).

F. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

G. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; American Water Works Association; 2009.

H. AWWA C605 - Underground Installation of PVC Pressure Pipe and Fittings for Water.

I. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution; American Water Works Association; 2007 (ANSI/AWWA C900/C900a).

J. UL 246 - Hydrants for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with San Bernardino Municipal Water Department (SBMWD) requirements.
   1. Provide fire service up to site Point of Connection (P.O.C.) at Double Check Detector Check Assembly (DCDCA) in accordance with SBMWD Standard Drawing Nos.W1.14, W1.15, W3.5, W3.7, and W6.16 as shown on the civil drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Polyvinyl Chloride (PVC) Pipe: ASTM D 1785, Schedule 80.
   1. Fittings: ASTM D 2466, PVC.
   2. Joints: ASTM D 2855, solvent weld.

B. Polyvinyl Chloride (PVC) Pipe: AWWA C900, Class 200 DR14
   1. PVC compound to meet ASTM D 1784, cell class 12454.
   2. Elastomeric Seal: Integral bell pipe provided with factory-installed gaskets meeting requirements of ASTM F 477.
   3. Gasket Joint Assembly: Meet requirements of ASTM D 3139.
   4. Product:
      a. AWWA C900 Blue Brute by JM Eagle Manufacturing Co., Inc., Los Angeles, CA.
      b. PVC C900 High Pressure Water Pipe by PW Eagle, Eugene, OR.

C. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Water Service " in large letters.

2.02 FITTINGS

A. Polyvinyl Chloride (PVC) Fittings:
   1. PVC compound to meet ASTM D 1784.
   2. Gasket Joint Assembly: Meet requirements of ASTM D 3139.
   3. Gaskets: ATM F 477.
   4. Wall Thickness: SDR-21.
   5. Pressure Rating: 200 psi.
   6. Product:
      a. Harco PVC Gasketed Fittings by Harrington Corporation, Lynchburg, Virginia.

2.03 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves Up To 3 Inches (75 mm):
   1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, post indicator, valve key, and extension box.

C. Gate Valves 3 Inches (75 mm) and Over:
   1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends, control rod, post indicator, valve key, and extension box.

2.04 HYDRANTS

A. Hydrants: Type as required by SBMWD St'd. Dwg. No. W2.2, see civil drawings.

B. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.

C. Hose and Streamer Connection: Match sizes with SBMWD, two hose nozzles, one pumper nozzle.

D. Finish: Primer and two coats of enamel in color required by SBMWD.

2.05 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 02317.

B. Cover: As specified in Section 02317.

2.06 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03300.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. See Section 02317 for additional requirements.

C. Hand trim excavation for accurate placement of pipe to elevations indicated.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Comply with AWWA C605, Underground Installation of PVC Pressure Pipe and Fittings for Water.

B. Maintain separation of water main from sewer piping in accordance with CPC code.

C. Group piping with other site piping work whenever practical.

D. Install pipe to indicated elevation to within tolerance of 5/8 inches (20 mm).

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Install access fittings to permit disinfection of water system performed under Section 02515.

H. Slope water pipe and position drains at low points.

I. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 02317.

3.05 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway.

D. Set hydrants to grade, with nozzles at least 20 inches (500 mm) above ground.

E. Locate control valve 4 inches (100 mm) away from hydrant.

F. Paint hydrants in accordance with Section 09900.

3.06 SERVICE CONNECTIONS

A. Provide fire protection water service to utility company requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

3.07 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.

END OF SECTION

SECTION 02515 3

DISINFECTION OF WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disinfection of existing and/or new building domestic water piping as required by the work of this Contract.

B. Testing and reporting results.

1.02 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites; American Water Works Association; 2010 (ANSI/AWWA B300).

B. AWWA B301 - Liquid Chlorine; American Water Works Association; 2004 (ANSI/AWWA B301).

C. AWWA B302 - Ammonium Sulfate; American Water Works Association; 2005 (ANSI/AWWA B302).

D. AWWA B303 - Sodium Chlorite; American Water Works Association; 2005.

E. AWWA C651 - Disinfecting Water Mains; American Water Works Association; 2005 (ANSI/AWWA C651).

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Test Reports: Indicate results comparative to specified requirements.

C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.

D. Disinfection report:
1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

E. Bacteriological report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.
7. Certification that water conforms, or fails to conform, to bacterial standards of authority having jurisdiction.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with AWWA C651.

B. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.

C. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of in the State of California.

PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: AWWA B300, Hypochlorite, AWWA B301, Liquid Chlorine, AWWA B302, Ammonium Sulfate, and AWWA B303, Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping system and water well has been cleaned, inspected, and pressure tested.

3.02 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Provide and attach equipment required to perform the work.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

END OF SECTION

SECTION 02535 3

SANITARY SEWER PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Site sanitary sewerage drainage piping, fittings, and accessories.

B. Connection of building sanitary drainage system to municipal sewers.

C. Cleanout Access.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Concrete for cleanout base pad construction.

B. Section 02317 - Trenching for Site Utilities: Excavating, bedding, and backfilling.

C. Section 02510 - Water Distribution.

D. Section 02511 - Fire Protection Water Line.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

A. ASTM A 74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2009.

B. ASTM C 14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe; 2007.

C. ASTM C 564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2009a.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories.

C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with CBC code.

B. Cast Iron Soil Pipe: ASTM A 74, Service type, inside nominal diameter as shown on the drawings, hubless.

C. Joint Seals for Cast Iron Pipe: ASTM C 564 neoprene gaskets.

D. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

A. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Sewer Service " in large letters.

2.03 CLEANOUTS

A. Vertical riser same material as sanitary pipe.

B. Cleanout: Cast Iron.
   1. Heavy-duty non-adjustable, no-hub, round top.
   2. Size: 8-inch nominal.
   3. Product:
      a. Zurn Z1402 or equal.

2.04 GREASE INTERCEPTOR

A. Grease interceptor with sample box, two manholes extended to grade, designed for direct H-20 loading of manhole extensions.

B. Product:
   1. Model PC-G-1500 as manufactured by Pro-Cast Products, Inc., Highland, CA; 909-793-7602.

2.05 GREASE INTERCEPTOR (CAN WASH)

A Grease interceptor with no-hub connections, flow diffusing baffle, integral trap, and vented inlet flow control device.

B. Product: Zurn GT2700-15 Grease Interceptor.

2.05 BEDDING AND COVER MATERIALS

A. Pipe Bedding Material: As specified in Section 02317.

B. Pipe Cover Material: As specified in Section 02317.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable code(s).

3.02 TRENCHING

A. See Section 02317 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).

D. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

E. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 02317.

3.04

3.05 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.06 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.

3.07 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02551

SITE GAS DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Underground pipe and fittings for natural gas distribution on-site outside buildings.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-in-Place Concrete: Thrust blocks.

B. Section 02317 - Trenching for Site Utilities: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

A. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2011e1.

B. ASTM D 3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

C. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

D. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2009.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents: Record actual locations of pipe mains, valves, connections, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

E. Pressure Tests.

1.05 QUALITY ASSURANCE

A. The supplier must be capable of manufacturing and supplying both the pipe and fittings.

B. The contractor shall have successfully installed high density polyethylene pipe using the butt fusion method on a minimum of ten (10) projects of similar size and complexity.

C. Perform Work in accordance with utility company requirements.

D. Conform to NFPA 54.

1.06 WARRANTY

A. Manufacturer shall provide five (5) year warranty from Date of Substantial Completion against defects in materials or workmanship on pipe and fittings.

B. Contractor shall provide five (5) year warranty from Date of Substantial Completion against defects in workmanship on fusion connections.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store pipe and fittings in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 PIPE

A. Polyethylene Pipe (MDPE)::Pipe material shall be classified in accordance with ASTM D 3350 and have a cell classification of 234373E. Materials listed with Plastic Pipe Institute (PPI) as PE 2406/2708 medium-density polyethylene. Pipe shall be manufactured in accordance with ASTM D 2513.
   1. Butt Fusion Fittings: Fittings shall have Cell Classification of PE 234373E as determined by ASTM D 3350. Butt Fusion Fittings shall have a manufacturing standard of ASTM D 3261. Molded and fabricated fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings shall be manufactured using a McElroy DataLogger. Reference to the McElroy DataLogger Quality Control records should be referenced from an indented stamp in each fusion bead of each fitting. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.
   2. Joints: Butt Fusion Welded.
   3. Product: UAC 2000 MDPE yellow gas pipe as manufactured by JM Eagle, Los Angeles, CA; 800-621-4404.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Natural Gas Service " in large letters.

2.02 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 02317.

B. Cover: As specified in Section 02317.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and utility gas main size, location and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, .

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections for butt fusion.

3.03 TRENCHING

A. See Section 02317 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPING

A. Maintain separation of gas line from sewer piping in accordance with California Plumbing Code.

B. Group piping with other site piping work whenever practical.

C. Butt Fusion Welding: Sections of polyethylene pipe shall be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe supplier's recommendations. The butt fusion equipment used in the joining procedures shall be capable of meeting all conditions recommended by the pipe supplier, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 psi.

D. Route piping in straight line.

E. Install piping to conserve space and not interfere with use of site space.

F. Install piping to allow for expansion and contraction without stressing pipe or joints.

G. Mechanical connection to other types of pipe shall be made by one of the following methods:
   1. Flange, using HDPE flange adapter with ductile iron back-up ring, and zinc-plated bolt pack.
   2. Mechanical joint, using HPPE Mechanical Joint adapter kit.

H. Establish elevations of buried piping to ensure not less than 24 inches (600 mm) of cover in non-travelled areas and 48 inches (1,200 mm) of cover in driveways and parking areas.

I. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 02317.

3.05 SERVICE CONNECTIONS

A. Install service regulator and riser pipe to prevent undue stress upon service pipe.

3.06 FIELD QUALITY CONTROL

A. Record Butt Fusion Detail: All pipe joints shall be butt fused using McElroy fusion equipment. Each McElroy butt fusion unit shall be equipped with a McElroy DataLogger. The contractor shall label each butt fused joint so as it will be recorded on the DataLogger. The DataLogger shall record temperature, fusion pressure, with a graphic representation of the fusion cycle and shall be part of the quality control records. The DataLogger information shall be downloaded weekly and give to the District's representative for quality control records.

B. Perform field inspection and testing in accordance with CPC 1214.3 and NFPA 54: 8.1.4. Submit results of Pressure Test to Architect.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.

END OF SECTION

SECTION 02635

STORM DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to municipal sewers.

C. Catch basins, Plant area drains, Paved area drainage, Site surface drainage, and Manholes.

1.02 RELATED REQUIREMENTS

A. Section 01320 - Field Engineering.

B. Section 02315 - Excavation: Excavating of trenches.

C. Section 02316 - Fill and Backfill: Bedding and backfilling.

D. Section 03300 - Cast-in-Place Concrete: Concrete for base pad construction.

1.03 REFERENCE STANDARDS

A. ASTM A 48 - Standard Specification for Gray Iron Castings.

B. ASTM C 33 - Standard Specification for Concrete Aggregates.

C. ASTM C 139 - Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.

D. ASTM C 387 - Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete.

E. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.

F. ASTM D 638 - Test Method for Tensile Properties of Plastics.

G. ASTM D 790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

H. ASTM D 1505 - Test Method for Density of Plastics by the Density-Gradient Technique.

I. ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.

J. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2011.

K. ASTM D 2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) Plastic Piping Systems.

L. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material.

M. California Building Code (CBC), California Code of Regulations, Title 24, Section 1120A.6.2, Gratings.

1.04 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating pipe, pipe accessories.

C. Shop Drawings: Submit for review of frames, grates, manholes and manhole steps, and catch basins.

D. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Project Record Documents:
   1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for materials and installation of the Work of this section.

1.07 WARRANTY

1.08 PROJECT CONDITIONS

A. Coordinate the Work with termination of storm sewer connection outside building, trenching, connection to foundation drainage system.

PART 2 PRODUCTS

2.01 STORM SEWER PIPE MATERIALS - GENERAL

A. Storm sewer pipe materials shall be manufactured in the U.S.A. Materials not manufactured in the U.S.A. will not be accepted.

2.02 HDPE PIPE

A. HDPE Pipe: High density, high molecular weight, polyethylene pipe made from a polyethylene resin.

	PROPERTY	TEST METHOD	NOMINAL VALUE
1.	Cell Classification:	ASTM D 3350,	345464C
2.	Density:	ASTM D 1505,	0.955 gm/cc
3.	Flexural Modulus:	ASTM D 790,	136,000 psi
4.	Elastic Modulus:	ASTM D 638,	30,000 psi
5.	Tensile Strength:	ASTM D 638	3,500 psi
6.	Hardness:	ASTM D 2240	64 Shore D
7.	Average Molecular Weight:	GPC	330,000

B. Acceptable Manufacturers:
   1. Design of HDPE pipe is based on the use of products manufactured by Polypipe, Inc., Gainsville, TX; 800-433-5632.
      a. Product: PolyPipe PE3408.
   2. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based or the products of the following manufacturer's:
      a. JM Eagle HDPE pipe by JM Eagle, Los Angeles, CA.
      b. DriscoPlex 4000 by Performance Pipe, Plano, TX.

2.03 PIPE ACCESSORIES

A. Solvent cement used to join pipe and fittings shall meet requirements of ASTM D 2564.

B. Trace Wire: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service " in large letters.

2.04 MANHOLES

A. New storm manholes shall be constructed as detailed on the Drawings and be one of the following:

1. Precast reinforced concrete manhole riser sections conforming to ASTM C 478.
2. Cast-in-place concrete of 3000 psi strength. Concrete used for utility structures shall conform to requirements specified in Section 03300.
3. Precast-segmental concrete masonry units conforming to ASTM C 139.

B. Mortar for jointing precast-segmental masonry units and joining sewer to new storm manholes shall be Type S and consist of one part portland cement to one part plaster sand, mixed with the least amount of clean water necessary to provide a workable mortar. Mortar shall meet requirements of ASTM C 387.

C. Concrete Fill for Benching Manhole Structures: Concrete shall be mixed with the least amount of clean water and shall have a minimum strength of 3000 psi and conform to ASTM C 387.

D. Steps for New Storm Sewer Manhole Concrete Structures: Cast iron conforming to ASTM A 48 or hot-dipped galvanized steel bar or as detailed on the drawings. Provide steps on storm manholes where the invert is two feet or more from the bottom of the cast iron frame. All manholes shall be manufactured and installed per local or county codes and regulations. All manhole covers to be flush with grade.

E. Cast Iron Frames, Grates and Covers for Storm Sewer Structures: Gray cast iron castings conforming to ASTM A 48 and be of type and configuration as noted or detailed. All grates and covers shall be painted if located in a concrete walkway. Color as selected by the Architect. Grates openings shall conform to CBC Section 1133B.7.2. Maximum openings within a walkway or paved area shall be 1/2-inch wide in direction of traffic flow.

2.05 CATCH BASIN AND AREA DRAIN COMPONENTS

A. Precast concrete catch basin - Traffic Areas.
1. Concrete shall test 4,000 PSI in 28 days.
2. Catch basin shall be designed for H20 loading and reinforced with 4x4/6-6 welded wire mesh.
3. Catch basin shall be fabricated to job requirements for depth and pipe openings.
4. Cast iron grate, traffic type (H-20), with 1-inch maximum clear openings.
5. Size: 24 inch X 24 inch unless noted otherwise.
6. Product: Model P24 Concrete Catch Basin with Traffic Grate as manufactured by Dura-Drain Custom Concrete, Santa Rosa, CA, 800-579-8819.
   a. Frame and grate hot-dipped galvanized per ASTM A 123.

B. Precast concrete catch basin - Non-traffic Areas:
1. Concrete shall test 4,000 PSI in 28 days.
2. Catch basin shall be designed for H20 loading and reinforced with 4x4/6-6 welded wire mesh.
3. Catch basin shall be fabricated to job requirements for depth and pipe openings.
4. Cast iron grate, non-traffic bicycle proof, linear design with maximum openings of 1/2-inch in direction of traffic flow, complying with CBC, Section 1133B.7.2.
5. Size: 24 inch X 24 inch unless noted otherwise.
6. Product: Model P24 Concrete Catch Basin with Non-Traffic Bicycle Proof Frame and Grate as manufactured by Dura-Drain Custom Concrete, Santa Rosa, CA, 800-579-8819.
   a. Frame and grate hot-dipped galvanized per ASTM A 123.

C. Catch Basin Filters:
1. Provide at all catch basins a multipurpose filter insert designed to capture sediment, debris, trash, oils, and grease from low (first flush) flows.
2. A (dual) high-flow bypass system which allows flows to bypass the device while retaining sediment and larger floatables (debris, and trash) and allows sustained maximum design flows under extreme weather conditions.
   a. Product: FloGuard+Plus as manufactured by KriStar Enterprises, Inc., Santa Rosa, CA.

2.06 BEDDING AND COVER MATERIALS

A. Bedding and Cover Material For Storm Sewer: Well graded crushed gravel, pea gravel or crushed stone, particles ranging between 1/4 inch and 3/4 inch in size. Conform to ASTM C 33 and ASTM Graduation Number 67. See Section 02317.

PART 3 EXECUTION

3.01 TRENCHING

A. See Section 02315 and Section 02316 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Bedding:
   1. Bedding for storm sewers shall be installed a minimum of six inches deep beneath the bottom of pipe to provide a granular cushion between the pipe and the natural soil.
   2. The pipe bedding shall be placed so that the entire length of the pipe will have full bearing. No blocking of any kind shall be used to adjust the pipe to grade except when used with granular bedding.
   3. Bedding backfill shall continue to a minimum of six inches on top of pipe, for final trench backfill.

C. Install pipe, fittings, and accessories in accordance with ASTM D 2321 and manufacturer's instructions. Seal joints watertight.

D. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 10 feet (3 m).

E. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

F. Make connections through walls through sleeved openings, where provided.

G. Connect to building storm sewer outlets, through installed sleeves.

H. Install continuous trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 02317.

3.03 INSTALLATION - PRECAST CATCH BASINS AND AREA DRAINS

A. Conform to details shown on the drawings.

B. Form bottom of excavation clean and smooth to correct elevation.

C. Set precast unit with provision for storm sewer pipe end sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Secure top section to elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01400.

B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to District.

C. Pressure Test: Test in accordance with local authority having jurisdiction.

3.05 CLEANING AND PROTECTION

A. At the completion of the work and prior to District's final acceptance, all sediment and debris shall be removed from all storm sewers and their structures.

B. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 02741

BITUMINOUS CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.

B. Prime Coat and Tack Coat.

C. Single course bituminous concrete paving.

D. Double course bituminous concrete paving.

E. Headers and accessories.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Preparation of site for paving and base.

B. Section 02316 - Fill and Backfill: Compacted subgrade for paving.

C. Section 02765 - Pavement Markings.

D. Section 02881 - Playground Equipment.

1.03 REFERENCES

A. AASHTO T 30 - American Association of State Highway and Transportation Officials.

B. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

C. ASTM D 692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.

D. ASTM D 979 - Standard Practice for Sampling Bituminous Paving Materials.

E. ASTM D 995 - Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving.

F. ASTM D 1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.

G. ASTM D 1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

H. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

I. Caltrans Standard 375 - Determining the In-place Density and Relative Compaction of Asphalt Concrete Pavement, 2003.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with State of California Standard Specifications for Public Works Construction (Standard Specifications), 2002 Edition.

B. Mixing Plant: Bulk asphaltic concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete. Comply with ASTM D 995.

C. Provide asphalt under Caltrans "Certification Program for Suppliers of Asphalt". Supplier shall be a currently approved supplier.

D. "Certificates of Compliance" shall accompany each shipment of asphalt to project site. Certificates shall include: shipment #; type of material; SG; refinery; consignee; destination; quantity; PO #; date; and statement of compliance. Certificates shall be submitted to Inspector of Record (I.O.R.).

E. Obtain materials from same source throughout.

1.05 SUBMITTALS

A. Product Data: For proprietary products, submit complete manufacturer's description literature and specifications in accordance with the provisions of Section 01300.
   1. Materials List: Submit complete lists of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.
   2. Manufacturer's Recommendations: Submit the manufacturer's current recommended methods of installation, including relevant limitations, safety and environmental cautions, and application rates.

B. Test Reports: Submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the Work of this Section.

C. Mixes: Submit asphaltic concrete mix design formula.

D. Certificates: Submit certificate signed by the asphalt concrete manufacturer, that paving materials conform to specification requirements.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable state and local codes for off-site street improvement paving work.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.

B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Cement Binder:
   1. Caltrans Performance Graded PG 64-10 conforming to Standard Specification, Section 92, "Asphalts".

B. Aggregate Base:
   1. Sound, angular crushed stone, crushed gravel, or crushed slag, and sand, stone or slag screenings conforming to Standard Specification, Section 26, "Aggregate Bases".
   2. Gradation: 3/4-inch Class 2 Aggregate Base.

C. Aggregate for Binder Course: Standard Specification, Section 39, "Hot Mix Asphalt", 1/2-inch Maximum Medium Type B aggregate, Angular crushed washed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with Section 39, within the following limits:
      a. 3/4-inch sieve: 100 percent passing.
      b. 1/2-inch sieve: 95-99 percent passing. TV +/- 6.
      c. 3/8-inch sieve: 75-95 percent passing. TV +/- 6.
      d. No. 4 sieve: 55-66 percent passing. TV +/- 7.
      e. No. 8 sieve: 38-49 percent passing. TV +/- 5.
      f. No. 30 sieve: 15-27 percent passing. TV +/- 4.
      g. No. 200 sieve: 2-8 percent passing. TV +/- 2.

D. Aggregate for Binder Course at Playground and Sports Court areas: Standard Specification, Section 39, "Hot Mix Asphalt", 3/8-inch Maximum Medium Type B aggregate, angular crushed washed stone; free of shale, clay, friable material and debris.
   1. Graded in accordance with Section 39, within the following limits:

a. 1/2-inch sieve: 100 percent passing.
b. 3/8-inch sieve: 95-100 percent passing. TV +/- 6.
c. No. 4 sieve: 58-72 percent passing. TV +/- 7.
d. No. 8 sieve: 34-48 percent passing. TV +/- 6.
e. No. 30 sieve: 18-32 percent passing. TV +/- 6.
f. No. 200 sieve: 2-9 percent passing. TV +/- 3.

E. Prime Coat: Homogeneous, medium curing, liquid asphalt.
1. Medium-Curing Type, Grade MC-70, conforming to Standard Specification, Section 93, "Liquid Asphalts".

F. Tack Coat: SS-1h, Emulsified asphalt conforming to Standard Specification, Section 94, "Asphaltic Emulsions".

G. Seal Coat: Slurry, type 2. Provide Lay Cold Walktop manufactured by Chevron Asphalt Co., or equal.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

A. Use dry material to avoid foaming. Mix uniformly.

B. Comply with Standard Specifications Section 92, "Asphalts".

C. Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.

D. Submit proposed mix design for review prior to beginning of work.

2.03 HEADERS AND STAKES

A. Construction Heart Grade Redwood. 2 x 4 nominal header and 1 x 2 nominal stakes. Use (2) 16d galvanized nails for fastenings, each stake.

2.04 WEED KILLER

A. Provide a dry, free-flowing, dust-free chemical compound containing not less than 30-percent sodium chlorate, or a chlorate-borate compound. Product shall be non-flammable, not creating a fire hazard when applied in accordance with the manufacturer's recommendations, soluble in water, and capable of being spread dry or in solution.

B. Product must be currently listed and approved for use in California by the Department of Pesticide Regulations.

C. Acceptable Products:
1. SpraKil SK-13 by SSI Maxim Co., Inc. Kilgore, Texas, 800-346-4781; EPA No. 34913-15.
2. Spike 80DF by Dow AgroSciences, Inc.; EPA No. 62719-107.

2.05 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with California Test 367.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify that gradients and elevations of subgrade are correct.

3.02 PREPARATION

A. Treat all subgrade with weed killer in accordance with manufacturer's instructions. Take extreme caution to confine weed poison to area covered with asphaltic concrete, and provide all necessary protection to prevent injury or damage to life or property.

3.03 AGGREGATE BASE COURSE

A. Aggregates for bases shall be delivered to the roadbed as uniform mixtures and shall be deposited in layers or windrows. Segregation shall be avoided and the material shall be free from pockets of coarse and fine material.

B. Spread, shape and compact all aggregate base material deposited on the subgrade during the same day.
   1. Aggregate base shall be watered in conformance with the provisions in Standard Specification, Section 17, "Watering".

C. Place and compact aggregate base course to not less than 95 percent of maximum dry density; ASTM D 1557, Method D.

D. Test density of compacted aggregate base course; ASTM D 2167.

E. Conduct one test for each 2,500 square yards of in-place material, but in no case less than one daily for each layer.

3.04 PREPARATION - PRIME COAT

A. Prime coat shall be applied at a temperature conforming to the range of temperatures provided in Standard Specification, Section 93-1.03, "Mixing and Applying".

B. Apply prime coat on aggregate base or subbase at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).

C. Apply primer to contact surfaces of curbs, gutters, and other concrete surfaces.

D. Use clean sand to blot excess primer. Remove loose sand before paving.

3.05 PREPARATION - TACK COAT

A. Apply tack coat in accordance with Standard Specification, Section 94-1, "Asphaltic Emulsions".

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.10 gal/sq yd (0.45 L/sq m).

C. Apply tack coat to contact surfaces of curbs, gutters and construction joints.

D. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.06 PREPARING ASPHALT MIXTURE

A. Comply with ASTM D 995 for plant equipment and operation and Standard Specification Section 39-3, for storing, proportioning and mixing materials.

B. Heating:
   1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture, conforming to Section 93, "Liquid Asphalts".
   2. Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt but not less than 250 degrees F nor more than 375 degrees F.

C. Aggregate:
   1. Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
   2. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job-mix formula requirements.

D. Joints:
   1. Carefully make joints between old and new pavements, or between successive days' work, to ensure a continuous bond between adjoining work.
   2. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack

coat.

3.07 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with Standard Specifications, Section 39, "Asphalt Concrete" and Section 93, "Liquid Asphalts".

B. Place asphalt within 24 hours of applying primer or tack coat.

C. Place to thickness shown on the civil drawings.

D. Install gutter drainage grilles and frames in correct position and elevation.

E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

F. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.08 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Install Work in accordance with Standard Specification, Section 39, "Asphalt Concrete" and Section 93, "Liquid Asphalts".

B. Place asphalt binder course within 24 hours of applying primer or tack coat.

C. Place to thickness shown on the civil drawings

D. Place wearing course within two hours of placing and compacting binder course.

E. Place to thickness shown on the civil drawings.

F. Install gutter drainage grilles and frames in correct position and elevation.

G. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

H. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.09 INSTALLING REDWOOD HEADER

A. Install redwood header with stakes spaced at 4-feet on centers at all transitions between bituminous concrete paving and lawn, planter or other landscaped areas, whether shown on the drawings or not.

3.10 PATCHING

A. Remove and replace defective areas. Remove defective areas for full depth of course.

B. Cut-out and fill with new, hot asphalt concrete. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

C. Compact by rolling to specified density and smoothness.

D. Apply tack coat to exposed surfaces before placing new asphalt concrete.

3.11 FLOOD TEST

A. Flood Test: Before applying a seal coat or striping, a water test shall be made in the presence of the Inspector of Record (I.O.R.). The flooding shall be done by water tank truck. All depressions, where water ponds to a depth of more than 1/8 inch shall be filled or the slope shall be corrected to provide proper drainage. The edges of the fill shall be feathered and smoothed so that the joint between the fill and the original surface is invisible. All corrected work of the asphalt concrete paving shall be of the same mix design.

3.12 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.

B. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch (12 mm).

3.13 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for quality control.

B. Vendor shall make available for review by the I.O.R., a certified copy of tests representing any shipment. If asphalt is used prior to sampling and testing, a "Certificate of Compliance", as provided in Section 6-1.07, shall accompany each shipment of asphalt to the project site. The certificate shall include the shipment number, type of material, specific gravity of material, refinery, consignee, destination, quantity, contract or purchase order number and date of shipment. The certificate shall state that the material complies with the specifications detailed in this section and shall be signed by the vendor.

C. Provide field inspection and testing to determine thickness, density, and surface smoothness by use of a properly calibrated nuclear gauge. Select and test locations in conformance with Caltrans Standard 375.

3.14 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 24 hours.

B. Provide barricades and warning devices as required.

END OF SECTION

SECTION 02751

PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior concrete slabs-on-grade, sidewalks, stair steps, integral curbs, gutters, and ramps.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Preparation of site for paving and base.

B. Section 02316 - Fill and Backfill: Compacted subbase for paving.

C. Section 02741 - Bituminous Concrete Paving: Asphalt wearing course.

D. Section 03100 - Concrete Forms and Accessories.

E. Section 03200 - Concrete Reinforcement.

F. Section 03300 - Cast-in-Place Concrete.

G. Section 07900 - Joint Sealers: Sealant for joints.

H. Section 02765 - Pavement Markings.

1.03 REFERENCES

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.

E. ACI 318 - Building Code Requirements for Mechanical Reinforcing Bar Connection.

F. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2006.

G. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.

H. ASTM C 33 - Standard Specification for Concrete Aggregates; 2003.

I. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.

J. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.

K. ASTM C 150 - Standard Specification for Portland Cement; 2005.

L. ASTM C 171 - Standard Specification for Sheet Material for Curing Concrete.

M. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2001.

N. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2006.

O. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving

and Structural Construction (nonextruding and Resilient Bituminous Types); 2004.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on curing paper, joint filler and curing compound.

C. Submit proposed mix design to testing laboratory for review prior to commencement of concrete operations.

D. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with ACI 301.

B. Obtain cementitious materials from same source throughout.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: Conform to ACI 301.

B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751).
   1. Thickness: 3/8 inch to 1/2 inch (12 mm).

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615, Grade 60 (420), unless otherwise shown on the drawings; use deformed billet steel bars for number 3 bars and larger; unfinished finish.

B. Reinforcing Steel for Welding: ASTM A 706, Grade 60 (420), provide for welding applications.

C. Steel Welded Wire Reinforcement: Plain type, ASTM A 185/A 185M; minimum size 6" x 6" - 6/6, unless otherwise shown on the drawings; in flat sheets; galvanized.

D. Dowels: ASTM A 615, Grade 40 (280); deformed billet steel bars; galvanized finish.

E. Bending: ACI 318.

F. Fabricate reinforcement to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual of Standard Practices. Minimum lap of reinforcing bars or welded wire mesh shall be six inches.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C 150, Normal - Type I Portland cement, low-alkali, grey color.

B. Fine and Coarse Mix Aggregates: Comply with ASTM C 33 and the following:
   1. Aggregate, coarse: Crushed rock or washed gravel with maximum size between 3/4 inch and 1 1/2 inches, and with minimum size number 4.
   2. Aggregate, fine: Natural washed sand of hard and durable particles varying from fine to particles passing a 3/8 inch screen, of which at least 12 percent shall pass a 50 mesh screen.

C. Water: Clean, and not detrimental to concrete.

D. Provide concrete in the proportions established by the mix design required under Sections 01400 and 03300 of this Specification, and to the compressive strengths indicated on the Drawings. The minimum concrete strength shall be 3,000 psi unless noted otherwise.

2.04 ACCESSORIES

A. Curing Compound: Conform to ASTM C 309, Type 2, Class B. Provide Hunt Process Corp.

"White Pigmented", ChemMasters "Safe-Cure 2000", or equal.

B. Concrete Curing Paper: Conform to ASTM C 171. Provide Flocure "Wet Strength Grade Concrete Curing Paper", manufactured by Flocure Corp., or equal.

C. Joint Sealer: As specified in Section 07900.

2.05 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

2.06 MIXING

A. Transit Mixers: Comply with ASTM C 94.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support base, paving and imposed loads.

B. Verify gradients and elevations of subgrade are correct.

3.02 SUBBASE

A. See Section 02316 for construction of base course for work of this Section.

3.03 PREPARATION

A. Base Course: Base shall be smooth, true to line and grade and tested for required compaction prior to start of placing concrete.

B. Moisten base to minimize absorption of water from fresh concrete.

C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

D. Notify Inspector of Record minimum 24 hours prior to commencement of concreting operations.

3.04 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

A. Place reinforcement at midheight of slabs-on-grade.

B. Provide one #3 continuous nosing bar at all edges of concrete walkways.

C. Interrupt reinforcement at contraction and expansion joints for site slabs-on-grade. See civil or structural details for other applications.

D. Place reinforcement to achieve pavement and curb alignment as detailed.

E. Provide doweled joints 12 inch (304 mm) on center where shown on the details.

3.06 PLACING CONCRETE

A. Transit:
   1. With each load, provide ticket certifying the materials and quantities as well as compliance with the approved mix design.
   2. On the transit mix ticket, state the time water was first added to the mix.

3. At the batch plant, withhold 1-1/2 gallons of water per cubic yard of concrete.
4. Upon arrival at the job site, and as directed by the Testing Laboratory inspector, add all or part of the withheld water before the concrete is discharged from the mixer.
5. Mix not less than five minutes after the withheld water has been added, and not less than one minute of that time immediately prior to discharge of the batch.
6. Unless otherwise directed, provide 15 minutes total mixing time per batch after first addition of water.
7. Do not use concrete that has stood over 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

B. Place concrete in accordance with ACI 304R.
1. Deposit concrete continuously in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section.
2. If a section cannot be placed continuously, provide construction joints as specified herein.
3. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
4. Deposit concrete as nearly as practicable in its final location so as to avoid segregation due to rehandling and flowing.
5. Consolidate concrete by the use of a vibrator.
6. Do not subject concrete to any procedure that will cause segregation.
7. Do not use concrete, which becomes non-plastic and unworkable, or does not meet required quality control limits, or has been contaminated by foreign materials.
8. Remove rejected concrete from the site.
9. Minimum thickness of the concrete slabs or walks shall be four inches thick unless noted otherwise on the drawings.

C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
1. Bring surfaces to the correct level with a straightedge, and then strike off.
2. Use bull floats or darbies to smooth the surface, leaving it free from bumps and hollows.
3. Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to start of finishing operations.

3.07 JOINTS

A. Align curb, gutter, and sidewalk joints.

B. Tooled joints: All joints shall be tooled. Tooling shall be done while concrete is plastic. Grooving tool shall be two inches wide at surface, tapered, with top edges rounded to 1/4 inch radius and minimum one inch penetration.

C. Isolation (Expansion) and Construction Joints:
1. Provide isolation joints where concrete slab abuts another slab, wall, column, adjacent building, or any appurtenance in the slab. Use at all construction joints.
2. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
3. Break reinforcing steel at joints, unless noted otherwise on the drawings
4. Tool edges to 1/4 inch radius.
5. Place isolation joints at 10 foot intervals for curbs and 20 feet on-center each way for flatwork, unless noted otherwise.

D. Contraction (Control) Joints:
1. Provide contraction (control) joints as shown on the drawings, or if not shown, at 10 feet on centers each way. Do not use as substitute for isolation joints.

3.08 FLOATING

A. Floating:
   1. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
   2. During or after the first floating, check the planeness of surface with a ten foot straight edge applied at not less than two different angles.
   3. Cut down high spots and fill low spots, and produce a surface level within 1/4 inch in 10 feet as determined by a ten foot straightedge placed anywhere on the surface in any direction.
   4. Refloat the surface immediately to a uniform sandy texture.

3.09 FINISHING

A. While concrete surface is still plastic, provide a textured finish.

B. Area Paving: Medium broom.

C. Sidewalk Paving and Concrete stairs: Medium broom, textured perpendicular to direction of travel, with troweled and radiused edge 1/4 inch (6 mm) radius.

D. Curbs and Gutters: Light broom, texture parallel to pavement direction.

E. Inclined Vehicular Ramps: Broomed perpendicular to slope.

F. ADA Path of Travel: Medium broom, texture perpendicular to direction of travel, with troweled and radiused edges, 1/4 inch radius. Provide finish at least as slip-resistant as that described as a medium salt finish on slopes 6% or less, and slip resistant (heavy broom finish) on slopes more than 6% (Note: Path of travel is a barrier free access without any abrupt vertical changes exceed 1/2 inch at 1:2 maximum slope, except that level changes do not exceed 1/4 inch vertical).
   1. Curb Ramps: Surface of each curb ramp and its flared sides shall be stable, firm, and slip-resistant and shall be of contrasting finish from that of the adjacent sidewalk.

3.10 CURING

A. Place curing compound or curing paper on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
   1. Moist Curing: Cover with reinforced waterproof curing paper. Seal all joints and weight down. Maintain moist for seven days.
   2. Curing compound: Apply a uniform coating within two hours of final troweling.

3.11 JOINT SEALING

A. See Section 07900 for joint sealer requirements.

3.12 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch (6 mm) in 10 ft (3 m).

3.13 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd (76 cu m) or less of concrete placed.
   1. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.14 ADJUSTING AND CLEANING

A. Construction Joints: Clean by sandblasting if necessary to remove excess concrete.

B. Patching: Patch cracks, rock pockets, and honeycombs as directed by Architect, or replace concrete to provide uniform quality and appearance.

3.15 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION

SECTION 02765

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Parking lot markings, including, parking bays, crosswalks, arrows, curb markings, and accessibility symbols.

B. Roadway lane markings, crosswalk markings, and "No Parking" curb painting.

C. Playground striping.

1.02 RELATED SECTIONS

A. Section 02741 - Bituminous Concrete Paving.

B. Section 02751 - Portland Cement Concrete Paving.

1.03 REFERENCES

A. FS TT-P-115 - Paint, Traffic, Highway, White, Yellow, Blue and Red.

B. California Building Code (CBC), California Code of Regulations, Title 24, Chapter 11B, Accessibility.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Certificates: Submit for each batch of paint stating compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Painted lines and markings on pavements at accessible/disabled parking zones shall be 3 inch minimum wide and blue in color equal to Color No. 15090 per Federal Standard 595B.

B. Parking spaces for the disabled shall be marked according to CBC Section 1129B.5.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by Franklin Paint Company, Franklin, MA, 800-486-0304.

B. Paint shall be the products of one manufacturer and shall be either the products upon which the

design is based, or equivalent products of the following manufacturers:
1. Bennette Paint Mfg. Co., Inc.
2. Aexcel, Inc.

2.02 MATERIALS

A. A durable, fast drying alkyd based marking and traffic paint conforming to FS TT-P-115, F Type 1, Safety and Zone Marking, and FS TT-P-115, E Type 1, Traffic Paint, modified with chlorinated rubber, meeting current V.O.C. regulations.

B. Line and Zone Marking Paint: color(s) as indicated.
1. Off-site Roadway Markings: As required by authorities having jurisdiction.
2. Driving lane dividers - #2040, White.
3. Parking dividers - #2040, White.
4. No parking zone markings - #2041, Yellow.
5. No parking curb - #2045, Red.
6. Accessible/disabled parking zone markings - #2044, Blue, meeting Federal Standard 595B.
7. Accessible/disabled cross-walk markings - #2040, White.
8. Directional arrows - #2040, White.
9. Playground striping - #2040, White.
10. Text - #2040, White.
11. Substitutions: See Section 01600 - Product Requirements.

C. Temporary Marking Tape: Preformed, reflective, pressure sensitive adhesive tape in color(s) required; Contractor is responsible for selection of material of sufficient durability as to perform satisfactorily during period for which its use is required.

2.03 EQUIPMENT

A. Pressurized, self-contained paint striping machine capable of applying a straight line from two inches to six inches wide, with consistent coverage of a minimum of 150 square feet per gallon. Unless otherwise noted on the drawings, minimum line width shall be 3 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of marking materials.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.
1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.
2. Completely remove rubber deposits and other coatings adhering to the pavement, by scraping, wire brushing, sandblasting, mechanical abrasion, or approved chemicals.

D. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

E. Establish survey control points to determine locations and dimensions of markings; provide

templates to control paint application by type and color at necessary intervals.

3.03 INSTALLATION

A. Begin pavement marking as soon as practicable after surface has been cleaned and dried.

B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).

C. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

D. Comply with FHWA MUTCD manual (http://mutcd.fhwa.dot.gov) for details not shown.

E. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

F. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends.
   1. Apply paint in one coat only.
   2. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
   3. Length Tolerance: Plus or minus 3 ((75 mm).
   4. Width Tolerance: Plus or minus 1/8 inch (3 mm).

G. Curb Markings: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.
   1. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used and for lettering.

H. Roadway Traffic Lanes: Use suitable mobile mechanical equipment that provides constant agitation of paint and travels at controlled speeds.
   1. If paint does not dry within expected time, discontinue paint operations until cause of slow drying is determined and corrected.
   2. Use hand application by pneumatic spray for application of paint in areas where a mobile paint applicator cannot be used.

I. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings.
   1. Mark the International Symbol of Accessibility at indicated parking spaces.
   2. Parking spaces for the disabled shall be marked according to CBC Section 1129B.5.
   3. Detectable warning lines shall be in conformance with CBC Section 1133B.8.5. See Section 10405, Detectable Warning Systems.
   4. Painted lines and markings on pavement shall be 3-inches minimum wide and blue in color equal to Color No.15090 per Federal Standard 595B.
   5. Hand application by pneumatic spray is acceptable.

J. Symbols: Use a suitable template that will provide a pavement marking with true, sharp edges and ends, of the design and size indicated.

3.04 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to District.

END OF SECTION

SECTION 02791

PLAYGROUND SURFACING TILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient, interlocking, playground safety tiles.

B. Adhesives and accessories.

C. Containment curbs.

1.02 RELATED REQUIREMENTS

A. Section 02741 - Bituminous Concrete Paving: Subbase for resilient surfacing tiles.

B. Section 03300 - Cast-in-Place Concrete: Concrete curbs.

1.03 REFERENCE STANDARDS

A. ASTM D 412 - Test Method for Rubber Properties in Tension.

B. ASTM D 2047 - Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine; 2004.

C. ASTM D 3884 - Test Method for Abrasion Resistance of Textile Fabrics (Rotary Platform, Double-Head Method).

D. ASTM E 108 - Test Methods for Fire Tests of Roof Coverings.

E. ASTM E 303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester.

F. ASTM E 648 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.

G. ASTM F1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2009.

H. ASTM F1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use; 2007a.

I. ASTM F 1951 - Standard Specification for Determination of Accessibility of Surface Systems Under and Around Play Equipment.

J. ASTM F 2075 - Standard Specification for Engineered Wood Fiber for Use As a Playground Safety Surface Under and Around Playground Equipment.

K. CACRM - California Access Compliance Reference Manual.

L. CPSC Pub. No. 325 - Handbook for Public Playground Safety; Consumer Products Safety Commission; 2008.

M. International Playground Equipment Manufacturers Association (IPEMA).

1.04 DEFINITIONS

A. Use Zone: The area beneath and immediately adjacent to a play structure or equipment (play event) that is designated for unrestricted circulation around equipment, and on whose surface it is predicted that a user would land when falling from or exiting the equipment.

B. Critical Fall Height: The maximum fall height at which the protective surfacing meets the requirements of ASTM F1292.

C. High Play Activity Area: Areas where the fall height is especially great, such as at swings. A

high play activity area is defined only where the protective surfacing of the entire playground area is not designed for the greatest fall height. High play activity areas are defined on the drawings.

D. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it as defined by ASTM F1487.

E. Protective Surfacing: Resilient ground surfacing. The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.

F. Subbase: A layer of aggregate base and bituminous concrete under the resilient layer of the protective surfacing but over the subgrade.

G. Subgrade: The surface of the ground on which the protective surfacing is installed.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For all manufactured surfacing products, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, and safety limitations.

C. Shop Drawings: Detailed scale drawings showing locations of existing playground equipment and exposed footings, bases, and anchorage points.
   1. Clearly identify footing and base elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing, surveyed by land surveyor licensed in the State in which the Project is located.
   2. Show locations of underground utilities, storm-drainage system and irrigation system.
   3. Show locations of related construction such as walkways and roadways, fences, site furnishings, and plantings.
   4. Show measured fall height for each playground equipment item, determined in accordance with ASTM F1487.
   5. Show Use Zone perimeters, determined in accordance with ASTM F1487.

D. Samples: For each product for which color must be selected provide color chart showing full range of colors.

E. Certificates: A copy of the certificate of compliance issued by IPEMA shall be provided by manufacturer of synthetic safety surfacing.

F. Installation Instructions: Manufacturer's written instructions and recommendations.

G. Percolation Test Report: Describing test method used and results.

H. Maintenance Data:
   1. For manufactured surfacing products, provide manufacturer's recommended maintenance instructions and list of repair products, with address and phone number of source of supply.

I. Manufacturer's Field Report.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company regularly engaged in manufacturing products specified in this section, with not less than ten years of experience.
   1. Surfacing installed in minimum 10 sites and been in successful service minimum 5 years.
   2. Provide certificate of Insurance AA rated for minimum 1,000,000 dollars covering both product and general liability.
   3. Manufacturer's Representative: Provide name, company name and address, and

qualifications.

B. Installer Qualifications: Company certified by manufacturer for training and experience installing the protective surfacing; provide installer's company name and address, and training and experience certificate.

1.07 PRE-INSTALLATION MEETING

A. Coordinate with Section 02881 - Playground Equipment.

B. Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
   2. Include representatives of Contractor.
   3. Notify Architect at least 2 weeks prior to meeting.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store protective surfacing to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum five year warranty for playground surfacing tiles.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Because the safety of the playground depends on strict conformance to the design criteria, this information is provided for Contractor's information.
   1. The protective surfacing constitutes a resilient layer installed over a non-resilient layer, which is installed over the subgrade, with the top of playground equipment footings and anchorage devices covered by full depth of the resilient portion of the protective surfacing.
   2. The top elevation of the protective surfacing is intended to be flush with adjacent grades.

B. If deviation from specified depth is required, it is the Contractor's responsibility to make all changes required to maintain specified top elevation and required impact attenuation at no extra cost to District; obtain approval prior to proceeding; follow approval request procedure as specified for substitutions.

2.02 MATERIALS

A. Design is based on the use of products by Environmental Molding, Concepts, San Bernardino, CA; 888-836-2665.
   1. Product: Kid Cushion

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted prior to Bid Opening.
   1. Substitutions: See Section 01600 - Product Requirements.

2.03 PLAYGROUND SURFACING TILES

A. Description: Solid upper layer membrane and underlying construction of rib system in waffle design and interconnecting safety surface. Vulcanized, high pressure and heat molded rubber with integrated connecting system hidden beneath top membrane.

B. Materials: The surface shall be manufactured from SBR rubber compounds vulcanized and molded at high pressure and temperature.

C. Tile Thickness: 3.75-inches (10 feet certified height) in 2 x 2-feet center tiles; 1 x 2 x 2-feet beveled outside corners and transition tiles, as required by the Consumer Product Safety Commission Guidelines and ASTM F 1292 Test Criteria.

D. Physical Properties:

1.	Flame Spread:	ASTM E 108	Class A
2.	Flammability:	ASTM E 648	Class II
3.	Accessibility:	ASTM F 1951	.31 F/.34 S
4.	Toxicity:	ASTM F 2075	Lead Free
5.	Slip Resistance:	ASTM D 2047	.84 (Pass)
6.	Skid Resistance:	ASTM E 303	Dry 96, Wet 47
7.	Tensile Strength:	ASTM D 412	1175.3 psi
8.	Wear Resistance:	ASTM D 3884	1.64% Loss/3000c
9.	UV Resistance:	QPanel QUV	<3.0/4032 ksqm

2.04 ACCESSORIES

A. SpectraLock Connectors.

B. Corner Ramps
1. Prefabricated outside and inside corners.
2. Material: Same as playground safety surfacing tiles.

C. Ramps:
1. Prefabricated Ramps: 48" x 12" wide, reducing from 3 1/2" down to 3/8".
2. Material: Same as playground safety surfacing tiles.

D. Adhesive: Kid Kushion adhesive furnished by the manufacturer.

E. Containment Curbs: Cast-in-place concrete; free of sharp vertical edges, protruding elements, and trip hazards.
1. Size(s): As indicated on drawings.
2. Minimum Edge Radius: 1/2 inch (13 mm).

F. Rigid Subbase: Bituminous, as specified in Section 02741.

PART 3 EXECUTION

3.01 EXAMINATION

A. Playground equipment installer will perform playground layout prior to installation of footings; verify correctness of layout before starting this work.

B. Verify that playground equipment and site furnishings and irrigation system located within playground area are complete.

C. Verify location of underground utilities and facilities in the playground area. Damage to underground utilities and facilities will be repaired at Contractor's expense.

D. Verify that subgrades are at proper elevations and that smooth grading is complete.

E. Verify that proper depth of surfacing is marked on base supports of playground equipment.

3.02 PREPARATION

A. Correct subgrade irregularities to ensure that required depth of protective surfacing can be installed, and subgrade elevation is in accordance with manufacturer's requirements.

B. Inside Use Zones remove all obstructions that would extend into the resilient protective surfacing.

C. Remove rocks, debris, and other similar items.

D. Install containment curbs with top surface flush with intended elevation of top surface of

protective surfacing.

3.03 SUBBASE

A. Install aggregate base and bituminous concrete (binder course) subbase as indicated on drawings and in Section 02741.

B. Install with top surface of subbase no higher than grades and levels indicated and not more than 1/4 inch (6 mm) lower than grades and levels indicated.

C. Install in true, even plane, sloped to provide positive drainage.

D. Cure subbase at least 28 days but not less than required by manufacturer of resilient surfacing.

E. Test asphalt for moisture in accordance with manufacturer's instruction to ensure it has sufficiently cured and is dry.

F. Power wash asphalt in accordance with manufacturer's instructions.

G. Variations in Elevation: Repair variations in elevation of completed subsurface greater than plus or minus 1/4 inch over 10 feet in any direction.

3.04 INSTALLATION

A. Install in accordance with CPSC Pub. No. 325, ASTM F1487, manufacturer's instructions, and requirements of authorities having jurisdiction.

B. Install proper thickness throughout Use Zone(s).

C. Clean and dry surface of subbase.

D. Tiles: Lay tile with cut end tiles of equal width.
   1. Bond tile to substrate with adhesive recommended by manufacturer.
   2. Make cutouts around equipment not more than 3/8 inch (10 mm) in width; remove and refit tile as required to reduce gaps.
   3. Fill and seal gaps around equipment with sealant.

3.05 FIELD QUALITY CONTROL

A. Obtain the services of the equipment manufacturer's field representative to review the finished installation for compliance with specified requirements and with design criteria to the extent known to the Contractor; submit report of field review.

B. Contractor shall provide third-party inspection of playground safety surfacing tiles within 30 days of installation.

C. Conduct inspection by National Recreation and Parks Association/National Playground Safety Institute (NRPA/NPSI) Certified Playground Safety Inspector (CPSI).

D. Determine compliance with ASTM F 1292, correct any non-compliant items at no cost to District.

3.06 CLEANING AND PROTECTION

A. Clean tiles in accordance with manufacturer's instructions.

B. Restore adjacent existing areas that have been damaged from the construction.

C. Clean playground area of excess adhesive spills, construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

E. Protect installed products until Substantial Completion.

F. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 02821

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fence framework, fabric, and accessories.

B. Excavation for post bases; concrete footings for posts and concrete mow strips.

C. Manual gates and related hardware.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete for post footings and mow strips.

B. Section 08710 - Door Hardware: Gate locking device.

C. Section 10426 - Signage and Graphics: Path of Travel signs.

1.03 REFERENCES

A. ASTM A 90 - Standard Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. ASTM A 392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2006.

D. ASTM A 824 - Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence.

E. ASTM B 6 - Standard Specification for Zinc.

F. ASTM F 567 - Standard Practice for Installation of Chain-Link Fence; 2000.

G. ASTM F 626 - Standard Specification for Fence Fittings.

H. ASTM F 1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2006.

I. California Building Code (CBC), California Code of Regulations, Title 24:
   1. Section 1003.3.1 - Doors.
   2. Section 1003.3.2 - Gates.
   3. Section 1133B - General Accessibility for Entrances, Exits, and Paths of Travel.

J. CLFMI CLF 2445 - Product Manual; Chain Link Fence Manufacturers Institute; 1997.

1.04 REGULATORY REQUIREMENTS

A. Gates along the path of travel (POT) serving a means of egress system shall comply with CBC Sections 1003.3.1 and 1003.3.2.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Provide steel fence and related gates as a complete compatible system including necessary erection accessories, fittings, and fastenings.

C. Conform to requirements of Chain Link Fence Manufacturers Institute Product Manual.

PART 2 PRODUCTS

2.01 MATERIALS

A. Posts, Rails, and Frames: ASTM F 1083, Schedule 40, hot-dipped galvanized steel pipe, welded construction:
   1. Tensile Strength: 48,000 psi (330 MPa) minimum.
   2. Yield Strength: 30,000 psi (205 MPa) minimum.

B. Wire Fabric: ASTM A 392 zinc coated steel chain link fabric.

C. Concrete: Type specified in Section 03300.

2.02 COMPONENTS

A. Line Posts: 2.375 inch (60 mm) outside diameter, 3.65 lb./lin. ft.

B. Corner and Terminal Posts: 2.875 inch (73 mm) outside diameter, 5.79 lb./lin. ft.

C. Gate Posts:
   1. Fabric Height up to 12 feet:
      a. Gate leaf up to 10 feet - 4 inch (102 mm) outside diameter, 9.10 lb./lin. ft.
      b. Gate leaf over 10 feet to 18 feet - 6.625 inch (168.3 mm) outside diameter, 18.02 lb./lin.ft.
      c. Gate leaf over 18 feet to 24 feet - 8.625 inch (219.1mm) outside diameter, 27.12 lb./lin. ft.

D. Top and Brace Rails: 1.66 inch (42 mm) outside diameter, 2.27 lb./lin. ft., plain end, sleeve coupled.

E. Gate Frame: 1.90 inch (48.3 mm) outside diameter, 2.72 lb./lin. ft., for welded fabrication.

F. Fabric: 2 inch (51 mm) diamond mesh interwoven wire, 0.148 inch (3.76 mm) thick (9 gage), top selvage knuckle end closed, bottom selvage knuckle end closed.

G. Tension Bar: 3/16 inch (4.8 mm) thickness by 3/4 inch (19.1 mm) width steel.

H. Tension Wire: 0.179 inch (4.50 mm) thick (7 gage) steel, single strand conforming to ASTM A 824, Type II.

I. Tension and Brace Bands: ASTM F 626, pressed steel or cast iron, galvanized.
   1. Tension Bands: Minimum thickness after galvanizing of 0.078 inch (1.98 mm), and minimum width of 3/4 inch (19.05 mm) for posts 4 inches O.D. or less; and, 0.108 inch (2.74 mm) thickness by 7/8 inch (22.23 mm) for posts larger than 4 inches O.D.
   2. Brace Bands: Minimum thickness of 0.108 inch (2.74 mm) after galvanizing, and a minimum width of 3/4 inch (19.05 mm).

J. Truss Rod and Turnbuckle: 5/16 inch (7.9 mm) diameter steel rod with turnbuckle, galvanized after threading and shall withstand 2000 lb (900 kg) of tension.

K. Tie Wire: 0.148 inch (3.76 mm) thick (9 gage) galvanized steel wire.

2.03 ACCESSORIES

A. Post and Line Caps: Pressed steel or cast iron, galvanized, sized to post diameter, set screw retainer.

B. Fittings: Sleeves, clips, rail ends, fasteners and fittings; pressed steel or cast iron, galvanized.

C. Gate Hardware: Gates located along accessible Path of Travel shall comply with CBC Sections 1003.3.1, 1003.3.2 and 1133B.1.1.1.4. Gate hardware shall be openable from the inside without the use of a key or any special knowledge or effort, and shall not require pinching, grasping, or twisting motion to operate. Provide solid kick plates 10 inches minimum high by width of gate and 3 inches maximum from the paving on both sides of the gate.

D. Hardware for Single Swinging Gates: 180 degree hinges, non lift-off type, 2 for gates up to 60 inches (1525 mm) high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position. See Paragraph 1.04 above for signage requirements.

E. Hardware for Double Swinging Gates: 180 degree hinges, non lift-off type, 2 for gates up to 60 inches (1525 mm) high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position. See Paragraph 1.04 above for signage requirements.

F. Gate Wheel: For single gates with swinging leaf over 48 inches in width, provide a wheel welded to bottom rail. Wheel shall be self-lubricating, ball bearing type. At double gates, provide one wheel for each gate.

G. Attachment Bolts: 5/16 inch (7.94 mm) x 1-1/4 inch (31.76 mm) galvanized carriage bolts with nuts.

2.04 FINISHES

A. All steel materials galvanized using zinc metal conforming to ASTM B 6. Zinc weight determined in accordance with ASTM A 90.

B. Post, Rails, Braces and Frames: ASTM F 1083, galvanized, minimum 2.0 oz/sq ft (600 g/sq m).

C. Fittings: ASTM A 123, galvanized, minimum 1.2 oz/sq ft (366 g/sq m).

D. Fabric: ASTM A 392, galvanized, Class 2, minimum 2.0 oz/sq ft (600 g/sq m).

E. Hardware: Hot-dip galvanized to weight required by ASTM A 153/A 153M.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories in accordance with ASTM F 567 and this Section.

B. Place fabric on outside of posts and rails.

C. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Set posts 4 inch minimum below finish grade where concrete mow strip occurs. Slope top of concrete for water runoff.

D. Line Post Footing Depth Below Finish Grade: 3 feet (0.914 m) minimum.

E. Corner, and Terminal Post Footing Depth Below Finish Grade: 3 feet (0.914 m) minimum.

F. Gate Post Concrete Footing Diameter and Depth:
   1. Fabric Height up to 6 feet:
      a. Gate leaf up to 10 feet - 12 inch x 36 inch.
      b. Gate leaf over 10 feet to 18 feet - 14 inch x 42 inch.
   2. Fabric Height over 6 feet to 12 feet:
      a. Gate leaf up to 10 feet - 14 inch x 36 inch.
      b. Gate leaf over 10 feet to 18 feet - 16 inch x 42 inch.

c. Gate leaf over 18 feet to 24 feet - 18 inch x 48 inch.

G. Brace each gate and corner post to adjacent line post with horizontal center brace rail and diagonal truss rods. Install brace rail one bay from end and gate posts.

H. Provide top rail through line post tops and splice with 6 inch (150 mm) long rail sleeves.

I. Install center brace rail on corner gate leaves.

J. Do not stretch fabric until concrete foundation has cured 28 days.

K. Stretch fabric between terminal posts or at intervals of 100 feet (30 m) maximum, whichever is less.

L. Position bottom of fabric 2 inches (50 mm) above finished grade.

M. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches (380 mm) on centers.

N. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.

O. Install bottom tension wire stretched taut between terminal posts.

P. Do not attach the hinged side of gate to building wall; provide gate posts.

Q. Install gate with fabric to match fence. Install hardware.

R. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.

S. Install signage specified in Section 10426, Signage and Graphics.

T. Install gate locking device specified in Section 08710 - Door Hardware.

3.02 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm).

B. Components shall not infringe adjacent property lines.

END OF SECTION

SECTION 02843

PARKING BUMPERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precast concrete parking bumpers and anchorage.

1.02 REFERENCE STANDARDS

A. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

B. ASTM C 33 - Standard Specification for Concrete Aggregates; 2008.

C. ASTM C 150 - Standard Specification for Portland Cement; 2007.

D. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.

E. ASTM C 330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 2005.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide unit configuration, dimensions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Parking Bumpers: Precast concrete, conforming to the following:
   1. Length: 4 feet long.
   2. Profile: Manufacturer's standard.
   3. Cement: ASTM C 150, Portland Type I - Normal; white color.
   4. Concrete Materials: ASTM C 33 aggregate, water, and sand.
   5. Reinforcing Steel: ASTM A 615/A 615M, deformed steel bars; unfinished finish, strength and size commensurate with precast unit design.
   6. Air Entrainment Admixture: ASTM C 260.
   7. Concrete Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent.
   8. Use rigid molds, constructed to maintain precast units uniform in shape, size and finish. Maintain consistent quality during manufacture.
   9. Embed reinforcing steel, and drill or sleeve for two dowels.
   10. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
   11. Minor patching in plant is acceptable, providing appearance of units is not impaired.
   12. Product: Concrete Parking Bumper manufactured by E.K. Sheefer and Sons, Paramount, CA, or equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units without damage to shape or finish. Replace or repair damaged units.

B. Install units in alignment with adjacent work.

C. Fasten units in place with two #5 rebar x 2'-0" long dowels per unit.

END OF SECTION

SECTION 02881

PLAYGROUND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Playground layout (staking).

B. Concrete footings for playground and court sports equipment.

C. Playground equipment.

D. Sports court equipment.

E. Site furnishings.

F. Location of each item of equipment is indicated on the drawings.

1.02 RELATED SECTIONS

A. Section 02310 - Grading: Shaping subgrade to specified grade levels; removal of excess soil and rocks.

B. Section 02741 - Bituminous Concrete Paving: Paving for court sports.

C. Section 02792 - Playground Surfacing: Protective surfacing in playground area.

D. Section 03300 - Cast-in-Place Concrete: Footings for playground equipment.

1.03 REFERENCES

A. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

B. ASTM A 135/A 135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2006.

C. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

D. ASTM A 513 - Standard Specification for Electric-Welded-Welded Carbon and Alloy Steel Mechanical Tubing; 2006b.

E. ASTM B 26/B 26M - Standard Specification for Aluminum-Alloy Sand Castings; 2005.

F. ASTM B 108 - Standard Specification for Aluminum-Alloy Permanent Mold Castings; 2006.

G. ASTM B 179 - Standard Specification for Aluminum Alloys in Ingot and Molten Forms for Castings from All Casting Processes; 2006.

H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2006.

I. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2006.

J. ASTM C 136 - Method for Sieve Analysis of Fine and Coarse Aggregate.

K. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position; 2006.

L. ASTM D 3363 - Test Method for Film Hardness by Pencil Test; 2005.

M. ASTM D 6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards; 2006.

N. ASTM F 1292 - Standard Specification for Impact Attenuation of Surfacing Materials Within the Use Zone of Playground Equipment; 2004.

O. ASTM F 1487 - Standard Consumer Safety Performance Specification for Playground Equipment for Public Use; 2005.

P. CPSC Pub. No. 325 - Handbook for Public Playground Safety; Consumer Products Safety Commission; 1997.

Q. International Play Equipment Manufacturers Association (IPEMA).

1.04 DEFINITIONS

A. Play Event: A piece of playground equipment that supports one or more play activities.

B. Use Zone: The area under and around a play event within which the ground surfacing must meet fall impact attenuation requirements of ASTM F1292 when tested at the fall height specified for the play event.

C. Fall Height: The vertical distance between the finished elevation of the designated play surface and the finished elevation of the protective surfacing beneath it, as defined in ASTM F 1487.

D. Protective Surfacing: Resilient ground surfacing.The characteristics of the protective surfacing are based on the fall height of the playground equipment. Changes in either the surfacing or the fall height, particularly reducing the resilience of the protective surfacing or increasing the fall height, will reduce safety-related performance.

E. Subgrade: The surface of the ground on which the protective surfacing is installed; the subbase for the protective surfacing is installed over the subgrade.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: For all manufactured equipment, provide manufacturer's product data showing materials of construction, compliance with specified standards, installation procedures, safety limitations, and the number of users permitted.
   1. Certifications: Provide International Play Equipment Manufacturers Association (IPEMA) certification that product complies with ASTM F 1487, excluding section 10 and 12.6.1.

C. Product Data: For fabricated items, provide the following:
   1. Galvanized Steel: Certification of galvanized coating thickness.

D. Shop Drawings: Detailed scale drawings showing play event layout, Use Zone perimeters, and fall height for each play event.
   1. Show locations and dimensions of footings and anchorage points.
   2. Clearly identify mounting elevations in relation to a fixed survey point on site and to subgrade elevation and depth of protective surfacing.
   3. Show locations of related construction such as walkways and roadways, fences, site furnishings, and plantings.

E. Samples: For each item for which color must be selected provide color chart showing full range of colors and finishes.

F. Maintenance Data: Provide manufacturer's recommended maintenance instructions and list of replaceable parts for each equipment item, with address and phone number of source of supply.

G. Manufacturer's Field Report.

H. Warranty: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company regularly engaged in manufacturing materials and products specified in this section, with not less than three years of experience.
   1. Provide certificate of Insurance AA rated for minimum 1,000,000 dollars covering both product and general liability.
   2. Manufacturer's Representative: Provide name, company name and address, and playground safety training certificate.

B. Installer Qualifications: Company certified by manufacturer for training and experience installing play events and equipment.

1.07 PRE-INSTALLATION MEETING

A. Convene a meeting one week before starting earthwork for playground to discuss coordination between various installers.
   1. Require attendance by personnel responsible for grading and installers of playground equipment, protective surfacing, footings, and adjacent work.
   2. Include representatives of Contractor.
   3. Notify Architect at least 2 weeks prior to meeting.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Deliver, handle, and store equipment to project site in accordance with manufacturer's recommendations.

B. Store materials in a dry, covered area, elevated above grade.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard warranty for each playground equipment.

PART 2 PRODUCTS

2.01 PLAYGROUND EQUIPMENT - GENERAL

A. Mount all equipment on concrete footings, unless otherwise indicated.
   1. The playground protective surfacing constitutes a resilient layer installed over a subbase (non-resilient) which is installed over the subgrade; the top of footings and anchorage devices is to be covered by full depth of the resilient portion of the protective surfacing.
   2. Provide supports as required to mount equipment at proper height above finish and sub-grades to allow installation of sufficient depth of protective surfacing; portion of support below top of surfacing must comply with specified requirements for equipment.
   3. Paint the portion of the support that is intended to be installed below the top surface of the protective surfacing a different color, or mark in other permanent way, so that installers and maintainers of protective surfacing can easily determine whether sufficient depth has been installed.

B. Label each equipment item with permanent labels stating age group that equipment was designed for, manufacturer identification, and warning labels in accordance with ASTM F 1487.

2.02 PLAYGROUND EQUIPMENT

A. Design is based on the use of products manufactured by Patterson Williams Athletic Manufacturing Company, Mesa AZ, 800-687-5768.
   1. Substitutions: See Section 01600 - Product Requirements.

B. Comply with ASTM F 1487 and CPSC Pub. No. 325; provide equipment complying with specific requirements for the relevant age group(s).
   1. Provide components having factory-drilled holes. Do not use components with extra holes that will not be filled by hardware or covered by other components.

2.03 SPORTS COURT EQUIPMENT

A. Design is based on the use of products manufactured by Patterson Williams Athletic Manufacturing Company, Mesa, AZ, 800-687-5768.
   1. Substitutions: See Section 01600 - Product Requirements.

B. Tetherball:
   1. 2-3/8 inch outside diameter galvanized steel post with welded cap, 3/8 inch plated eyebolt, 30 inch plated chain (7/32 inch diameter), swivel snap for ball attachment, and regulation size tetherball.
   2. PW Model No. 2221-10.
   3. Sleeve: PW Model No. 8301-01.

C. Single Post Basketball System:
   1. Single post 4-1/2 inch outside diameter Schedule 40, galvanized steel pipe with adjustable offsets. Adjustment offsets comprised of 2-3/8 inch outside diameter galvanized pipe, welded to 1/4 inch thick galvanized steel half clamps. 1-3/8 inch outside diameter braces support the upper portion of the backboard for stability.
   2. PW Model No. 1541 (five foot offset).
   3. Backboard: 48 inch x 72 inch galvanized 12-gauge steel rectangle, Powder Coated White, PW Model No. 25.
   4. Basketball Goal with Net: Heavy Duty Single Rim with Nylon Net: PW Model No. 43.
   5. Sleeve: PW Model 8305-11.

D. Volleyball Pole and Net:
   1. Dual post 3-1/2 inch outside diameter Schedule 40 galvanized steel pipe with top cable/bottom rope ties. PV Model 2216-21.
   2. 3 mm nylon mesh, 5 inches by 7 inches size net. PV Model 8361-10.
   3. 3-1/2 inch ground sleeves. PV Model 8303-001.

2.04 SITE FURNISHINGS

A. Design is based on the use of products manufactured by Patterson Williams Athletic Manufacturing Company, Mesa, AZ, 800-687-5768.

B. Bike Racks:
   1. Fabricate racks from formed 1/2 inch round steel rod. Provide assemblies of welded construction and hot-dip galvanized after fabrication.
   2. PW Model No. 1603-08, 8 spaces, single sided.

2.05 CUSTOM PLAY STRUCTURES

A. Coordinate the Work of this Contract with District.

B. Provide custom play structure Model No. C5847PMR4 as distributed by Dave Bang Associates, Tustin, CA; 800-669-2585.

2.06 MATERIALS

A. Steel Pipe and Tube: Conforming to ASTM A 135/A 135M, ASTM A 500, or ASTM A 513; hot-dipped galvanized and free of excess weld and spatter.
   1. Tensile Strength: 45,000 psi (310 MPa), minimum.
   2. Yield Point: 33,000 psi (225 MPa), minimum.
   3. Galvanizing: Hot-dip metal components in zinc after fabrication, in accordance with ASTM A 123/A 123M; remove tailings and sharp protrusions and burnish edges.

B. Extruded Aluminum: ASTM B 221 or ASTM B 221M, Alloy 6061, 6062, or 6063.
   1. Tensile Strength: 39,000 psi (270 MPa), minimum.
   2. Yield Point: 36,500 psi (250 MPa), minimum.

C. Cast Aluminum: ASTM B 26/B 26M, ASTM B 108, or ASTM B 179.

D. Chain: Corrosion resistant zinc plated steel; minimum size 4/0; polyvinyl chloride coating.

E. Hardware: Of design without hazardous protrusions, corners, or finishes, and requiring tools for removal after installation; countersunk fasteners are preferred.
   1. Use stainless steel for metal-to-metal connections; select type to minimize galvanic corrosion of materials connected by hardware.
   2. Use stainless steel for wood-to-wood and wood-to-metal connections.
   3. Use stainless steel with plastic components.
   4. Bearings: Self lubricating.
   5. Hooks, Including S-Hooks: Closed loop; maximum gap 0.04 inches (1 mm), less than the thickness of a dime.
   6. Rails, Loops, and Hand Bars: Same metal as item is mounted on or aluminum; with powder coating.
   7. Anchors: In accordance with manufacturer's recommendations.

F. Transparent Plastic: Clear polycarbonate plastic sheets, flat; shatterproof; resistant to crazing, cracking, and fogging.
   1. Sheet Thickness: 3/16 inch (5 mm), minimum.

G. Opaque Plastic: Molded homogeneous plastic or wood-polymer composite lumber; do not use plastic as major load bearing members; use as deck boards, panels, and railings is acceptable.
   1. Homogeneous Plastic: Ultraviolet and color stabilized polyethylene without applied surface coating; color through entire thickness.
   2. Wood-Polymer Composite Lumber: Complying with ASTM D 6662; factory finished.
   3. Decks and Platforms: Non-slip surface texture.
   4. Maximum Deflection: 1/360 of span, when tested in accordance with ASTM D 648, with a uniform live load of 40 pounds/ft (585 N/m).
   5. Deck Board Span: 12 inches (300 mm) on center, maximum, spanning minimum of 3 joists.
   6. Panel Thickness: 3/16 inch (5 mm), minimum.
   7. Panel Edges: 3/16 inch (5 mm) radius, minimum.

H. Polyvinyl Chloride (PVC) Coating: Ultraviolet stabilized and mold-resistant; slip-resistant finish. Prime parts to be coated with clear acrylic thermosetting solution, and preheat prior to dipping in liquid PVC.
   1. Thickness: 0.08 inch (2 mm), minimum, plus/minus 0.02 inch (0.5 mm).
   2. Hardness: 85 durometer, when tested in accordance with ASTM D 3363.

I. Concrete: As specified in Section 03300.

PART 3 EXECUTION

3.01 LAYING OUT THE WORK

A. Stake the location of all playground elements, including Use Zone perimeters, perimeter of protective surfacing, access and egress points, hard surfaces, walls, fences, and structures, and planting locations.

B. Stake the layout of the entire Use Zone perimeter before starting any work and before subbase under resilient surfacing is laid.
   1. Verify that Use Zone perimeters do not overlap hard surfaces, whether currently installed or not.
   2. Verify that Use Zones are free of obstructions that would extend into the resilient portion of the protective surfacing.
   3. If conflicts or obstructions exist, notify Architect.
   4. Do not proceed until revised drawings have been provided, showing corrected layout, and obstructions have been removed.

3.02 EXAMINATION

A. Verify that playground and sports court equipment footings have been installed in proper locations and at proper elevations.

B. Verify location of underground utilities and facilities in the playground area. Damage to underground utilities and facilities will be repaired at Contractor's expense.

3.03 INSTALLATION

A. Coordinate work with preparation for and installation of protective surfacing specified in Section 02791. The resilient portion of the protective surfacing is to be installed after playground equipment installation. Coordinate sports court work with preparation for and installation of bituminous concrete paving where noted on the drawings.

B. Install in accordance with CPSC Pub. No. 325, ASTM F 1487, manufacturer's instructions, and requirements of authorities having jurisdiction.

C. Anchor equipment securely below the bottom elevation of the resilient surfacing layer.

D. Install without sharp points, edges, or protrusions; entanglement hazards; or pinch, crush, or shear points.

E. Do not modify play events on site without written approval of manufacturer.

F. Install required signage if not factory-installed.

3.04 FIELD QUALITY CONTROL

A. Obtain the services of the equipment manufacturer's field representative to review the finished installation for compliance with specified requirements and with design criteria to the extent known to the Contractor; submit report of field review.

B. Inspector of Record will inspect playground equipment after installation to verify that playground meets specified design safety and accessibility requirements.

C. Repair or replace rejected work until compliance is achieved.

3.05 CLEANING AND PROTECTION

A. Restore adjacent existing areas that have been damaged from the construction.

B. Clean playground equipment of construction materials, dirt, stains, filings, and blemishes due to shipment or installation. Clean in accordance with manufacturer's instructions, using cleaning agents as recommended by manufacturer.

C. Clean playground area of excess construction materials, debris, and waste.

D. Remove excess and waste material and dispose of off-site in accordance with requirements of authorities having jurisdiction.

E. Protect installed products until Substantial Completion.

F. Replace damaged products before Substantial Completion.

END OF SECTION

SECTION 02910

LANDSCAPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Landscape plantings in the areas shown on the Drawings.

B. The work in this Section includes but is not limited to the following:
   1. Pre-planting weed control.
   2. Soil preparation.
   3. Fine grading.
   4. Planting operations.
   5. Maintenance.
   6. Warranty.

1.02 RELATED SECTIONS

A. Section 02230 - Site Clearing.

B. Section 02310 - Grading.

C. Section 02316 - Filling and Backfilling.

1.03 QUALITY ASSURANCE:

A. Perform work in accordance with all applicable laws, codes and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by authorities in furnishing, transporting, and installing materials. The following standards shall be a reference from a part of this Section:
   1. Standardized Plant Names, latest edition, issued by the American Joint Committee on Horticulture Nomenclature (AJCHN).
   2. American Standard for Nursery Stock, latest edition, issued by the American Association of Nurserymen, Inc. (ANN).

1.04 SUBMITTALS

A. Substitutions:
   1. If any plant specified is not obtainable, submit a written substitution request to the District during the bidding period.
   2. Substitutions of plant materials will not be permitted.

B. Construction Schedule: At the pre-construction meeting, provide a written projected planting schedule noting the estimated completion date, number of working days required and any special coordination requirements.

C. Selection, Tagging and Ordering Plant Material:
   1. Submit a request for inspection and documentation to the Landscape Architect at least one month prior to start of landscape planting work that plant material has been ordered.
   2. Plants shall be subject to inspection and rejection by the Landscape Architect at place of growth, and after delivery, for conformity to this Specification.

   results in a change to the specified amendments, a Change Order will be issued.

D. Certification:
   1. Submit written certifications, copies of work orders, and container labels upon delivery to the job site, the following items:
      a. Quantity of fertilizer.
      b. Quantity of soil amendments.
      c. Quantity of seed.
      d. Quantity of agricultural gypsum (if required).

e. Submit copies of work orders and written certification of hydromulching.

E. Samples and Test: District reserves the right to take and evaluate samples of materials for conformity to this Specification at any time. Furnish samples upon request. Rejected materials shall be immediately removed from the site at no cost to the District.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handling Plants: Handle plants in a manner to avoid any damage to the plant. Protect plants from sun or drying winds. Plants that cannot be planted immediately on delivery shall be kept in the shade, well protected, and adequately watered.

1.06 PROJECT CONDITIONS

A. Underground Utilities and Obstructions: Verify the location of underground utilities and other obstructions that may affect the Work. Report any obstructions encountered to the District. Repair damage to any known utility line or other underground obstruction without additional cost to the District.

B. Notify District in writing of soil or drainage conditions encountered during planting operations which are detrimental to growth of plant material.

C. Protection:
1. Provide necessary safeguards and exercise caution against injury or defacement of existing site improvements.
2. Be responsible for any damage resulting from landscape planting operations. Repair damage and return the area to the previous condition at no cost to the District.

D. Schedule for Inspection:
1. Pre-job conference.
2. Final grade approval.
3. After pre-planting weed control.
4. Plant material inspection.
5. Plant layout.
6. Soil preparation and planting operations. (One tree with each type of specified staking shall be approved prior to planting of trees).
7. Pre-maintenance inspection.
8. Final inspection.
9. Post-warranty inspection.

1.07 WARRANTY:

A. Plant Material:
1. Plant materials furnished or relocated under this Section shall be warranted in writing, for a period of one year from the date of final acceptance against improper installation, defective, unsound, or diseased conditions that may appear.
2. Upon receipt of written notice from District of death of any warranted plant materials shall be promptly replaced with the same species originally planted, and of a size closely approximating the size of the plant of normal growth had occurred since the original planting. Replacements shall be subject to the requirements of this Specification.
3. When plants are replaced, advise the District in writing, of the necessary establishment maintenance which must be performed.
4. The expense of replacement shall be evenly shared by the District and the Contractor if replacement is necessary after the maintenance period but during the warranty period.
5. Contractor shall not be held liable for loss of plant materials that have not been maintained properly by the District. The Landscape Architect shall be the sole authority as to whether a plant loss was due to failure on the part of the District.

PART 2 - PRODUCTS

2.01 FERTILIZER:

A. Provide 8-8-4 Commercial fertilizer, uniform in composition, free flowing and suitable for application with approved equipment, delivered to the site in moisture proof unopened containers, each fully labeled, conforming to the applicable fertilizer laws, and bearing the name or mark of the manufacturer.

B. Provide 20 pounds of fertilizer per 1000 square feet of area.

2.02 ORGANIC SOIL AMENDMENT:

A. Provide nitrogen stabilized organic amendment derived from redwood sawdust, fir sawdust of finely ground bark.

B. Provide 6 cubic yards of organic soil amendment per 1000 square feet of area.

2.03 PRE-PLANTING HERBICIDE:

A. Use Round-Up or equal.

2.04 PRE-EMERGENT WEED CONTROL: Do not use in seeded ground cover area for 12 months after planting.

A. Use RONSTAR-G, Treflan, Eptam, Vegitex or equal.

2.05 PLANT MATERIAL:

A. Identification: Plant material shall be true to type and nomenclature in accordance with AJCHN Standardized Plant Names, and each bundle or plant shall be properly identified with durable, legible labels.

B. Quality and Size of Plants: In accordance with rules and grading of ANN American Standard for Nursery Stock, and as shown on the Drawings.
   1. Trees, shrubs, vines, and ground covers shall have normal habit of growth and shall be sound, healthy, vigorous and free from insect infestations.
   2. Plants that meet the measurements specified, but do not possess a normal configuration or balance of height and spread will be rejected.
   3. Trees and shrubs shall have been grown in containers of the size stated on Drawings, and shall have sufficient roots to hold the root ball together after removal from containers without being rootbound.
   4. Trees will be straight and of uniform shape without damaged, crooked, or multiple leaders. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 1/2 inch which have not been pruned and painted or completely calloused, will be rejected.
   5. Groundcover plants shall be grown in flats or as indicated on the Drawings. Flatgrown plants (rooted cuttings) shall remain in those flats until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.

2.06 LAWN: Hydromulch turf mix shall be as follows:

A. Triple Crown Fescue, Hydroseed Fescue Blend by Stover Seed Company

2.07 MISCELLANEOUS MATERIALS:

A. Wood Tree Stakes: 2 inch diameter round knotfree Lodge Pole Pine stakes, treated in pentachlorophenol.

B. Ties: Rubber Tree Ties.

2.08 MULCH:

A. 3/4 inch size nitrogenized redwood chips spread 1-1/2 inch thick in all planters.

2.09 BACKFILL MIX:

A. Blend the following ingredients:
   1. 50 percent by volume of on-site soil.

2. 50 percent by volume of nitrolized redwood sawdust.
3. Agiform tablet (21-10-5)
   a. 1 gallon containers 1 tablet
   b. 5 gallon containers 3 tablets
   c. Large containers 1/2 inch of trunk diameter

PART 3 - EXECUTION

3.01 GENERAL:

A. Do not wilfully install this work when it is obvious that the work, as described in the drawings; does not match the site conditions, or something normal to the completion of this or similar work is missing or incorrect, or the drawings include an obvious error. Such conditions shall be brought to the attention of the District, otherwise the Contractor must assume full responsibility for any and all necessary revisions with no additional cost to the District.

3.02 INSPECTION:

A. Acceptance of Previous Work: Inspect and accept the condition of the site relative to this Section before commencing with the Work of this Section. If not acceptable, notify the District in writing. By proceeding with the Work of this Section, the Contractor implies his acceptance of previous related work.

3.03 CLEARING:

A. Clear planting areas of existing vegetation not specified to remain and of other debris and foreign material considered a hindrance to planting operations or unsightly in appearance. Dispose of off-site.

B. Maintain previously established grades and swales.

3.04 HYDROMULCH WEED ERADICATION PROGRAM:

A. Fertilize all planting areas with 35-0-0 commercial fertilizer at the rate of 0.5 pounds per 1000 square feet.

B. Water all planting areas thoroughly and continuously for a period of three consecutive weeks. A specific watering duration and frequency program designed to germinate all residual weed seeds shall be approved in advance.

C. Discontinue watering process for two days. Then apply a non-selective broad spectrum systemic herbicide for perennial weeds.
   1. The type of chemical to be used shall be determined by a licensed pest control advisor. If annual weeds are present, use straight contact herbicide in accordance with pest control advisor's recommendations.

D. Allow sufficient period of time to insure that all weeds are dead. Follow herbicide manufacturer's direction.

E. Water all planting areas thoroughly and continuously for a period of three weeks. A shorter watering period may be permissible at the discretion of the Landscape Architect.
   1. Discontinue watering process for one day to the second application of the herbicide spraying. Re-apply the spraying operation with a straight contact weed killer according to pest control advisor's recommendations. Avoid irrigation for a minimum of four days for effective final weed kill.

F. Clear all desiccated weeds from the area.

G. Water all planting area thoroughly and continuously for three consecutive days prior to hydromulching operation.

H. Allow planting area soil surface to dry out for one day only prior to the hydromulching application. Exercise care to not allow the soil surface to be either super-saturated with water or

bone dry prior to the hydromulching installation. There should be some residual moisture within the first 1/4 inch of the soil surface.

3.05 WEED CONTROL:

A. Apply preplanting herbicide to visible weed, before and after soil placement.

B. Pre-emergent Weed Control: Immediately after planting, apply pre-emergent weed control materials to planted areas which will not be seeded.

C. Protect existing plants from damage.

3.06 IMPORTED TOPSOIL:

A. Provide imported topsoil for raised planters only and bring soil up to required finish grade.

3.07 SOIL PREPARATION:

A. Uniformly distribute organic soil amendment and the fertilizer specified by the soil analysis over all areas receiving plants on turf.

B. Roto-till, in two directions, the top six inches of all planting areas to evenly incorporate the amendments into the soil.

3.08 FINE GRADING:

A. Adjust finish grading with imported topsoil as necessary. Grades shall be smooth and even on a uniform plane with no abrupt changes or pockets, and shall slope away from the building. Verify the surface drainage of planting areas, and notify the District of any discrepancies, obstructions, or other conditions considered detrimental to proper execution of the work.

B. After initial settlement, the finish grade shall be lower than the adjacent walks, curbs, and headers by the following amounts:
   1. Coarse Grasses: 1/2 inch to 3/4 inch.
   2. Shrubs and groundcovers: 1 inch to 1/2 inches.

3.09 PLANTING OPERATIONS:

A. Plant Pits: Trees and shrubs shall be installed in round pits with vertical sides, twice the diameter and six inches deeper than the root ball or container. Sides and bottom of plant pits shall be scarified.

B. Setting Container and Larger Plants:
   1. Plants shall be centered and set on the appropriate native soil that has been puddled and settled.
   2. Plants shall be set with the top of the root ball level and even with the finish grade and rotated to give the best appearance in relationship to adjacent structures or surroundings.
   3. Use appropriate backfill mix to continue filling plant pits. Set plant plumb and brace rigidly in position until backfill mix has been tamped solidly around root ball. When 3/4 of the pit is backfilled, water thoroughly, saturating the root ball. Continue filling pit to finish grade with backfill mix.
   4. When the plant pit is filled, form saucer berm around plants with backfill material sufficient to hold two inches of water.
   5. Water the plants immediately after planting.

C. Staking and Guying: Immediately after planting, stake five gallon, 15 gallon and 24 inch box trees. Guy larger trees as detailed on the drawings.

3.10 GROUND COVER:

A. Install plant material in moist soil in the areas and at the spacings indicated on the Drawings, in neat rows, insuring complete coverage of planting areas, including under and around trees and shrubs. Spacings shown in the Plant List or on the Drawings are triangular spacing unless

otherwise noted.

3.11 HYDROMULCH LAWN:

A. Inspection of Condition: Examine related work including irrigation and grading of surfaces before proceeding with Work. Report conditions which may prevent the proper execution of this work. Failure to report unsuitable conditions will require the Contractor to rectify unacceptable work at no additional cost to the District.

B. Prepared Soil: Remove rocks, weeds and debris from area to be seeded. Work up soil to a depth of six inches and break up clods.

C. Grading and Rolling: Carefully smooth surface to be seeded. Roll area to expose soil depressions or surface irregularities. Regrade as required.

D. Before filling tanks, the Contractor shall completely clean tank of seed and debris in the presence of and to the satisfaction of the Landscape Architect.

E. Material for hydromulch shall be uniformly blended in slurry container with minimum capacity of 1,000 gallons and agitated by mechanical device to produce desired uniform blend.

F. Deliver slurry by hose to fan-type nozzle at proper pressure for uniform distribution.

G. Apply hydromulch lawn slurry at the rates specified on the Planting Plan.

H. Submit certification, in writing, from the contractor stating that the hydromulching has been installed exactly as specified.

I. Hydromulched grass shall be watered sufficiently and at intervals necessary to germinate grass seed, and to attain a mature uniform stand of the specified lawn mix. Reseed bare areas to sustain a mature stand of grass. Grass shall have been mowed prior to the Contractor requesting a Pre-maintenance Inspection.

3.12 PLANTING MAINTENANCE:

A. Maintain all plants and planting areas in optimum growing condition and appearance for a period of 90 days after date of Pre-Maintenance Inspection. Contractor is responsible to continually maintain plants during construction period and until he is notified, subsequent to the Pre-maintenance inspection, of the certain date that the formal maintenance period has begun.
   1. Protect areas susceptible to traffic by erection barricades immediately after planting.

B. Irrigate planting areas as required to insure active growth keeping areas moist but not saturated. Regulate irrigation as necessary to avoid erosion and gullying.

C. Fertilize as needed in accordance with the manufacturer's recommendation and five days prior to final inspection. Exercise proper caution and take measures necessary to avoid plant burn.

D. Keep planting areas free of weeds and undesirable grasses through daily weeding if necessary.

E. Inspect plants, including lawn, for disease or insect weekly. Treat affected plant material immediately.

F. Remove damaged or diseased growth from trees and shrubs. Treat cuts larger than 1/2 inch in diameter with specified tree paint.

G. Immediately remove any dead or dying plants not in a vigorous thriving condition. Replacements shall be the same species and size as originally planted (refer to 1.07 Warranty).

H. Restake, tighten, repair guys, and reset to proper grades or upright position any plants not in their proper growing positions.

I. Mow lawn to 1-1/2 inch height and trim edges whenever the average height exceeds two inches. Remove clippings.

J. As it becomes evident that certain lawns and groundcover have not uniformly or properly

established, replant the areas immediately with the same plants and quantity as specified for 90 percent coverage of healthy, actively growing grass and groundcovers for approval at Final Inspection.

3.13 FIELD QUALITY CONTROL:

A. Pre-maintenance Inspection and Final Inspection:
   1. At completion of landscape planting operations and prior to the beginning of the formal maintenance period, the Pre-maintenance Inspection shall be held. At completion of the formal maintenance period, the Final Inspection shall be held.
   2. Request these inspections of the Landscape Architect five working days prior to the completion of work in order that a mutually agreeable time for inspection may be arranged. The Architect will be present at the inspection.
   3. At the time of inspection, have the areas under Contract free of weeds, dead leaves and other trash or debris, neatly cultivated and raked. Stakes, guys and plant basins shall be in good order.
      a. At the Final Inspection, lawns shall be neatly cut and all clippings removed.
      b. If, after Pre-maintenance Inspection, the Landscape Architect is of the opinion the Work has been performed in accordance with the Drawings and Specifications, written notice of preliminary acceptance will be given. This report will note any items which must be corrected, and state the date of commencement and completion of the formal maintenance period.
      c. If, after the Final Inspection, the Landscape Architect is of the opinion that the Work has been performed in accordance with the Drawings and Specifications, written notice of acceptance and completion of the Project will be given. If all or certain portions of the work are not acceptable, a reasonable amount will be retained and the formal maintenance period for the unacceptable work shall be extended at no cost to the District until the defects in the work have been corrected and accepted by the District.

3.14 ADJUSTING AND CLEANING:

A. Clean Up: Keep all areas of the Work clean, neat and orderly at all times during the period of Contract. Clean construction areas at the end of each day.

END OF SECTION

SECTION 03100

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.02 RELATED REQUIREMENTS

A. Section 1400 - Quality Services.

B. Section 03200 - Concrete Reinforcement.

C. Section 03300 - Cast-in-Place Concrete.

D. Section 03390 - Concrete Curing.

E. Section 06100 - Rough Carpentry

F. Section 04810 - Unit Masonry Assemblies.

G. Section 04816 - Masonry Veneer: Spacing for veneer anchor reglets recessed in concrete.

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute; 2010.

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2008.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

E. PS 1 - Structural Plywood; 2007.

F. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 19A, Concrete; 2007.

1.04 DESIGN REQUIREMENTS

A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements; resultant concrete to conform to required shape, line and dimension.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on tubular column form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 347, ACI 301, and ACI 318.

B. Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State of California.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for design, fabrication, erection and removal of formwork.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable State and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347, ACI 301, and ACI 318.

2.02 WOOD FORM MATERIALS

A. Forms for Exposed Concrete: Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

B. Forms for Unexposed Concrete: Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

2.03 PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage (1.5 mm) matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Tubular Column Type: Round, spirally wound laminated fiber material, surface treated with release agent, non-reusable, of sizes indicated.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, free of defects that could leave holes larger than 1 inch (25 mm) in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

C. Form Release Agent: Colorless mineral oil that will not stain concrete.

D. Corners: Filleted, rigid plastic type; 3/4 x 3/4 inch size where shown on the drawings; maximum possible lengths.

E. Dovetail Anchor Slot: Galvanized steel, 22 gage (0.8 mm) thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Flashing Reglets: Galvanized steel, 22 gage (0.8 mm) thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength

and character to maintain formwork in place while placing concrete.

H. Waterstops: Rubber, minimum 1,750 psi (12 MPa) tensile strength, minimum 50 degrees F (46 degrees C) to plus 175 degrees F (79 degrees C) working temperature range, 6 or 8 inches wide, maximum possible lengths, ribbed profile, preformed corner sections, heat welded jointing. Provide at all keyed joints and where shown on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

B. Inspect the substrate and the conditions under which concrete formwork is to be installed. Do not proceed with the Work until unsatisfactory conditions have been corrected.

3.02 EARTH FORMS

A. Verify elevations and provide final excavation required for footings prior to placing concrete.

B. If natural soil or compacted fill can be accurately cut and maintained and concrete coverage is increased one inch in thickness at each earth contact surface, foundations may be poured against earth without forming when requested by Contractor and approved by the Structural Engineer or Architect and Division of State Architect (D.S.A.).

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301.
   1. Stakes are not permitted within footing sections.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Provide forming for concrete bases for mechanical and electrical equipment indicated on the drawings in accordance with Shop Drawings furnished for such equipment.
   1. Coordinate size and location of equipment with mechanical, plumbing and electrical requirements.
   2. Provide coved base for all equipment bases poured on concrete slabs.
   3. Tool all edges.

D. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

E. Align joints and make watertight. Keep form joints to a minimum.

F. Obtain approval before framing openings in structural members that are not indicated on drawings.

G. Provide fillet strips on external corners of beams, joists, and columns.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes or applied

coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work. Comply with CBC Section 1906A.3

B. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

C. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.

D. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

E. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

F. Set and build into the 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 submitted by suppliers of the items to be attached thereto.

G. Allow other trades to set Work which is to be embedded in concrete such as sleeves. Coordinate with electrical and mechanical trades to locate required openings for pipes and inserts. Reinforce required openings as directed by the Structural Engineer or Architect.

H. Piping: Do not embed piping or electrical conduit in structural concrete unless approved by the Structural Engineer or Architect.

I. Sleeves: Standard or heavier weight galvanized steel pipe sleeves may pass through footings in protected locations. Refer to Structural Drawings for special reinforcing around sleeves and for method of locating sleeves. Size sleeves to pass largest coupling on the pipe.

J. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchors, angles and other items to be embedded in concrete. Set embedded bolts and sleeves for fans, meters, pumps and other equipment to template and Shop Drawings prepared by trades supplying equipment. Verify location of anchor bolts with respect to motor supports.

K. Shaped Wood Inserts and Nailers: Use preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required. Wood plugs shall not be used. Set all wood inserts and nailers vertically spaced at 16 inches on center, unless noted otherwise on the drawings. Size of nailer minimum one inch by two inch unless noted otherwise on the drawings. Chamfer edges of nailer set into concrete.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117.

3.08 FIELD QUALITY CONTROL

A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with

formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

B. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

3.09 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Comply with CBC Section 1906A.2

END OF SECTION

SECTION 03200 3

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED SECTIONS

A. Section 01400 - Quality Services.

B. Section 03100 - Concrete Forms and Accessories.

C. Section 03300 - Cast-in-Place Concrete.

D. Section 04810 - Unit Masonry Assemblies: Reinforcement for masonry.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

B. ACI 318 - Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2005.

C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 2004.

D. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2006.

E. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.

F. California Code of Regulations (CCR): Title 24, Chapter 19, Section 1903.5 and 1907.

G. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2005.

H. AWS D12.1 - Structural Welding Code - Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction; American Welding Society; 1998.

I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2001.

J. CRSI (P1) - Placing Reinforcing Bars; Concrete Reinforcing Steel Institute; Eighth Edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
   1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State of California.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

D. Reports: Submit certified copies of mill test report of reinforcement materials analysis. Transmit copy to installer for welded splices.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

B. Provide Inspector with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.

C. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS and UBC STD 27-6 qualification within the previous 12 months.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination, accumulation of dirt or excessive rust.

C. Deliver and store welding electrodes in accordance with AWS D1.4.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M, deformed in accordance with ASTM A305. If not otherwise specified on the drawings, provide the following: Grade 40 (280) for No. 3 bars and smaller, stirrups, ties, slabs on grades, and non-structural items; Grade 60 (420) for No. 4 bars and larger.

B. Reinforcing Steel to be Welded: ASTM A 706, Grade 60 (420).

C. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
   1. Flat Sheets.
   2. Mesh Size and Wire Gage: As indicated on drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage (1.5 mm).
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide galvanized components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review locations of splices with Structural Engineer.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position. Locate and support reinforcing by metal chairs, runners, bolster spacers, and hangers as required.
   1. Provide sufficient numbers of supports and of necessary strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

B. Place reinforcement to obtain the minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports together with 16 gage tie wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends

are directly away from exposed concrete surfaces.

C. Provide clearance between parallel bars and between bars and forms of not less than 2-inches.

D. Splicing:
   1. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with details and requirements of Structural Drawings for minimum lap of spliced bars.
   2. Welding: Comply with the requirements of Title 24, Section 1903.5 and AWS D12.1 for field welding. Prior to field welding, determine the weld characteristics of reinforcing bars by a laboratory chemical analysis of the steel. Only steel conforming to the chemical requirements specified in AWS D12.1 may be welded.
   3. Welding inspection as per California Code of Regulations, Title 24, Part 2, Section 1928A.10.

E. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with 16 gage wire. Offset end laps in adjacent widths to prevent continuous laps.
   1. Extend fabric to within one inch of edge at slabs-on-grade.
   2. Cut mesh at expansion joints and full depth control joints.
   3. Do not make laps midway between supporting beams.

F. Provide protection caps for exposed reinforcement, bolts, and anchors vertically protruding plus six inches above forms or poured-in-place concrete to prevent possible injury from falls.

G. Do not displace or damage vapor barrier.

H. Conform to applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01400, will inspect installed reinforcement for conformance to contract documents before concrete placement.
   1. Tests and verifications will be made by the Testing Laboratory as follows:
      a. Certification of welders engaged in electric arc welding of reinforcing.
      b. Verification of location of reinforcing.
      c. Inspection of reinforcing bar welds.
      d. X-ray test one of the first 3 arc welds made by each welder.
      e. Tensile tests of sample welds of the largest size bar for each type of welding.
   2. Deficient welds will require the Contractor to provide and pay for such additional X-rays and tests as directed by the Architect or Structural Engineer. Repair or replace defective welds to the satisfaction of the Architect or Structural Engineer.

B. Notify Structural Engineer and DSA Field Engineer 48 hours prior to placement of any portions of concrete material or mortar material.

END OF SECTION

SECTION 03300 3

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.

B. Floors and slabs on grade.

C. Concrete shear walls, elevator shaft walls, and foundation walls.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

F. Concrete curing.

1.02 RELATED SECTIONS

A. Section 01400 - Quality Services

B. Section 02316 - Fill and Backfill

C. Section 02751 - Portland Cement Concrete Paving: Sidewalks, curbs and gutters.

D. Section 03100 - Concrete Forms and Accessories: Forms and accessories for formwork.

E. Section 03200 - Concrete Reinforcement.

F. Section 07900 - Joint Sealers.

1.03 REFERENCES

A. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International; 1998 (Reapproved 2004).

B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

E. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.

F. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).

G. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001.

H. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2005.

I. ASTM C 31/C 31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field; 2003.

J. ASTM C 33 - Standard Specification for Concrete Aggregates; 2003.

K. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.

L. ASTM C 42/C 42M - Standard Test Method for Obtaining and Test Drilled Cores; 2004.

M. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.

N. ASTM C 114 - Test Methods for Chemical Analysis of Hydraulic Cement.

O. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2005a.

P. ASTM C 150 - Standard Specification for Portland Cement; 2005.

Q. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete; 2003.

R. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete; 2004.

S. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2001.

T. ASTM C 192 - Practice for Making and Curing Concrete Test Specimens in the Laboratory.

U. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method; 2004

V. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2006.

W. ASTM C 330 - Standard Specification for Lightweight Aggregates for Structural Concrete; 2005.

X. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2005a.

Y. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002.

Z. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 1999.

AA. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2007.

AB. ASTM D 412 - Test Methods for Rubber Properties in Tension.

AC. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 1998 (Reapproved 2003).

AD. ASTM D 882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

AE. ASTM D 1709 - Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

AF. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004.

AG. ASTM E 96 - Test Methods for Water Vapor Transmission of Materials.

AH. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 1996 (Reapproved 2001).

AI. ASTM E 1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

AJ. California Building Code (CBC), California Code of Regulations, Title 24, Chapter 19A, Concrete.

AK. Military Specification Mil-B-19235 (Docks).

AL. COE CRD-C 572 - Corps of Engineers Specifications for Polyvinylchloride Waterstop; Corps of Engineers; 1974.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

C. Samples: Submit samples of underslab vapor retarder to be used.

D. Design Mix: Submit concrete design mix for review. Review will be for general information only. Production of concrete to comply with specified requirements is the Contractor's responsibility.

E. Material Certificates: Submit material certificates signed by the material producer and the Contractor, certifying that each material item complies with, or exceeds, the specified requirements.

F. Records: Maintain an accurate record of the items listed below. Keep records available for inspection at the site. Upon completion, deliver two copies of each record to Architect in approved form.
   1. Concrete Placement: Date and time of placement in each portion of schedule.
   2. Test Cylinders: Correlate with placement record.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Acquire cement from same source and aggregate from same source for entire project.

C. Follow recommendations of ACI 305R when concreting during hot weather.

D. Tests for Concrete Materials: Utilizing batch plant test records, perform following tests in strict accordance with provisions of CBC, Section 1928A. Coordinate requirements with test schedule included in Section 01415.
   1. Sample and test cement, or provide mill test reports, as approved, certifying that the cement conforms to specifications.
   2. Sample and test concrete aggregate for grading, soundness and abrasion, before concrete mix designs are established.
   3. Test concrete cylinders or cores in accordance with CBC, Section 1905A.3. Fabricate, cure and test specimens in accordance with ASTM C 192.
      a. Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards of concrete, or not less than once for each 2,000 s.f. of surface area for slabs or walls. In addition, samples for strength tests for each class of concrete work or whenever the mix or aggregate is changed.
      b. If the total volume of concrete is such that the frequency of testing required by (a.) above would provide less than five (5) strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
      c. A strength test shall be average of the compressive strengths of two cylinders made from the sample of concrete and tested at 28 days or at test age designated for determination of f'c.
   4. Perform additional tests and designs as required due to defective concrete.
   5. Where small daily placements (less than 75 cubic yards) make it necessary to have additional samples tested, the Contractor shall pay the cost of all such sample testing.

E. Inspection:
   1. For all concrete a signed copy of batch plant's certificate stating the quantity of each material, amount of water, admixtures, departure time and date shall accompany each load of materials or concrete and such certificates shall be given to the Inspector of Record.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protection: Work of other trades shall be protected from damage and if damaged in performance of work of this section, shall be replaced or patched in manner fully acceptable to the Architect at no added cost to the District.

1.07 PROJECT CONDITIONS

A. The contractor shall provide a concrete slab smooth troweled and level to a tolerance of 1/8 inch in a 10'-0" radius where wood flooring and resilient flooring systems are installed. Grind down all ridges and other irregularities. Fill all cracks, holes, and depressions with latex cement underlayment (patching compound) as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03100.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03200.

2.03 CONCRETE MATERIALS

A. Fine and Coarse Aggregates: ASTM C 33.

B. Lightweight Aggregate: ASTM C 330.

C. Portland Cement: ASTM C 150, Type I or Type II.
   1. Use low alkali type with 0.6 percent alkali content per ASTM C 114 when aggregates fail to pass soundness test.

D. Normal Weight Aggregate: ASTM C 33, comply with CBC, Section 1903A.3, and as herein specified.
   1. Fine Aggregate: Washed natural sand of hard, strong particles, containing not more than one percent of deleterious material. Fineness modules 2.85 to 3.15.
   2. Coarse Aggregate: Clean washed gravel or sound crushed rock, containing not more than 5 percent flat, thin, elongated or laminated material, not more than one percent deleterious substances.
      a. Grade 1-inch aggregate from No. 100 sieve to 1-inch.
      b. Grade 1-1/2 inch aggregate from No. 100 sieve to 1-1/2 inches.
   3. Maximum Size: No larger than 3/4 of the clear space between reinforcing bars, and between reinforcing bars and forms.
      a. 1-1/2 inch Maximum Aggregate: In mass concrete where reinforcement clearance will permit.
      b. 1 inch Maximum Aggregate: In walls, slabs on grade and all other concrete.

E. Water: Clean and free from deleterious amount of acids, alkalis, salts or organic materials.

F. Do not change brand of cement or source of aggregate during course of work without prior written approval of the Architect.

2.04 CHEMICAL ADMIXTURES

A. General: Admixtures may be used only with written approval of the Structural Engineer and The Division of the State Architect (D.S.A.). Comply with CBC Section 1903A.6 and manufacturer's recommendations for use.

B. Air Entrainment Admixture: ASTM C 260.

C. Chemical Admixtures: ASTM C 494/C 494M, Type A - Water Reducing, Type B - Retarding, and Type C - Accelerating.
   1. Water Reducing: Shall provide a minimum of 5 percent water reduction, 10 percent increase of 28-day compressive strength. Drying shrinkage at 21 days shall be less than

concrete without admixture.

2. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: Vapor barrier membrane must have the following properties.
   1. 15 mil thickness, manufactured from prime virgin resins.
   2. Water Vapor Barrier — ASTM E 1745 — Meets or exceeds Class A.
   3. Water Vapor Transmission Rate — ASTM E 96 — 0.006 gr/sq ft/hr or lower.
   4. Permeance Rating — ASTM E 96 — 0.02 perms or lower.
   5. Puncture Resistance — ASTM D 1709 — Minimum 2200 grams.
   6. Tensile Strength — ASTM D 882 — Minimum 50.0 lbf/in.
   7. Acceptable Products:
      a. Stego Wrap Vapor Barrier by Stego Industries, LLC, San Juan Capistrano, CA, 877-464-7834.
      b. Moistop Ultra 15 by Fortifiber Building Systems Group, Reno, NV, 800-773-4777.
      c. TruBarrier 15 Mil by Floor Seal Technology, Inc., Santa Ana, CA, 800-295-0221.
      d. Perminator by W.R. Meadows/Sealtight, Hampshire, IL, 847-214-2100.
      e. Vipor Vapor Check II, 15 mil ASTM E 1545, by Insulation Solutions, Inc., East Peoria, IL.
   8. Substitutions: See Section 01600 - Product Requirements.

B. Chemical Hardener: Fluosilicate solution designed for densification of cured concrete slabs.
   1. Acceptable Products:
      a. Hornolith - A.C.Horn/W.R. Grace.
      b. Saniseal 50 - Master Builders Company.
      c. Armortop - Anti-Hydro Waterproofing Company.
      d. Lapidolith - Sonneborn-Contech.

C. Aggregate for Non-slip finish: Aluminum oxide grits or crushed emery, factory-graded, packaged, rust-proof, and non-glazing.

D. Cement Grout: One part by volume portland cement and 2-1/2 parts fine sand, mixed dry. Add just enough water to make mixture flow under its own weight.

E. Dry Pack: One part by volume portland cement and 1-1/2 parts fine aggregate, mixed dry. Add just enough water to dampen mix to a cohesive packing or tamping consistency.

F. Non-Shrink Grout: ASTM C 1107/C 1107M; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,400 psi (17 MPa).
   2. Minimum Compressive Strength at 28 Days: 7,000 psi (48 MPa).
   3. Acceptable Products:
      a. Five Star by U.S.Group Corp.

G. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, clear polyethylene, white polyethylene, or white burlap-polyethylene sheet.

H. Liquid Curing Compound: ASTM C 309, Type 1, clear or translucent.

I. Concrete Sealer: ASTM C 1315 Type 1 Class A, ASTM C 309 Type 1 Class A, penetrating product to have no less than 34% solids content, leaving no sheen, compatible with all floor finish materials.
   1. Acceptable Products:
      a. CreteSeal CS2000 Spray Apply System manufactured by CreteSeal, Anaheim, CA, 800-278-4273.
      b. Curranseal PMC 3300, ASTM C 131, ASTM C 309, ASTM C156, as manufactured by Curranseal, Santa Ana, CA; 714-641-1121.

J. Latex Cement Underlayment: Portland cement-based self-drying underlayment. Provide Ardex Feather Finish by Ardex Engineered Cements or equal.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-dispersible acrylic latex, complying with ASTM C 1059 Type II.
   1. Acceptable Products:
      a. Weldcrete by Larsen Products Corporation.
      b. Daraweld C by Grace Construction Products.
      c. Substitutions: See Section 01600 - Product Requirements.

B. Epoxy Bonding System: Complying with ASTM C 881, 2 component, mineral-filled, epoxy-polysulphide polymer.
   1. Acceptable Products:
      a. A-H Poly-Epoxy Bonding #100 by Anti-Hydro Waterproofing Company.
      b. Substitutions: See Section 01600 - Product Requirements.

C. Waterstops: rubber, flat ribbed, complying with ASTM D 412 and COE CRD-C 572.
   1. Acceptable Products:
      a. Model No. FR-4316 by BoMetals, Inc., 800-862-4835.
      b. Substitutions: See Section 01600 - Product Requirements.

D. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
   1. Size: 1/2 inch (12 mm) throat, 1/2 inch (12 mm) deep.

E. Expansion Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard, complying with ASTM D 1751, thickness as indicated on drawings and full depth of slab less 1/2 inch (12 mm); tongue and groove profile. Provide expansion board cap same width as joint filler.
   1. Acceptable Product: Provide Expansion Board Cap manufactured by BoMetals, Inc.

F. Expansion Joint Filler: Compressible asphalt mastic with felt facers, complying with ASTM D 994, thickness as indicated on drawings and full depth of slab less 1/2 inch (12 mm). Provide expansion board cap same width as joint filler.
   1. Acceptable Product: Provide Expansion Board Cap manufactured by BoMetals, Inc.

G. Control and Construction Joint Devices: Integral galvanized steel; 24 gage, formed to tongue and groove profile, with removable top strip exposing sealant trough, knockout holes spaced at 6 inches (150 mm), interlocking 16 gage steel spikes with tongue to fit top screed edge. Provide Pro-Key System with Pro-Key Lock Slot stakes manufactured by BoMetals, Inc., Powder Springs, GA, 800-862-4835.

H. Sealant and Primer: As specified in Section 07900.

2.07 PROPORTIONING

A. Proportioning shall be by weight of loose, dry material, 94 pounds of cement shall be considered 1 cubic foot. Fine aggregate volume shall be at least 35 percent of the sum of the separate fine and coarse aggregate volumes. Weighing equipment shall be accurate to within one pound and be adjustable for varying aggregate moisture content. A beam auxiliary shall register any part of the last 100 pounds of each aggregate. The aggregate hopper shall have a volume adjustment.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with CBC Section 1905A.2.3, Method B.

B. Proportioning Structural Lightweight Concrete: Comply with CBC Section 1905A.2.3, Method B.

C. Prepare and design mixes for each type and strength of concrete.
   1. Proportions: For each material including admixtures and water, state water-cement ratio and maximum allowable water content, using not less than the minimum cement content recommended by the manufacturer.

2. Materials: List manufacturer's name, designation and source of each material.
3. Aggregate: Conform to CBC Section 1903A.3 for grading of combined aggregate.

2.09 MIXING

A. Retempered Concrete: Concrete not placed within 90 minutes after water is introduced into mix or which has stood for 30 minutes after leaving mixer shall not be used.

B. Job-Mixed Concrete: Mix all job-mixed concrete in accordance with CBC, Section 1905A.8, and with additional requirements herein specified. Mixer shall be equipped with an automatic metering device for measuring water which may be locked at any desired adjustment.

C. Transit mix the concrete in accordance with provisions of ASTM C 94/C 94M.
1. With each load, provide ticket certifying the materials and quantities as well as compliance with the approved mix design.
2. On the transit-mix ticket, state the time water was first added to the mix.
3. At the batch plant, withhold 2-1/2 gallons of water per cubic yard of concrete.
4. Upon arrival at the job site, and as directed by the testing laboratory inspector, add all or part of the withheld water before the concrete is discharged from the mixer.
5. Mix not less than five minutes after the withheld water has been added, and not less than one minute of that time immediately prior to discharge of the batch.
6. Unless otherwise directed, provide 15 minutes total mixing time per batch after first addition of water.
7. Do not use concrete that has stood over 30 minutes after leaving the mixer, or concrete that is not placed within 60 minutes after water is introduced into the mix.

D. The minimum ultimate 28-day compressive strength of concrete shall be controlled in accordance with CBC, Section 1905A, Method B for laboratory designed mixes. Mixes may be established by a qualified person based upon previously proven mixes and material tests made by a recognized testing agency.

E. Slump: Three inches, maximum, for flatwork; four inches, maximum, for other work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Inspection: Notify Architect, Structural Engineer and D.S.A. Field Representative 48 hours before scheduled start of placing concrete. Excavations, forms, reinforcement and embedded items shall have opportunity for inspection and approval before any concrete is placed.

B. Forms: Immediately before start of pour, remove foreign matter accumulated in forms and close ports and openings left in formwork.

C. Reinforcement: Clean bars extending through construction joints while concrete encrustation is soft.

D. Embedded Items: Properly secure reinforcement, conduit, outlet boxes, sleeves, bolts, and other items in place before inspection and start of pour. Conduits under concrete slabs on grade shall be placed below the reinforcing steel. The slab shall be thickened so that there is a concrete cover three inches thick (minimum) around conduit.
1. Drilling and setting of all bolts for steel, etc. shall be Work of this Section. Provide drilling and anchorage of dowels with non-shrink grout where required or shown on Drawings.

E. Wetting: Wet bottom of footing excavations immediately prior to pouring. Remove saturated soil or mud from excavation. Dampen subgrade at slabs placed directly on earth 24 hours in advance of placing. Re-roll as required. Wet wood forms sufficiently to tighten cracks, reduce suction, and maintain workability of concrete mix.

F. Underslab Vapor Barrier:
   1. Install vapor barrier under all interior slabs on grade. Roll subgrade smooth before placing vapor barrier. Install 2 inch base layer of sand over subgrade. Place vapor barrier, lap joints minimum 12 inches and seal watertight by taping edges and ends. Tape and seal all penetrations and laps using manufacturers seam tape and mastic. Turn up edges of vapor barrier four inches. Cover with 2 inch layer of sand; repair damaged vapor barrier before covering.
   2. Do not disturb or damage vapor barrier while placing concrete reinforcing. If damage does occur, repair areas before placing concrete.
   3. At depressed slabs greater than three inches, provide a one additional layer of vapor barrier up the face and five feet each way along the termination point of the depressed slab.

G. Equipment: Thoroughly clean tools and equipment used in transporting, placing, and consolidating concrete immediately before and after each pour.

H. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

I. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
   2. Use latex bonding agent only for non-load-bearing applications.

J. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

A. Convey concrete in accordance with CBC, Section 1905A.9.

B. Place concrete in accordance with ACI 304R and CBC, Section 1905A.10.

C. Place concrete for floor slabs in accordance with ACI 302.1R.

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Separate slabs on grade from vertical surfaces with joint filler.

F. Place expansion joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

G. Extend expansion joint filler from bottom of slab to within 1/2 inch (13 mm) of finished slab surface. Conform to Section 07900 for finish joint sealer requirements.

H. Install control joint devices in accordance with manufacturer's instructions where shown on the drawings, or if not shown, not more than 20 feet on-centers in both directions. Locate on column center lines and at re-entry corners wherever possible. Form joints true to line and profile, round all edges with 1/4 inch radius tool.

I. Install joint device anchors for expansion joint assemblies specified in Section 05810. Maintain correct position to allow joint cover to be flush with floor and wall finish.

J. Pouring Schedule: Pour concrete in accordance with approved pouring schedule and construction joint layout.

K. Conveying: Approved methods include bucket, cart, wheelbarrow, and buggies. Pumping or belts shall be used only for mix especially designed for that purpose. Maximum drop height for concrete shall be 6 feet.

L. Placing: Place concrete continuously between predetermined construction and control joint. Keep surface of concrete level throughout, without flow from one position to another. Deposit at such a rate that mix is plastic and flows readily into space between bars.

M. Compression Test Specimens: Refer to Article: QUALITY ASSURANCE, above.

N. Compacting:
   1. General: Spade, rod, vibrate, and consolidate concrete in forms. Vibrators shall not be left in any one spot longer than 30 seconds and shall be kept constantly in motion. One vibrator shall be assigned to each location where concrete is being placed and a standby vibrator shall be kept ready at all times. Eliminate rock pockets, air bubbles, and honeycomb. Avoid separation of ingredients.
   2. Work concrete thoroughly around reinforcement and embedded fixtures and into corners and angles of forms by spading, rodding, and tamping.
   3. Consolidation: Vibrate to consolidate each layer with that previously placed, completely embedding reinforcing and fixtures, and bringing fine material to surfaces of slabs so as to produce proper finish.

O. Slab on Grade: Use control and/or construction joints. Set screeds. Rod in both directions, tamp and float to indicated levels and slopes. Maintain reinforcing at proper levels. Slabs depressed to receive finish of other Sections shall be screeded and tamped.
   1. Over vapor barrier use screed pads to hold screed posts. Do not pierce vapor barrier.

P. Hot Weather Placing: Comply with requirements of ACI 305R. Take approved measures to reduce evaporation and temperature of concrete during hot, dry weather.
   1. Contractor shall be prepared to use fog spray when required by the Architect.

Q. Apply sealants in joint devices in accordance with Section 07900.

R. Place concrete continuously between predetermined expansion, control, and construction joints.

S. Do not interrupt successive placement; do not permit cold joints to occur.

T. Screed and finish floors level, maintaining surface flatness of maximum 1/4 inch in 10 ft (6 mm /3 m) in any direction. High spots on slabs which are to receive resilient flooring shall be ground down and low spots filled with latex cement underlayment.
   1. Variations in finish surface where resilient floors and wood floors are to be installed shall not exceed 1/8 inch in 10-foot radius.

3.04 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels.
   1. Place topping in checkerboard panels not to exceed 20 ft (6 m) in either direction.

F. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.05 COLOR CONCRETE

A. Where indicated on the drawings, provide color curing compound as indicated below.
   1. Provide color curing compound by Burke, Bomanite, or equal.

B. The concrete receiving color shall have a minimum compressive strength of 2500 psi. Portland cement shall conform to ASTM C150, Type I, II or V, depending on soil conditions. Aggregate shall conform to ASTM 33. A normal set or retarded set water reducing admixture complying

with ASTM C494 may be used. Nothing containing calcium chloride is permitted in the mix.

C. The color shall be as selected by the Architect. The grade shall be heavy duty. Color curing membrane complying with ASTM C309 and with all applicable air pollution regulations.

D. Color hardener shall be applied evenly to the plastic surface by the dry-shake method using a minimum of 60 pounds per 100 square feet. It shall be applied in two or more shakes, floated after each, and troweled only after the final floating.

E. Color curing compound, thinned in the proportion of one part cure to one part mineral spirits (paint thinner), shall be applied uniformly for curing with a roller or sprayer. The coverage shall be approximately 600 to 650 square feet per gallon of unthinned curing compound.

F. The surface shall be cleaned to remove residual dust.

3.06 GROUTING AND DRYPACK

A. Cement Grout: Do all required grouting except that specified under work of other trades. Provide cement grout. Thoroughly puddle and rod to provide good bond.

B. Dry Pack: Install dry pack properly beneath all bearings of wood or metal plates, columns, and like structural members. Install cement-sand dry pack at other locations.

C. Non-Shrink Grout: Install non-shrink grout using specific product recommended by manufacturer in accordance with his printed instructions.

3.07 EQUIPMENT BASES

A. Form concrete bases for all mechanical and electrical equipment indicated on the drawings, including architectural, structural, mechanical, electrical, and plumbing drawings, in accordance with approved shop details furnished by the various trades. Corners shall be bullnosed and bases shall be coved.

3.08 PITS, TRENCHES AND CURBS

A. Pour pits for valves, trenches, curbs, and miscellaneous concrete items. Steel trowel surfaces hard, dense and smooth with corners, intersections, and terminations rounded. Where structural details for minor structures listed above do not specify otherwise, walls, floors and covers shall be six inches thick, reinforced with No. 3 bars, six inches on-centers both ways at center of members.

3.09 CONCRETE FINISHING

A. Unexposed Concrete: Similar treatment as specified for exposed concrete except ridges, offsets and other prominent marks need not be ground off, concrete cleaned or "sacked". This requirement applied to concrete areas that will be concealed by other construction. Exception: Painted concrete shall be considered as being "exposed".

B. Exposed Concrete: Do not leave exposed steel ties, clamps, etc., in concrete. Solid pack holes resulting from form construction after flushing them with water. Fill tie wire, nail bolt and core sample holes, which will be exposed within 24 hours after forms are stripped. Grout and repair any rough pockets, cracks or honeycomb. If patches are required, chip defective area to a uniform depth of at least one inch, with sides at right angles to surface. Match surrounding concrete surfaces in color and texture. Make trial patch to determine color match. Before applying, moisten surrounding concrete and flush with neat cement grout.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/8 inch (3 mm) or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
   2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap,

and keep moist for 36 hours.

3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Initial Troweling: Delay until surface water sheen has disappeared. Do not apply dry cement, sand, or water to surface.
   2. Wood float surfaces that will receive quarry tile and ceramic tile with full bed setting system.
   3. Steel trowel surfaces that will receive carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
   4. Steel trowel surfaces that will be left exposed.
      a. Chemical Hardener: After slab has cured, apply water-diluted hardener in three coats per manufacturer's instructions, allowing 24 hours between coats.
   5. Abrasive Finish - Stairs & Ramps: Sprinkle abrasive aggregate uniformly on unhardened surface immediately prior to finishing, at the rate of two pounds per square yard. Work into surface during finishing. Rub lightly to expose aggregate while concrete is green.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

F. Concrete slab paving shall have a medium salted (medium broom) finish on all surfaces sloped less than 6% and slip resistant (heavy broom finish) on all surfaces sloped greater than 6% per CBC Section 1133B.7.1.

3.10 CURING AND PROTECTION

A. Comply with requirements of ACI 308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.
   2. High early strength concrete: Not less than 4 days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
   1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Begin final curing after initial curing but before surface is dry.
      a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
      b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer. Omit where directed by Work of other Sections in order to bond floor finishes.

E. Protection: Protect finish surfaces from mechanical injury, abrasion, sun, wind, stains, rain, and water. Protect other finished surfaces from hardener or curing solutions. Protect color concrete area using a protective covering until occupancy. Any damaged or defaced portions of color concrete area shall be replaced at no additional cost to the District.

3.11 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Continuous Inspection: Construct all structural concrete under continuous inspection of the Inspector of Record (I.O.R.). A complete and accurate record of these tests shall be kept by the

Inspector.

1. For all concrete a signed copy of batch plant's certificate stating the quantity of each material, amount of water, admixtures, departure time and date shall accompany each load of materials or concrete.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

E. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

F. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
   1. Slump: ASTM C 143/C 143M. One test for each concrete load at point of discharge and one test for each set of compressive strength test specimens.
   2. Air Content: ASTM C 173, volumetric method for normal weight concrete. ASTM C 231, pressure for normal weight concrete. One for each set of compressive strength test specimens.
   3. Concrete Temperature: Test hourly when air temperature is 40 degrees F or below, and when 80 degrees F or above and each time a set of compression test specimens made.
   4. Compression Test Specimen: ASTM C 31. One set of three standard cylinders for each compressive strength test, unless otherwise directed. Mold and store each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
   5. Compressive Strength Tests: ASTM C 39. One set for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or for each 2,000 square feet of surface area placed. Two specimens tested at seven days, three specimens tested at 28 days, and specimens tested at seven days, three specimens tested at 28 days and when frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer.

G. Welding Inspection: Whether welding is done in the shop or at the site, perform welding or reinforcing bars under inspection of the Testing Laboratory Welding Inspector.

H. Test Results: Will be reported in writing to Architect, District, District's Inspector, D.S.A. Field Representative, Structural Engineer and Contractor within 48 hours of the day tests are made. Reports of compressive strength tests shall contain the concrete testing service, concrete type and class, location of concrete batch in structure, design compressive breaking strength and type of break for both 7-day tests and 28-day tests.

I. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

3.12 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect, Inspector, and Contractor within 24 hours of test.

B. Mix Proportions: If ultimate compressive strength of test cylinders fall below minimum assumed in design, evaluate current operations and adjust proportions of concrete mixes for remaining portion of structure to produce concrete of desired design strength. Replace defective concrete at no cost to the Owner.

C. Test Cores: Should required test cylinders fail to show design compressive strength, test cores shall be taken at locations designated by Architect. Cores shall be tested complying with UBC 19-10, 88. If results show compressive strength to be less than design stress, concrete shall be deemed defective and shall be replaced in a manner acceptable to the Architect and the

Division of State Architect. Cost of cores, tests, and patching shall be paid by Contractor. Coring holes shall be drypacked.

D. Concrete work not formed as indicated, not true to intended alignment, not plumb, level, or true to intended grades, with embedded sawdust or debris, and not fully conforming to the provisions of these specifications shall be deemed defective and shall be removed from the job site as directed by the Architect and shall be replaced with concrete complying with specification requirements and at no additional cost to the District. **END OF SECTION**

SECTION 04810

UNIT MASONRY ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Precision Concrete Block.

B. Mortar.

C. Reinforcement and Anchorage.

D. Accessories.

1.02 RELATED SECTIONS

A. Section 01400 - Quality Services

B. Section 03200 - Concrete Reinforcement: Reinforcing steel for grouted masonry.

C. Section 06100 - Rough Carpentry: Nailing strips built into masonry.

D. Section 07900 - Joint Sealers: Backing rod and sealant at control and expansion joints.

1.03 REFERENCES

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International; 2005.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2005.

C. ASTM A 82/A 82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement; 2005a.

D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

E. ASTM C 5 - Standard Specification for Quicklime for Structural Purposes.

F. ASTM C 33 - Standard Specification for Concrete Aggregates; 2003

G. ASTM C 90 - Standard Specification for Loadbearing Concrete Masonry Units; 2006b.

H. ASTM C 91 - Standard Specification for Masonry Cement; 2005.

I. ASTM C 129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2006.

J. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2006.

K. ASTM C 144 - Standard Specification for Aggregate for Masonry Mortar; 2004.

L. ASTM C 150 - Standard Specification for Portland Cement; 2005.

M. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006.

N. ASTM C 270 - Standard Specification for Mortar for Unit Masonry; 2007.

O. ASTM C 332 - Standard Specification for Lightweight Aggregate for Insulating Concrete.

P. ASTM C 404 - Standard Specification for Aggregates for Masonry Grout; 2006.

Q. ASTM C 476 - Standard Specification for Grout for Masonry; 2002.

R. California Building Code (CBC), California Code of Regulations, Title 24, Chapter 21A,

Masonry.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit two samples of specified units to illustrate color, texture, and extremes of color range.

D. Test Reports: When, and as directed by the Architect, submit certified laboratory test reports confirming physical characteristics of materials used in the performance of the Work of this Section.

E. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

B. Source Quality Control:
   1. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry-recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.
   2. Certification: Certify source and type of aggregates proposed to be incorporated into the Work.

1.06 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high, which includes mortar and accessories and structural backup.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

B. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F. in the shade with relative humidity less than 50 percent.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all concrete masonry units from the same manufacturer.

B. Acceptable Manufacturers:

1. Orco Block Company, Riverside, CA, 800-655-6726. Product: Orco Precision Block.
2. Angelus Block Company, Inc., Fontana, Ca, 909-350-0244. Product: Angelus Precision Block.
3. Substitutions: See Section 01600 - Product Requirements.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depth of 8 inches (200mm), open 1 and 2 ends.
   2. Provide expanded shale or clay aggregate.
      a. Conform to ASTM C 33 for normal weight aggregate and ASTM C 332 for lightweight aggregate.
   3. Special Shapes: Provide non-standard blocks configured for pilasters, corners, lintels, headers, control joint edges, and other detailed conditions. Provide manufacturer's cap units at top of all free standing walls.
   4. Load-Bearing Units: ASTM C 90, Grade N, Type 1, medium weight, f'm as shown on the structural drawings.
   5. Bond beam block shall be deep cut type.

B. Unit Tests: Shall be in accordance with CBC, Section 2105A.3.4 (1). Repeat testing and inspection, if required, will be reimbursed by Contractor.

2.03 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or II. Masonry cement will not be acceptable.
   1. Not more than 0.60 percent alkali.
   2. Hydrated Lime: ASTM C 207, Type S.
   3. Quick Lime: ASTM C 5.
   4. Mortar Aggregate: ASTM C 144.
   5. Grout Aggregate: ASTM C 404.

B. Water: Clean and potable.

2.04 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: Provide as specified in Section 03200, size as indicated on structural drawings.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Acceptable Manufacturers:
      a. Hohmann & Barnard, Inc; Product RS Series Rubber Control Joint: www.h-b.com.
      b. BoMetals, Inc.; Product - Model No. BCJ-10.
      c. Substitutions: See Section 01600 - Product Requirements.

B. Cleaning Solution: water based, non-acidic, biodegradable and not carcinogenic.
   1. Manufacturers:
      a. Triangle Coatings, Inc.; Product - White Mountain Efflorescence Remover or White Mountain "Jobsite": www.tricoat.com.

2.06 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C 270, using the Proportion Specification.

B. Ingredients:
   1. Portland Cement: ASTM C 150, Type 1.
   2. Lime:
      a. Provide hydrated lime complying with ASTM C 207, or quicklime complying with ASTM C 5.

b. When quicklime is used, slake and then screen through a 16 mesh sieve. After slaking and screening, but before using, store and protect for not less than ten days.

3. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter, and complying with ASTM C 144.
4. Admixtures: Do not use admixtures unless specifically approved in advance by the Architect and the Division of the State Architect, (D.S.A.).
5. Water: Provide water free from deleterious amounts of acids, alkalis, and organic materials.
6. Mortar shall attain a minimum compressive strength, f'm, of 1500 psi at 28 days and 900 psi at 7 days. Mix per CBC, Section 2103A.3.2 and Table 21A-A.

C. Mixing:
1. Provide mortar Type S. Mortar shall conform to the proportions shown on CBC, Table 21A-A.
2. Proportions:
   a. For Type S mortar, aggregate measured in a damp loose condition not less than 2-1/4 and not more than 3 times the sum of the separate volumes of cementitious materials, per CBC, Table 21A-A.
3. Mechanically mix in a batch mixer for not less than three minutes, using only sufficient water to produce a mortar which is spreadable and of a workable consistency.
4. Retemper mortar with water as required to maintain high plasticity.
   a. On mortar boards, retemper only by adding water within a basin formed with mortar, and by adding water within a basin formed with mortar, and by working the mortar into the water.
   b. Discard and do not use mortar which is unused after 1-1/2 hours following initial mixing.

D. Test: Mortar as per CBC, Section 2105A.3.4 (2).

2.07 GROUT MIXES

A. Grout: ASTM C 476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).

B. Ingredients:
1. Portland Cement: ASTM C 150, Type I.
2. Aggregate: Provide clean, sharp, well graded aggregate free from injurious amounts of dust, lumps, shale, alkali, surface coatings, and organic matter.
3. Admixtures: Do not use admixtures unless specifically approved in advance by the Architect and D.S.A.
4. Water: Provide water free from injurious amounts of acids, alkalis, and organic materials.
5. Grout shall attain a minimum compressive strength, f'g, of 2000 psi at 28 days and 1200 psi at seven days. Mix per CBC 2102A.2 (1) and 2103A.4.1.

C. Mixing:
1. Provide fine grout or coarse grout as designated on the Drawings.
2. Proportions:
   a. For fine grout, provide one part portland cement to 2-1/4 parts minimum to three parts the sum of volumes of the cementitious materials of loose sand, 1/10 part hydrated lime or lime putty with sufficient water to achieve fluid consistency.
   b. For coarse grout, provide one part portland cement to 2-1/4 to 3 parts the sum of volumes of the cementitious materials of damp loose sand to two parts coarse aggregate, with sufficient water to achieve fluid consistency.
3. "Fluid consistency" is interpreted as meaning as fluid as possible for pouring intimately in place without segregation.

D. Test: Grout as per CBC Section 2105A.3.4 (2).

E. Admixtures: Use of admixtures shall be in accordance to CBC Section 2103A.5 and with the approval of the Architect and D.S.A.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

C. Foundations:
   1. Do not commence installation until foundations are clean, rough, and level.
   2. Clean projecting dowels free from loose scale, dirt, concrete and other material that will inhibit bond.
   3. Verify that dowels are in proper location.

3.03 REINFORCEMENT

A. Place reinforcement as shown on the structural drawings.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running. Align vertical cells.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.
      a. Nominal thickness: 3/8 inch uniform.

3.05 PLACING AND BONDING

A. Lay only dry masonry units.

B. Hollow Units: Provide full mortar coverage on horizontal and vertical face shells and webs in courses of the following:
   1. Piers, columns, and pilasters.
   2. Starting course on footings and solid foundation walls.
   3. Where adjacent to cells or cavities to be filled with grout.

C. Remove excess mortar and mortar smears as work progresses. Remove mortar protruding into cells of cavities to be reinforced or filled.

D. Interlock intersections and external corners, except for units laid in stack bond.

E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

F. Perform job site cutting of masonry units with masonry saws to provide straight, clean, unchipped edges. Broken masonry unit corners or edges are not acceptable.

G. Cut mortar joints flush where cement plaster or bitumen dampproofing is applied.

H. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

I. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

J. If necessary to stop off a horizontal run of masonry, rack back one-half block length in each course. Do not use toothing to join new masonry to set or partially set masonry when continuing a horizontal run.

3.06 GROUTING

A. Low Lift Grouting: Comply with Title 24, Section 2104A.6.1.1.2. All cells shall be filled. Units shall be laid and grouted in max. 2'-0" high lifts.

3.07 CONTROL JOINTS

A. Do not continue horizontal reinforcement through control joints unless shown otherwise on the structural drawings.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joint in accordance with Section 07900 for sealant performance.

3.08 BUILT-IN WORK

A. As work progresses, install built-in vent flashings, conduits, inserts, metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

3.09 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape,and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01400.

B. Masonry Inspection: All structural masonry work shall be continuously inspected during the laying and grouting by a special masonry inspector approved by DSA in accordance with CBC Section 2105A.7.

C. Masonry Core Tests: Provide required number of core tests in accordance with CBC, Section 2105A.3.1.

D. Masonry Prism Tests: Provide required number of masonry prism tests in accordance with CBC, Section 2105.3.2.

E. Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with CBC, Section 2105A.3.4 (1), for conformance to requirements of this specification.

3.11 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Dry brush and clean soiled surfaces with specified cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Leave work and surrounding surfaces clean and free of mortar spots and droppings.

3.12 PROTECTION OF FINISHED WORK

A. Without damaging completed work, provide protective boards at exposed external corners which are subject to damage by construction activities.

B. Protect sills, ledges and off-sets from mortar drippings or other damage during construction. Remove misplaced mortar or grout immediately.

C. Cover top of walls with non-staining waterproof coverings when work is not in progress.

END OF SECTION

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members, support members and struts.

B. Base plates, shear stud connectors and expansion joint plates.

C. Grouting under base plates.

1.02 RELATED SECTIONS

A. Section 01400 - Quality Services

B. Section 05310 - Steel Deck: Support framing for small openings in deck.

C. Section 05500 - Metal Fabrications: Steel fabrications affecting structural steel work.

D. Section 07815 - Sprayed-On Fireproofing: Fireproof protection to framing and metal deck systems.

E. Section 07816 - Intumescent Fireproofing: Fireproof protection of steel columns and beams.

1.03 REFERENCES

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2005.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2005.

C. AISC S348 - Specification for Structural Joints Using ASTM A325 or A490 Bolts; 2004.

D. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.

E. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.

F. ASTM A 108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished; 2003.

G. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

H. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

I. ASTM A 242/A 242M - Standard Specification for High-Strength Low-Alloy Structural Steel; 2004.

J. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength; 2004.

K. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2006.

L. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2005.

M. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

N. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001 (Reapproved 2005).

O. ASTM A 526 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

P. ASTM A 572/A 572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; 2006.

Q. ASTM A 591 - Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.

R. ASTM A 992/A 992M - Standard Specification for Structural Steel Shapes; 2006.

S. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2007.

T. ASTM F 959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2006.

U. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

V. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.

W. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

X. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

Y. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

Z. California Building Code (CBC), California Code of Regulations, Title 24:
   1. Chapter 17A, Structural Tests and Inspections.
   2. Chapter 22A, Steel.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate cambers and loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports: Submit certified laboratory test reports confirming structural strength, destructive test analysis and non-destructive test analysis. Where tests will be conducted outside the State of California, the Contractor shall pay for travel, lodging, testing hours, etc., for the testing laboratory field inspector(s) for the length of testing and also additional testing which failed. See Section 01400, Quality Requirements for inspection of structural steel required.

E. Welders Certificates: Certify shop welders and welders employed on the Work, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

B. Tests and Inspections: Where required by CBC, Section 2231A, provide tests and inspections.

C. Fabricator: Company specializing in performing the work of this section with minimum 10 years of documented experience.

D. Erector: Company specializing in performing the work of this section with minimum 5 years of

documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to UL Design Nos. X641 and X642 at fire rated columns and D941 at fire rated beams, unless otherwise detailed on the drawings. See Section 07816.

1.07 PRODUCT HANDLING

A. Delivery of materials to be installed under other Sections:
   1. Anchor bolts, base plates and other anchorage devices which are embedded in cast-in-place concrete or masonry construction shall be delivered to the project site in time to be installed before the start of cast-in-place concrete operations or masonry work.
   2. Provide setting drawings, templates, and directions for the installation of the anchor bolts and other devices.

B. Storage of Materials:
   1. Structural steel members which are stored at the project site shall be above ground on platforms, skids or other supports.
   2. Steel shall be protected from corrosion.
   3. Other materials shall be stored in a weather-tight and dry place, until ready for use in the Work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Shapes other than W Shapes and Tees: ASTM A 36 for Ky = 36 KSI.

B. Steel Angles and Channels: ASTM A 36/A 36M.

C. Steel W Shapes and Tees: ASTM A 992/A 992M.

D. Rolled Steel Structural Shapes: ASTM A 992/A 992M.

E. Steel Plates and Bars: ASTM A 572/A 572M, Grade 50 (345) for Fy = 50 KSI, high-strength, columbium-vanadium steel.

F. Cold-Formed Structural Tubing:
   1. ASTM A 53, Grade B, Fy = 35 KSI.
   2. ASTM A 500, Grade B, Fy = 46 KSI.

G. Hot-Formed Structural Tubing: ASTM A 501, seamless or welded.

H. Pipe: ASTM A 53/A 53M, Grade B, Finish black.

I. Shear Stud Connectors: Made from ASTM A 108 Grade 1015 bars.

J. Structural Bolts and Nuts: Carbon steel, ASTM A 307, Grade A galvanized to ASTM A 153/A 153M, Class C.

K. High-Strength Structural Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, medium carbon, galvanized.

L. Anchor Bolts: ASTM A 307, Grade A.

M. All-thread rod: ASTM A 36.

N. High-Strength Anchor Bolts: ASTM A 325, Type 1 medium carbon, plain.

O. Load Indicator Washers: Provide washers complying with ASTM F 959 at all connections requiring high-strength bolts.

P. Welding Materials: Shielded Metal Arc Welding, AWS D1.1 with approved electrodes (E70XX-low hydrogen).

Q. Sliding Bearing Plates: Teflon coated.

R. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C 1107/C 1107M and capable of developing a minimum compressive strength of 7,000 psi (48 MPa) at 28 days. Provide Five Star manufactured by U.S.Group Corp..

S. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

T. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible. Shop connections shall be welded.

B. Fabricate structural steel in accordance with AISC Specifications and Title 24, Section 2712.

C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

D. Fabricate connections for bolt, nut, and washer connectors.

E. Field connections: Provide bolted, except where welded connections are indicated.

F. Column bases shall be shop attached to columns.

G. Galvanizing: Provide hot-dip galvanizing in accordance with ASTM A 123 and ASTM A153 for all exterior ferrous metal. Hot-dip galvanize interior ferrous metal where specifically noted or specified. Galvanizing shall be performed after fabrication (shearing, punching, bending, forming, assembling, and welding) in the largest units practicable. All projections, barbs, and icicles shall be removed after galvanizing, in accordance with ASTM A 526 or ASTM A 591.

H. Shear Connectors: Prepare steel surfaces as recommended by the manufacturer of the shear connectors. Shop weld shear connectors, spaced as shown, to beams and columns. Use automatic end welding of headed stud shear connectors in accordance with the manufacturer's printed instructions.

2.03 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be enclosed by interior finishes, fireproofed, field welded, in contact with concrete, or high strength bolted.

B. Preparation: Clean surfaces of mill scale, grease, dirt and foreign matter by sandblasting or wire brushing with a power tool.

C. Contact Surfaces: Clean immediately prior to assembly and leave unpainted. Heavily coat machine finished surfaces with tallow or other similar removable viscus coating to prevent corrosion.

D. Priming: Apply one coat primer, minimum 1-1/2 mil thick (dry). Prime steel parts not in contact but inaccessible for priming after erection with two coats of primer, minimum total of 3 mils (dry). Primer shall be thoroughly worked into joints, angles and open spaces.

E. Touch-up of Shop Coat: Clean and coat abraded, burned, and otherwise damaged spots and exposed bolts with one coat of primer.

F. Rusting: Shop coat showing evidence of rusting over 25 percent of any surface after erection shall be removed and replaced.

2.04 SOURCE QUALITY CONTROL AND TESTS

A. Tests and Inspections: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry-recognized procedures. Inspections shall be performed by a Special Inspector

approved by the Division of the State Architect (D.S.A.). Comply with the following requirements:

1. Tests of Structural Steel: CBC, Section 2231A.1
2. Tests of High-strength Bolts, Nuts, and Washers: CBC, Section 2231A.2.
3. Tests of End-welded Studs: CBC, Section 2231A.3
4. Shop Fabrication Inspection: CBC, Section 2231A.4.
5. Welding Inspection: CBC, Section 2231A.5.
6. Inspection of High-strength Bolt Installations: CBC, Section 2231A.6.
7. Tests of Beam to Column Moment Connections: CBC, Section 2231A.8

B. Field Tests and Inspections:

1. Inspection: In accordance with CBC, Section 1701A.1.1, the above referenced standards and AWS "Welding Inspection", the Special Inspector shall visually inspect welds, shall be present to inspect and approve groove, multi-pass, and penetration welding, shall inspect high-strength bolting performed in fabricator's shop or at the site, and shall inspect all erection.
2. Tests of Welding and Bolting: Testing Laboratory shall inspect and test field welding and high-strength bolting in conformance with requirements of the Code, and certify in writing, after completion of the Work, that welding and high-strength bolting have been performed in accordance with the Drawings, Specifications and Code.
3. Inspection of High-Strength Bolts: The Testing Laboratory shall check the bolt tightness on a minimum 10 percent of bolts, selected at random, for each high-strength bolted joint. Bolts shall be tested and inspected for conformance with the requirements of CBC, Section 2208A and Section 2209A.
4. Inspection of Welds: Testing Laboratory shall inspect groove and full penetration welded connections by ultrasonic or other approved non-destructive tests.
   a. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. All defective welds shall be repaired and costs for retesting defective welds shall be paid by the Contractor.
   b. Rate of Testing: Initially, all welds requiring ultrasonic testing shall be tested at a 100 percent rate to establish the qualifications of each individual welder. The frequency of testing may be reduced to 25 percent rate if rejectable defects occur in less than five percent of tested welds. If the rate of rejectable defect increases to five percent or more, 100 percent testing shall be performed until the defect rate is reduced to less than five percent. The percentage shall be calculated for each welder independently.
   c. Backing Strips: Contractor shall remove backing strips whenever ultrasonic indications arising from weld roots can be interpreted as either a weld defect or the backing strip and, if no root defect is visible, weld shall be retested. If no defect is indicated on this retest, and no significant amount of the base and weld metal have been removed, the joint needs no further repair or welding. If a defect is indicated, it shall be repaired. Contractor shall bear the cost of removals.
   d. Questionable root indications that prove not to be defective welds shall not count against the welder to increase the test rate.
   e. Ultrasonic Instrumentation shall be calibrated by technician to evaluate the quality of the welds in accordance with AWS D1.1, Sections 5 and 6.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges", and Title 24.

B. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Anchor bolts and anchors shall be properly placed and built into connecting work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

D. Field weld components and shear studs indicated on shop drawings.

E. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts". Tighten with load indicator washers or by using tension set bolts as specified for the shop high-strength bolting.

F. Do not field cut or alter structural members without approval of Architect.

G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

H. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.03 ERECTION TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

3.04 ADJUSTING AND CLEANING

A. Field Touch-up Painting: After the erection of structural steel, touch-up paint field connections and abrasions in the shop paint coating with the same paint used for the shop painting.

B. After erection and field welding, wire brush scarred galvanized surfaces and give field touch up of American Solder and Flux Co. "Drygalv", or Metalloy Products Co. "Galvalloy" applied according to manufacturer's specifications.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Provide items fabricated from iron, steel and aluminum shapes, plates, bars, strips, tubes, pipes, and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Provide as part of this Section all "sheet metal" thicker than 10 gage unless otherwise specified.

C. Furnish inserts and anchoring devices which must be set in concrete or built into concrete for installation of miscellaneous metal work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

1.02 RELATED SECTIONS

A. Section 05120 -Structural steel column anchor bolts.

B. Section 05310 - Steel Deck: Bearing plates for metal deck bearing, including anchorage.

C. Section 05510 - Metal Stairs.

D. Section 05520 - Handrails and Railings.

E. Section 09900 - Paints and Coatings: Paint finish.

1.03 REFERENCES

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.

B. ASTM A 27 - Specification for Steel Castings, Carbon, for General Application.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.

D. ASTM A 47 - Specification for Ferritic Malleable Iron Castings.

E. ASTM A 48 - Specification for Gray Iron Castings.

F. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.

G. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

H. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

I. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003.

J. ASTM A 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength; 2004.

K. ASTM A 336 - Specification for Steel Forgings, Alloy, for Pressure and High-Temperature Parts.

L. ASTM A 385 - Practice for Providing High Quality Zinc Coatings (Hot Dip).

M. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

N. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001 (Reapproved 2005).

O. ASTM A 526 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

P. ASTM A 572 - Specifcation for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.

Q. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

R. ASTM A 992 - Standard Specification for Structural Steel Shapes; 2004a.

S. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.

T. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.

U. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

V. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

W. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.05 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Source Quality Control:
   1. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Shapes other than W Shapes and Tees: ASTM A 36/A 36M.

B. Steel W Shapes and Tees: ASTM A 992.

C. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.

D. Steel Tubing: ASTM A501, hot-formed, welded, or seamless.

E. Steel Plates and Bars: ASTM A 572, Grade 50 (345) for Fy = 50 KSI.

F. Steel Plates: ASTM A 283, grade C, bent or cold-formed.

G. Pipe: ASTM A 53/A 53M, Grade B Schedule 40 (unless otherwise shown or specified), black finish.

H. Cold-rolled Carbon Steel Sheets: ASTM A336.

I. Galvanized Carbon Steel Sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525.

J. Stainless Steel Sheets: AISI type 302 or 304, 22 gage, with number 4 finish.

K. Steel Bolts and Nuts: ASTM A 307, Grade A.

L. Gray Iron Castings: ASTM A48, Class 10.

M. Malleable Iron Castings: ASTM A47.

N. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported rails or fabricated items, unless otherwise indicated.

O. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47, or cast steel ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.

P. Anchorage Devices: Provide expansion shield anchor complying with Fed Spec FF-S-325.

Q. Fasteners: Provide zinc-coated fasteners for exterior use, in wet areas or where built into exterior walls. Select fasteners for the type, grade and class required.
   1. Bolts and nuts: Provide hexagon-head regular type complying with ASTM A307, grade A;
   2. Lag bolts: Provide square-head type complying with Fed Spec FF-B-561;
   3. Machine screws: Provide cadmium plated steel type complying with Fed Spec FF-S-111D;
   4. Washers:
      a. Plain washers: Comply with Fed Spec FF-W-92B, round, carbon steel;
      b. Lock washers: Comply with Fed Spec FF-W-84A, helical spring type carbon steel;
      c. Toggle bolts: Provide type, class, and style needed but complying with Fed Spec FF-B-588.

R. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

S. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

T. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

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

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds unless otherwise specified.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

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

G. Galvanizing: Provide hot-dip galvanizing in accordance with ASTM A 123 and ASTM A153 for all exterior ferrous metal. Hot-dip galvanize interior ferrous metal where specifically noted or specified. Galvanizing shall be performed after fabrication (shearing, punching, bending, forming, assembling, and welding) in the largest units practicable. All projections, barbs, and icicles shall be removed after galvanizing, in accordance with ASTM A 525 or ASTM A 591.

2.03 FABRICATED ITEMS

A. Roof Access Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 2 x 1/4 inch members spaced at 18 inches.
   2. Rungs: 3/4 inch diameter solid round bar spaced at 12 inches on center.
   3. Space rungs at 7-1/2 inches from wall surface.
   4. Support on wall with 2 x 1/4 inch steel leg angles secured to wood blocking with 2-1/2 x 1/2 inch lag bolts at 48 inches on center, maximum.
   5. Floor anchors: 1-3/4 x 2-1/4 x 1/4 inch steel angles with slotted holes. Secure angle to side rail with 3/8 inch diameter through-bolt with nut and washer. Anchor to floor with Trubolt wedge anchors as manufactured by Ramset/Red Head or equal.

B. Bollards: Galvanized steel pipe (Schedule 80), 5-inch nominal diameter, concrete filled, crowned cap, with prime paint finish. Set bollards in concrete foundation footing, minimum 16 inch diameter by 36-inch deep, unless noted otherwise.

C. Removable Bollards:
   1. Pipe Sleeve: Galvanized steel pipe (Schedule 80), 5-inch nominal diameter by 18-inches long. Set bollards in concrete foundation footing, minimum 12-inch diameter by 24-inches deep, unless noted otherwise.
   2. Bollard: Galvanized steel pipe (Schedule 80), 3-inch nominal diameter, prime paint finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of frames, metal decking, and masonry; prime paint finish.

E. Lintels: As detailed; prime paint finish.

F. Door Frames for Overhead Door Openings and Wall Openings: Channel, and Angle sections; prime paint finish.

G. Operable Partition Support Framework.

H. Mechanical Screen Framing.

I. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

J. Trash Enclosure Gate: As detailed, galvanize all components.
   1. Steel Deck: Non-composite type, fluted steel sheet conforming to ASTM A 653, 16 gage. B-36, as manufactured by ASC Steel Deck, Fontana, CA, or equal.

K. Miscellaneous Items:
   1. Manufacturer or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.
   2. Rough Hardware: Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing, supporting, anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.
   3. Miscellaneous Framing and Supports: Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete Work. Include

necessary brackets and supports for vanities, water closets, toilet partitions, etc.

4. Miscellaneous Steel Trim: Provide shapes and sizes as required for profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation of other work.

2.04 FINISHES - STEEL

A. Hot-dip galvanize all exterior steel items.

B. Prime paint all interior steel items, unless otherwise indicated.
   1. Exceptions: Galvanize items to be embedded in concrete or masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

C. Prepare surfaces to be primed in accordance with SSPC-SP2.

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

E. Prime Painting: One coat.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M requirements.

G. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M requirements.

H. Galvanizing of Steel Deck: Galvanize after fabrication to ASTM A 653, G90 requirements.

I. Galvanizing of Assembled Steel Products: Assemble work in as large sections as can be handled, galvanize to ASTM A 385.

J. Galvanizing of Iron and Steel Hardware: Galvanize to ASTM A 153.

K. Galvanize all exterior ferrous metal work after fabrication, including items exposed to the exterior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

C. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible. Do not delay job progress. Allow for trimming and fitting wherever taking field measurements before fabrication might delay work.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components indicated.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 PROTECTION

A. Protect completed aluminum work from physical damage and contamination by plaster, lime, cement, acid or other harmful substances.

END OF SECTION

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails and free-standing handrails at steps and ramps.

B. Stair railings, balcony railings, and guardrails.

1.02 RELATED SECTIONS

A. Section 02826 - Ornamental Steel Fencing: Site fences.

B. Section 03300 - Cast-in-Place Concrete: Placement of anchors in concrete.

C. Section 04810 - Unit Masonry Assemblies: Placement of anchors in masonry.

D. Section 05510 - Metal Stairs: Handrails other than those specified in this section.

E. Section 09260 - Gypsum Board Assemblies: Placement of backing plates in stud walls.

F. Section 09900 - Paints and Coatings: Paint finish.

1.03 REFERENCES

A. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.

B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

C. ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A 500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2003a.

E. ASTM A 501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2001 (Reapproved 2005).

F. ASTM A 513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 1991.

G. ASTM A 526 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

H. ASTM A 591 - Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.

I. ASTM E 935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

J. ASTM E 985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

K. SSPC-Paint 15 - Steel Joist Shop Paint; The Society for Protective Coatings; 1999 (Ed. 2004).

L. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); The Society for Protective Coatings; 2002 (Ed. 2004).

1.04 DESIGN REQUIREMENTS

A. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs (333 N) at any point without damage or permanent set. Test in accordance with ASTM E 935.

B. Handrails shall be 1-1/4 NPS and mounted 1-1/2 inch clear from side walls.

C. All welded joints and surfaces shall be ground smooth, no sharp or abrasive corners or edges or surfaces. Wall surfaces adjacent to handrail shall be smooth.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. Samples: Submit two, 48 inch (1212 mm) long samples of welded guardrail or balcony rails. Submit two samples of wall bracket and end stop.

1.06 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Source Quality Control:
   1. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E 985 and applicable local code.

B. Design railing assembly, wall rails, and attachments to resist lateral force of 75 lbs (333 N) at any point without damage or permanent set. Test in accordance with ASTM E 935.

C. Allow for expansion and contraction of members and building movement without damage to connections or members.

D. Pipe Rail Dimensions: See drawings for configurations and heights.
   1. Top Rails, Intermediate Rails, and Wall Rails: 1-1/4 inches NPS, round.
   2. Posts: 1-1/4 inches NPS, round.
   3. Balusters: 5/8 inch (15.9 mm) round solid bar.

E. Steel Tube Dimensions: See drawings for configurations and heights at stair and balcony railings and guardrails:
   1. Top and Bottom Rails: 2 inch (50.8 mm) square metal tubing, .083" wall thickness (14 gage) at 2.164 lb./ft.
   2. Vertical Pickets: Shall be 1 inch (25.4 mm) square metal tubing, .083" wall thickness (14 gage) at 1.035 lb./ft., spaced equally between support posts, approximately 4 inches o.c. welded to top and bottom rail. Vertical pickets shall not extend beyond the top and bottom rails.
   3. Line and Corner Posts: Shall be 2 inch (50.8 mm) square metal tubing, .120" wall thickness (11 gage) at 3.12 lb./ft.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete.
   2. For anchorage to masonry, provide brackets to be embedded in masonry, for bolting anchors.
   3. For anchorage to stud walls, provide backing plates, for bolting anchors.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A 500, Grade B cold-formed or ASTM A 501 hot-formed structural tubing having a yield strength of 45,000 psi and a tensile strength of 58,000 psi.

B. Steel Pipe: ASTM A 53/A 53M, Grade B Schedule 40, galvanized finish.

C. Welded Tubing: ASTM A 513, electric-resistance-welded tubing from hot-rolled or cold-rolled steel. Seams continuously welded and ground smooth.

D. Welded Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

E. Fittings: Elbows, T-shapes, wall brackets, escutcheons; cast steel.

F. Mounting: Adjustable Brackets and flanges, with steel inserts for casting in concrete. Prepare backing plate for mounting in wall construction.

G. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

H. Straight Splice Connectors: Steel concealed spigots.

I. Galvanizing: Hot-dip galvanize all ferrous materials after fabrication has been completed in accordance with requirements of ASTM A 123/A 123M. Fasteners and hardware shall be galvanized in accordance with ASTM A 153.
   1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints: Grind smooth.

E. Provide anchors and plates required for connecting railings to structure.

F. Exposed Mechanical Fastenings: Provide flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

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

H. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.

I. Interior Components: Continuously seal joined pieces by continuous welds.

J. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

K. Accurately form components to suit specific project conditions and for proper connection to building structure.

L. Accommodate for expansion and contraction of members and building movement without damage to connections or members.

M. Galvanizing: Provide hot-dip galvanizing in accordance with ASTM A 123 and ASTM A153 for all exterior ferrous metal. Hot-dip galvanize interior ferrous metal where specifically noted or specified. Galvanizing shall be performed after fabrication (shearing, punching, bending, forming, assembling, and welding) in the largest units practicable. All projections, barbs, and icicles shall be removed after galvanizing, in accordance with ASTM A 525 or ASTM A 591.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify that wall surfaces adjacent to handrail are smooth and free of any protrusions, abrasions, or other defects.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

B. Anchor railings securely to structure.

C. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Assemble with spigots and sleeves to accommodate tight joints and secure installation.

END OF SECTION

SECTION 05810

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint assemblies for floor, wall, and roof surfaces.

1.02 RELATED SECTIONS

A. Section 03100 - Concrete Forms and Accessories: Placement of joint assembly frames in formwork.

B. Section 03300 - Cast-in-Place Concrete.

C. Section 6100 - Rough Carpentry.

D. 07536 - S.B.S. Modified Bitumin Roofing: Roof membrane.

E. Section 07900 - Joint Sealers: Expansion and control joint finishing utilizing a sealant.

F. Section 09206 - Metal Lath.

G. Section 09220 - Portland Cement Plaster.

1.03 REFERENCES

A. ASTM A 36 - Standard Specification for Structural Steel.

B. ASTM A 167 - Standard Specification for Stainless and Heat-Resisting Chromium -Nickel Steel Plate, Sheet, and Strip.

C. ASTM A 283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.

D. ASTM A 786 - Standard Specification for Rolled Steel Floor Plates.

E. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2006.

G. ASTM D 2000 - Classification System for Rubber Products in Automotive Applications.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, anchorage locations.

D. Samples: Submit two samples 8 inch (203 mm) long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes; provide templates for cast-in or placed frames or anchors; required tolerances for item placement.

1.05 QUALITY ASSURANCE

A. Loading Characteristics: Floor covers shall be designed to withstand a minimum load of 500 lbs. without damage or permanent deformation.

B. Single-source Responsibility: Obtain expansion joint cover assemblies from one source from a single manufacturer.

C. Field Measurements: Verify compliance with manufacturer's requirements.

D. Manufacturer shall be ISO 9001:2000 Certified.

E. Installer: Firm with not less than three years experience in the installation of systems similar to those required by the project and acceptable to the manufacturer of the system.

1.06 PROJECT CONDITIONS

A. Verify actual locations of walls and other construction to which work must fit, by accurate field measurements before fabrication. Show recorded measurements on final shop drawings.

1.07 WARRANTY

A. Submit manufacturers' warranty that materials furnished will perform as specified for a period of not less than one year when installed in accordance with manufacturers' recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies: Design is based on the use of products manufactured by Conspec Systems, Inc., Muncy, PA.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer approved in accordance with Section 01600.

C. Acceptable Manufacturers:
   1. Architectural Art Mfg., Inc: www.archart.com.
   2. MM Systems Corp: www.mmsystemscorp.com.
   3. Balco, Inc..
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Structural Steel Shapes: ASTM A 36.

B. Steel Plates: ASTM A 283 Grade C.

C. Rolled Steel Floor Plates: ASTM A 786.

D. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions: ASTM B 209, alloy 6061-T6, sheet and plate.
   1. Protect aluminum surfaces in contact with cementitious materials with heavy metal free high solids primer or chromate conversion coating.

E. Stainless Steel: ASTM A 167, Type 304 with 2B finish.

F. Extruded Preformed Seals: Single or multilayered rubber extrusions as classified under ASTM D 2000, designed with or without continuous, longitudinal, internal baffles and formed to fit compatible frames, in color as selected by architect from manufacturer's standard colors.

G. Exterior Seals: Typically two single layered flexible extrusions, one interior PVC and one exterior Santoprene 8000 Series non-hydroscopic, thermoplastic rubber, as classified under ASTM D 2000, retained in a set of compatible frames, in color as selected by architect from manufacturer's standard colors.

H. Resilient Filler: Neoprene, exhibiting Shore A hardness of 40 to 50 Durometer.

I. Threaded Fasteners: Fasteners, accessories and other materials required for complete installation in accordance with the manufacturers' installation instructions.

J. Backing Paint: Asphaltic or zinc chromate type.

2.03 FABRICATION

A. General: Provide expansion joint cover assemblies of design, basic profile, materials, and operation indicated.
   1. Fabricate special transitions and corner fittings as required.
   2. Miter and weld joints as applicable
   3. Back paint components in contact with cementitious materials.
   4. Galvanize embedded ferrous metal anchors and fastening devices.
   5. Shop assemble components and package with anchors and fittings.
   6. Provide joint components in single length wherever practical. Minimize site splicing.

B. Extruded Aluminum Seismic Joint Cover Assemblies: Provide continuous extruded aluminum frame assemblies of suitable profile to receive free floating center plate of design indicated. Center plate to be held in place and kept centered throughout movement cycle by stainless steel turnbar spaced 24" on center max. All aluminum in contact with concrete to have a zinc chromate finish.
   1. Extruded Aluminum Seismic Floor Cover Assemblies: Provide continuous concealed frame on each side of joint designed to support simple cover plate and allow full movement of cover to +50% of joint width without seals or gaskets. Product: Model SJP.
   2. Extruded Aluminum Seismic Floor to Wall Cover Assemblies: Provide continuous frame on one side of joint suitable for fastening to applicable wall condition, other side frame to line up with and match adjacent floor cover frame. Product: Model SJPW.

C. Exterior Joint Covers:
   1. Vertical Exterior Seals: Thermoplastic rubber primary seals extruded in Santoprene retained in extruded aluminum side frames complete with independent continuous PVC back seal. Side frames mounted on butyl caulk tape with appropriate anchors 18" o. c. Installation to include factory, heat welded transitions where applicable to ensure watertight system. Color of primary seal to be one of four standard colors selected by architect. Product: Model SF-300/500.

D. Elastomeric Flexible Roof Covers:
   1. Provide continuous neoprene sheet bellows complete with foam support membrane and continuous galvanized attachment flanges, mechanically fastened to curb member 24" o.c. Cover to be one-piece unit with optional back seal. All transitions and end caps to be factory fabricated with butt joints sealed with site applied flexible splice covers. Product: Model BRJW.

2.04 FINISHES

A. Floors: Mill finish.

B. Walls and Ceilings: Clear anodized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and affected dimensions are acceptable.

3.02 PREPARATION

A. Provide anchoring devices for installation and embedding under Section 03100.
   1. Provide templates and rough-in measurements.

3.03 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment. Do not shim.

D. Allow adequate free movement for thermal expansion and contraction of metal to avoid buckling.

E. Exterior Seal Joint Assemblies:
   1. Seal all end joints within continuous runs and joints at transitions in accordance with manufacturer's directions to provide watertight installation.
   2. Install exterior flexible seal in standard lengths.
   3. Seal transitions and butt joints in accordance with manufacturer's instructions.
   4. Install secondary seals in continuous lengths; vulcanize all field splice joints in secondary seal material to provide watertight joints using manufacturer's recommended procedures.

3.04 ADJUSTING AND PROTECTION OF FINISHED WORK

A. Adjust joint cover to freely accommodate joint movement.

B. Do not permit traffic over unprotected floor joint surfaces.

C. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural dimension lumber framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Structural floor, wall, and roof framing.

D. Sheathing.

E. Roof-mounted curbs.

F. Roofing nailers.

G. Roofing cant strips.

H. Miscellaneous framing and sheathing.

I. Communications and electrical room mounting boards.

J. Preservative-treated wood nailers, blocking, cants, crickets, and curbs for roofing and items installed on roof.

K. Preservative-treated wood sills, blocking, and nailing strips in contact with concrete, masonry, or soil.

L. Concealed wood blocking, nailers, and supports.

M. Miscellaneous wood nailers, furring, and grounds.

N. Fireblocking and draftstops.

1.02 RELATED REQUIREMENTS

A. Section 01400 - Quality Services.

B. Section 03100 - Concrete Forms and Accessories.

C. Section 05120 - Structural Steel: Prefabricated beams and columns for support of wood framing.

D. Section 05500 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

E. Section 06175 - Wood I-Joists.

F. Section 06181 - Glued-Laminated Structural Units.

G. Section 06200 - Finish Carpentry.

H. Section 06410 - Custom Cabinets.

I. Section 07620 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AFPA (WFCM) - Wood Frame Construction Manual for One- and Two-Family Dwellings; American Forest and Paper Association; 2001.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel

Hardware; 2009.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2010.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

F. American Lumber Standard Committee (ALSC).

G. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.

H. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.

I. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood Protection Association; 2010.

J. PS 1 - Structural Plywood; 2007.

K. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

L. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; West Coast Lumber Inspection Bureau; 2004, and supplements.

M. California Code of Regulations (CCR), Title 24, California Building Code (CBC); Chapter 7, Fire-Resistance Rated Construction, and Chapter 23, Wood.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials.

C. Shop Drawings: For site fabricated items not as detailed on the drawings, indicate dimensions, wood species and grades, component profiles, drilled holes, fasteners, connectors, details, and sequence of erection.

D. Samples: For rough carpentry members that will be exposed to view, submit two samples, illustrating wood grain, color, and general appearance.

E. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

F. Wood Products Certificate: Certification that wood products are FSC Certified.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.
   1. Acceptable Lumber Inspection Agencies: WCLB.

B. Plywood: Comply with U.S. Product Standard PS 1, Construction and Industrial Plywood, latest edition.

C. Wood Products Certification:
   1. Wood products shall be FSC Certified according to the rules of the Forest Stewardship Council.
   2. Accredited Certification Bodies shall be one of the following:
      a. Scientific Certification Systems.
      b. Smart Wood.
      c. SGC Qualifor

D. Grade Marks:
   1. Identify lumber and plywood by official grade mark.
   2. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, designation, and condition of seasoning at time of manufacture.
   3. Plywood: Grade stamp to contain symbol of grading agency, mill number or name, U.S. Plywood Standard, panel grade, panel thickness, span rating, and exposure durability.

E. Source Quality Control:
   1. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures. Both the laboratory performing the tests and the test methods employed will be subject to the approval of the Architect.

F. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency approved by the Division of State Architect, certifying level and type of treatment in accordance with AWPA standards.

1.06 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01600 for requirements.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: West Coast Lumber Inspection Bureau (WCLIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry (19 percent maximum).

D. Plates, Sills, and Stud Framing:
   1. Species: Douglas Fir-Larch, unless otherwise noted.
   2. Grade: No. 1, unless otherwise noted.

E. Joist, Rafter, and Small Beam Framing:
   1. Species: Douglas Fir-Larch, unless otherwise noted.
   2. Grade: No. 1, unless otherwise noted.

F. Miscellaneous Framing, Solid Wall and Joist Blocking, Roof Nailers, Grounds, and Furring:
   1. Lumber: S4S, Grade No. 1, unless otherwise noted.
   2. Boards: Standard or No. 3, unless otherwise noted.

2.03 BEAMS AND POSTS FOR CONCEALED APPLICATIONS

A. Grading Agency: West Coast Lumber Inspection Bureau (WCLIB).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: Kiln-dry (19 percent maximum).

D. Beams and Posts :
   1. Species: Douglas Fir-Larch, unless otherwise noted.
   2. Grade: No. 1, unless otherwise noted.

2.04 EXPOSED BEAMS AND POSTS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (19 percent maximum).

C. Surfacing: S4S.

D. Species: Douglas Fir-Larch, unless otherwise noted.

E. Grade: Select Structural, selected for good appearance.

2.05 TREATED SILL PLATES BEARING ON CONCRETE OR MASONRY

A. Moisture Content: Kiln-dry (19 percent maximum).

B. Surfacing: SAS.

C. Species: Hem-Fir or Douglas Fir, unless otherwise noted.

D. Grade: 2

2.06 PLYWOOD CONSTRUCTION PANELS

A. Flooring (Building): APA Structural 1 Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Structural 1 in accordance with CBC Section 2303 and U. S. Department of Commerce Product Standard DOC PS 1 - 95 for Construction and Industrial Plywood.
   2. Exposure Class: Exterior.
   3. Thickness: As noted on the structural drawings.

B. Roof Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Structural I in accordance with CBC Section 2303 and U. S. Department of Commerce Product Standard DOC PS 1 - 95 for Construction and Industrial Plywood.
   2. Thickness: As noted on the structural drawings.

C. Wall Sheathing: APA PRP-108, Structural I Rated Sheathing, Exterior Exposure Class, and as follows:
   1. Structural I in accordance with CBC Section 2303 and U. S. Commerce Product Standard DOC PS 1 - 95 for Construction and Industrial Plywood.
   2. Thickness: As noted on the structural drawings.

D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

E. Other Applications:
   1. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
   2. Other Locations: PS 1, C-D Plugged or better.
   3. Electrical Component Mounting: APA rated sheathing, fire retardant treated.

2.07 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Commercial grade, Hot-dipped galvanized steel per ASTM A 153/A 153M.

B. Rough Hardware:
   1. Bolts: FS FF-B-575C.
   2. Nuts: S FF-N-836E.
   3. Expansion Shields: FS FF-B-561.
   4. Lag Screws and Bolts: FS FF-B-561.
   5. Toggle Bolts: FS FF-B-588D.
   6. Wood Screws: FS FF-S-111.
   7. Common Nails and Staples: FS FF-N-105.
   8. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

C. Pre-fabricated Wood Construction Connectors:
   1. Pre-fabricated connectors must be listed in a current and valid evaluation report issued by an evaluation agency recognized by DSA.
   2. Connectors shall comply with requirements of DSA Interpretation of Regulations Document IR 23-1 and the evaluation report.
   3. Each pre-fabricated connector must bear a stamp or adhered label showing the name of the manufacturer, model number, and evaulation report number.

D. Metal connectors, anchors, hold-downs, caps and bases, joist and beam hangers, straps, ties, bridging, etc.: Hot dipped galvanized steel, G-90, sized to suit framing conditions. Provide connectors, anchors, and fasteners as shown on the drawing, manufactured by Simpson Strong-Tie Co., or approved equal.
   1. For contact with preservative treated wood or concrete, provide minimum G185 (Z550) galvanizing per ASTM A 653/A 653M.

E. Subfloor Glue: Waterproof, water base, air cure type, cartridge dispensed.

F. Weather-resistive Barrier: Water vapor permeable paper backing complying with Federal Specifications UU-B-790a, Building Paper, Type 1, Style 2, Grade D.
   1. Product: 60 Minute Super Jumbo Tex manufactured by Fortifiber Building Products, or approved equal.

G. Adhesive: APA Spec. AFG-01.

H. Cement Grout and Non-shrink Grout: Provide as specified in Section 03300.

2.08 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
   1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
   2. Treat lumber in contact with masonry or concrete.
   3. Treat lumber in other locations as indicated.
   4. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with masonry or concrete.
      c. Treat plywood in other locations as indicated.

C. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m)

retention.

D. Preservative for Field Application to Cut Surfaces: AWPA Method H-84. Apply two coats.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 FRAMING INSTALLATION

A. Set structural members level, plumb, and true to line. Discard pieces with defects that would lower required strength or result in unacceptable appearance of exposed members.

B. Make provisions for temporary construction loads, and provide temporary bracing sufficient to maintain structure in true alignment and safe condition until completion of erection and installation of permanent bracing.

C. Install structural members full length without splices unless otherwise specifically detailed.

D. Comply with member sizes, spacing, and configurations indicated, and fastener size and spacing indicated, but not less than required by AFPA Wood Frame Construction Manual and CBC, Part 2, Chapter 23.

E. Install horizontal spanning members with crown edge up and not less than 1-1/2 inches (38 mm) of bearing at each end.

F. Construct double joist headers at floor and ceiling openings and double joists under mechanical equipment and wall stud partitions that are parallel to floor joists; use metal joist hangers unless otherwise detailed.

G. Provide bridging at joists in excess of 8 feet (2.3 m) span as detailed. Fit solid blocking at ends of members.

H. Frame wall openings with two or more studs at each jamb; support headers on cripple studs.

I. Sills:
   1. Secure sills with 5/8 inch diameter by 12 inches long minimum size anchor bolts embedded six inches below cold joint if used, spaced maximum of four feet, or as scheduled or indicated on the Structural Drawings.
   2. Provide minimum of two anchor bolts per piece and maximum of nine inches from ends or as indicated on the Structural Drawing.
   3. Any anchor bolt not founded correctly, or was not placed as indicated on the Structural Drawings that require shot pins, red heads, (subject use to be approved by the Structural Engineer), will require 50% pull-out requirement. Cost of testing will be backcharged to the Contractor. The design pull-out strength will be as calculated (to each specified condition) at time of occurrence.
      a. Shot pins shall not be installed at concrete curbs.

J. Provide miscellaneous members as indicated or as required to support finishes, fixtures, specialty items, and trim.

K. Provide miscellaneous members as indicated or as required to support finishes, fixtures,

specialty items, trim and blocking:

1. Fireblocking and Draftstops:
   a. Fireblocking and draftstops shall be in accordance with C.B.C. Section 717, Concealed Spaces. Provide draftstops in floor-ceiling assemblies - when there is usable space above and below the concealed space of a floor ceiling assembly. Draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet and so that the horizontal dimension does not exceed 60 feet. Draftstopping shall divide the concealed space into approximately equal areas.
   b. Draftstop construction shall not be less than 1/2" gypsum board, 3/8" Type 2-M particleboard or other approved materials adequately supported.
2. Firestops:
   a. Stud Walls: Two inches by depth of member blocking at each floor level and top story ceiling level.
   b. Floor and Ceiling Framing: Two inches thick by depth of wood member blocking, fitted to fill openings from one space to another to prevent drafts.
3. Blocking:
   a. Install in continuous horizontal row at mid-height of single story partitions over eight feet high and multi-story partitions.
   b. Locate solid blocking to facilitate installation of finishing materials, fixtures, specialty items, and trim.
4. Framing for Mechanical Work:
   a. Frame members for passage of pipes and ducts to avoid cutting structural members.
   b. Do not cut, notch, or bore framing members for passage of pipes or conduits without concurrence of the Structural Engineer.
   c. Reinforce framing members where damaged by cutting.
5. Plaster Reliefs: Block out with shaped solid blocking as required to create base for cement plaster decorative forms.
6. Wood and Plywood Crickets or Cants: Install crickets or cant strips (except cane fiber), max. 3-1/2 inch x 3-1/2 inch -- Standard 45 degrees as detailed or noted. Provide cant strips (except where crickets occur) at all roof/wall intersections.
7. Cutting and Patching: Do all patching, major cutting and boring required for this work or the work of other trades. Minor cutting and boring of the structural carpentry for installation plumbing, mechanical, electrical or other work will be done by each trade.
8. Cutting and Boring: Cutting of wood girders, beams or joist is limited to cuts and bored holes as detailed on the drawings, and CBC.
9. Washers: Install washers under heads and nuts of all bolts and lag screws bearing on wood; use malleable iron washers at redwood mudsills, plate washers elsewhere.
10. Framing for Piping: Provide required clearance for plumbing, heating and vent piping. No pipe exceeding one and one-half inches (1-1/2") outside diameter will be permitted in bearing or shear walls, unless approved reinforcement is specifically provided. Install pipes one and one-half inches (1-1/2") or less outside diameter in the center of plates using a neatly bored hole; no notching will be permitted, minimum plate width for piping six inches (6") nominal. Provide all furring required to accommodate ducts, piping, recessed panelboards, etc. Holes shall not exceed one third the width of the framing member.
11. End Bearing: Cut joists, roof beams, girders and rafters to provide full, even, horizontal seating of member over support unless specifically detailed or shown otherwise.
12. Sheathing Felt: Apply sheathing felt as required for installation of this work; nail with large-headed roofing nails in sufficient quantity to ensure a smooth neat installation without wrinkles, buckles or torn sheets.
13. Attic Separations: Install 3/8-inch thick exterior grade plywood or 3/8-inch particleboard separations in spaces between and as required in accordance with applicable provisions of CBC Sections 717.3.1 and 717.4, to divide attic spaces into 3000 square foot areas with no horizontal dimension exceeding 100'-0" between stops or separations.
14. Machine Applied Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and the approval by the project Architect or Structural Engineer and the Division of the State Architect. The approval is subject to continued

satisfactory performance. Machine nailing will not be approved in 5/16 inch plywood. If nailheads penetrate the outer ply more than would be normal for a hand hammer or if minimum allowable edge distances are not maintained the performance will be deemed unsatisfactory.
   a. 3/8 inch minimum edge distance.
   b. Remove all shiners.
   c. No crushing of wood due to overdriving permitted.
15. Equipment Platform: Provide framed level platforms or curbs for mechanical equipment as required. See mechanical drawings for size and location.
16. Pipe Supports: Provide roof top pipe supports as required. See mechanical and plumbing drawings for size and location.

L. Provide nailing as shown in Nailing Schedule on the structural drawings and in accordance with CBC, Table No. 2304.9.1, Fastening Schedule, unless otherwise noted.

3.04 INSTALLATION OF ACCESSORIES AND MISCELLANEOUS WOOD

A. Coordinate installation of glue laminated structural units, prefabricated wood trusses, and plywood web joists.

B. Curb roof openings except where prefabricated curbs are provided. Form corners by alternating lapping side members.

C. Coordinate curb installation with installation of decking and support of deck openings and parapet construction.

3.05 INSTALLATION OF PLYWOOD CONSTRUCTION PANELS

A. Subflooring: Glue and nail to framing; staples are not permitted. Glue shall be continuous at each joist.

B. Roof Sheathing: Secure panels perpendicular to framing members, continuous over two or more spans, with ends staggered and sheet ends over firm bearing.
   1. Provide solid edge blocking between sheets.
   2. Nail panels to framing; staples are not permitted.

C. Wall Sheathing: Secure with long dimension parallel to wall studs unless otherwise detailed, with ends over firm bearing and staggered, using nails.

D. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply two brush coats of preservative treatment to site-sawn cuts.

B. Allow preservative to dry prior to erecting members.

3.07 TOLERANCES

A. Framing Members: 1/8 inch (1 mm) in 10 feet, maximum.

3.08 PROTECTION

A. Protect roof sheathing with protective covering until roofing work commences. Plywood damaged by water shall be replaced at no cost to the District.

END OF SECTION

SECTION 06181

GLUED-LAMINATED STRUCTURAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Preservative treatment of wood.

C. Steel hardware and attachment brackets.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 09900 - Paints and Coatings: Field Finishing.

1.03 REFERENCES

A. AITC 117-DESIGN - Standard Specifications for Structural Glued Laminated Timber of Softwood Species; American Institute of Timber Construction; 2004, and errata.

B. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber; American Institute of Timber Construction; 2002.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.

D. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.

E. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

F. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2006.

G. ASTM A 563 - Standard Specification for Carbon and Alloy Steel Nuts; 2004a.

H. ASTM D 2559 - Standard Specification for Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions; 2004.

I. ASTM D 3737 - Standard Test Method for Establishing Stresses for Structural Glued Laminated Timber (Glulam).

J. AWPA C28 - Standard for Preservative Treatment of Structural Glued Laminated Members and Laminations Before Gluing of Southern Pine, Coastal Douglas-Fir, Hemfir and Western Hemlock by Pressure Processes; American Wood Preservers' Association; 2003.

K. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2007.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2006.

M. WCLB (GR) - Standard Grading Rules for West Coast Lumber No. 17; West Coast Lumber Inspection Bureau; 2004, and supplements.

N. WWPA G-5 - Western Lumber Grading Rules; Western Wood Products Association; 2005.

O. California Building Code (CBC), California Code of Regulations, Title 24:
   1. Section 2306A.12, Weather Exposure.
   2. Section 2337A.1, Glued-laminated Timber.

P. Uniform Building Code (UBC) Standard 23-1, Classification, Definition, Methods of Grading and

Development of Design Values for All Species of Lumber.

1.04 DESIGN REQUIREMENTS

A. Design and laminate members in accordance with AITC 117-DESIGN and ASTM D 3737.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings.

D. Source Quality Control:
   1. Certification: Submit inspection certificates and verified reports in accordance with Section 01400.

1.06 QUALITY ASSURANCE

A. Manufacturer/Fabricator: Company specializing in manufacture of glue laminated structural units with five years of documented experience.

B. Manufacturer/Fabricator: Company specializing in manufacture of glue laminated structural units with ten years of documented experience, and certified by AITC in accordance with AITC A190.1.

C. Erector: Company specializing in erection of products of the type specified and approved by the manufacturer.

D. Standard of Quality: Conform to WWPA, WCLIB, AND UBC Standard 23-1.

E. Fabricate and inspect members in accordance with Title 24, Section 2337A.1. Fabricator shall be approved by the Division of the State Architect (D.S.A.).

F. Inspection: All structural glued laminated timber shall be continuously inspected during fabrication by a glue fabrication inspector specifically approved by the Division of the State Architect. An AITC Certificate will not meet this requirement. Comply with CBC, Section 2337A.1.
   1. Eligibility for approval will be based on examination of the Inspector's knowledge and experience in glued laminated construction.

G. Certification: Stamp each structural glued laminated member with an identifying number accompanied by a certificate of inspection showing the grade and species of lumber, type of glue and other information as required. Certificates will bear a signed statement by the Inspector, that the work has been executed in strict accordance with the approved drawings and specifications.

H. Design Supervision: Design structural members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.

I. Welding: Perform welding in accordance with AWS D1.1.

J. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

K. Pressure Preservative-Treated Wood: Provide lumber marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA C28 standards.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for loads, seismic zoning, and other load criteria.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Keep glued laminated timbers dry during delivery, storage, handling and erection, by maintaining the factory applied protective covering in weather tight condition, or by applying other weather tight protection, until the building enclosure is completed to the extent necessary for protection of interior glued laminated timber work, and until final finishing of exterior work is ready to proceed. Store units on sleepers above ground and slit bottom of wrapping intermittently to allow moisture to escape.

B. Leave individual wrapping in place until finishing occurs.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber Species: Unless otherwise indicated on Drawings, provide Douglas Fir, combination grade 24F-V8, DF/DF at interior GLB's, and Alaska Cedar, combination grade 20F-V13, AC/AC, at exterior GLB's (when shown on the drawings).
   1. Moisture Content: Not less than 7 percent or more than 12 percent at time of gluing. Range of moisture content of various laminations assembled into a single member not to exceed 5 percent.
   2. Appearance Grade: Architectural Appearance Grade GLB.

B. Steel Connections and Brackets: ASTM A 36/A 36M weldable quality, galvanize per ASTM A 123/A 123M.

C. Hardware: ASTM A 325 (ASTM A 325M) Type 1 high strength heavy hex bolts and ASTM A 563 (ASTM A 563M) nuts, hot-dip galvanized to meet requirements of ASTM A 153/A 153M, matching washers.

D. Anchor Bolts: ASTM A 325 (ASTM A 325M) Type 1 heavy hex high strength bolts and ASTM A 563 (A 563M) nuts; hot-dip galvanized to meet requirements of ASTM A 153/A 153M, matching washers.

E. Laminating Adhesive: Tested for wet/exterior service in accordance with ASTM D 2559.

F. End Sealer: Manufacturer's standard transparent, colorless wood sealer, which is effective in retarding the transmission of moisture (both in and out) at cross-grain cuts in glued laminated timber work.

G. Penetrating Sealer: Manufacturer's standard translucent penetrating wood sealer, which will not interfere with application of wood stain and transparent finish, or paint finish, as indicated for the work.

H. Bearing Plate Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.02 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Preservative Pressure Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc; Product Wolman CCA Type C: www.wolmanizedwood.com.
      b. Substitutions: See Section 01600 - Product Requirements.
   2. Preservative Pressure Treatment of Glued-Laminated Structural Units: AWPA Use

Category UC3B, Commodity Specification F (Treatment C28) using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.

a. Kiln dry lumber after treatment and before lamination to maximum moisture content of 19 percent.

C. Surface-Applied Wood Preservative:
   1. Product: Wolmanized Outdoor Wood manufactured by Arch Wood Protection, Inc.

D. Shop treat wood materials in accordance with manufacturer's instructions.

2.03 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Industrial grade.

B. Allowable Stresses: As noted on the structural drawings.

C. Verify dimensions and site conditions prior to fabrication.

D. Cut and fit members accurately to length to achieve tight joint fit.

E. Fabricate member with camber built in.

F. Do not splice or join members in locations other than those indicated without permission.

G. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

H. End Cut Sealing: Immediately after end cutting each member to final length, and after wood treatment, apply a saturation coat of sealer to ends and other cross-cut surfaces, keeping surfaces "flood coated" for not less than ten minutes.

I. Seal Coat: After complete fabrication and sanding of each unit, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on all weather-exposed surfaces in accordance with CBC, Section 2306.12, and AITC requirements.

J. Field Finishing of Members: Specified in Section 09900.

PART 3 EXECUTION

3.01 EXAMINATION

A. Time the delivery and the installation of glued laminated timber work to avoid extended on-site storage, and to avoid delaying the work of the other trades whose work must follow the erection of the glued laminated timber work.

B. Verify that supports are ready to receive units.

C. Verify sufficient end bearing area.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 ERECTION

A. Lift members using protective straps to prevent visible damage.

B. Set structural members level and plumb, in correct positions or sloped where indicated.

C. Provide temporary bracing and anchorage to hold members in place until permanently secured.

D. Fit members together accurately without trimming, cutting, or other unauthorized modification.

E. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

F. Repair damaged surface finishes after completion of erection and removal of wrappings, or replace damaged members as directed by the Architect when damage is beyond satisfactory repair.

END OF SECTION

SECTION 06200

FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Installation of wood door frames, glazed frames.

C. Wood casings, moldings, and trim.

D. Installation of hardware and attachment accessories.

E. Installation of hollow metal doors and frames.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry

B. Section 06410 - Custom Cabinets: Shop fabricated custom cabinet work.

C. Section 08110 - Steel Doors and Frames

D. Section 08210 - Wood Doors.

E. Section 08710 - Door Hardware.

F. Section 09900 - Paints and Coatings: Painting and finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.

B. NAAMM Standard HMMA 830-97 - Hardware Preparation and Locations for Hollow Metal Doors and Frames, Hollow Metal Manufacturers Association, Division of The National Association of Architectural Metal Manufacturers (NAAMM); 1997.

C. National Fire Protection Association (NFPA).

D. WI (MAN) - Manual of Millwork; Woodwork Institute; 2003.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, accessories, to a minimum scale of 1-1/2 inch to 1 ft (1:8).

D. Samples: Submit two samples of wood trim six inch (152 mm) long.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with Woodwork Institute Manual of Millwork, Custom grade.

B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

C. Fabricator Qualifications: Company specializing in fabricating the products specified in this

section with minimum five years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to NFPA No. 80 code for fire rating requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture and physical damage before, during and after installation. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Architect and at no additional cost to the District.

1.08 PROJECT CONDITIONS

A. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

B. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

B. Unless otherwise indicated provide products of quality specified by Woodwork Institute Manual of Millwork for Premium grade.

C. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled as specified in Section 01600.

2.03 LUMBER MATERIALS

A. Hardwood Lumber: moisture content shall be a minimum of 6 percent and shall not exceed 12 percent up to 2-inch nominal thickness.

B. Standing and Running Trim: Flat Grain.
   1. For Opaque (Paint) Finish: In accordance with WI Manual for Custom Grade.
      a. Species: Poplar.
   2. For Transparent Finish: In accordance with WI Manual for Custom Grade.
      a. Species: Red Oak.

C. Wood caps: Vertical Grain.
   1. For transparent Finish: In accordance with WI Manual for Premium Grade.
      a. Species: Red Oak.

D. Storage and Closet Shelving: Softwood plywood shelves with hardwood edges for paint finish. Comply with WIC Sections 4 and 11 if laminate plastic is not specified for shelving.

2.04 ADHESIVE

A. Adhesive: Type recommended by WIC to suit application.

2.05 FASTENINGS

A. Fasteners: Of size and type to suit application.

B. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir or Pine species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with Woodwork Institute Manual of Millwork, Section 5.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. See Section 06100 for installation of recessed wood blocking.

3.02 PREPARATION

A. Field Measurements: Field measure project conditions to assure accurate fit of fabricated and manufactured units.

B. Condition woodwork to average prevailing humidity conditions in installation areas prior to work. Do not install woodwork until wet operations are completed and concrete, masonry and plaster work has been thoroughly dried out, and woodwork has been primed or sealed. Reseal cut surfaces, edges and ends in approved manner.

C. Prior to installation of work, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

3.03 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.

B. Set and secure materials and components in place, plumb, level and true with no distortions.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim to conceal larger gaps.

D. Standing and Running Trim:
   1. Install with a minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members. Cope at returns and miter at corners.
   2. Apply wood finish material straight, plumb, level, in true alignment and closely fitted. Apply

mouldings and trim with mitered corners and mitered or coped angles. Securely attach finish carpentry items to prepare wood ground or blocking or other suitable prepared solid surfaces. Form joints to minimize shrinkage effects and dressed to hairline tolerance.

3. Exposed surfaces of finish carpentry work shall be free from tool marks, torn grain, cross sanding, or any workmanship defects that cannot be concealed by specified finish.

E. Wood Ceilings:
1. Install with a minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to the greatest extent possible. Stagger joints in adjacent and related members.
2. Apply wood finish material straight, plumb, level, in true alignment and closely fitted. Securely attach wood stripping to prepared wood grounds or blocking or other suitable solid surfaces. Form joints to minimize shrinkage effects and dressed to hairline tolerance.
3. Exposed surfaces shall be free from tool marks, torn grain, cross sanding, or any workmanship defects that cannot be concealed by specified finish.

F. Doors:
1. Assure that frames are firmly secured, plumb, square and properly handed.
2. Fit metal doors accurately in frames, within clearances specified in the referenced standards.
3. Where fitting of wood doors is necessary, trim both sides and both ends equally. Bevel lock edges of single doors and both edges at meeting stile of double doors. Do not cut doors to openings smaller than those for which they are fabricated.
4. Place fire rated doors with clearances as specified in NFPA No. 80.
5. Upon completion check each door to assure that hardware functions properly and that doors, when open in any position, remain fixed without influence from gravity. After fitting and hanging, remove from frame so painter can refinish cut edges and ends. Replace doors when finish is dry.

G. Finish Hardware:
1. Install hardware in accordance with manufacturer's instructions.
2. Surface Mounted Hardware: Drill pilot holes for screws. Accurately and neatly make holes from templates of the finish hardware furnished by hardware supplier.
3. Fit all hardware to fully conform to standard procedure and to manufacturer's directions. Position of hardware is based on NAAMM Standard HMMA 830-97 as indicated in Section 08710.
4. Remove finish items (except hinges) which are not otherwise protected. Reinstall after painting is completed.
5. Readjust hardware for proper function as required after doors are finished. Check for free operation and proper clearances. Refit and refinish as required.
6. Readjust hardware for proper function as required after doors are finished. Check for free operation and proper clearances. Refit and refinish as required.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09900.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.5 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.7 mm).

END OF SECTION

SECTION 06410

CUSTOM CABINETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated laminated plastic cabinet units.

B. Countertops and splashes.

C. Cabinet hardware.

D. Factory finishing.

E. Field verification of dimensions prior to fabrication.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking in walls.

B. Section 06200 - Finish Carpentry: Installation of casework.

C. Section 07900 - Joint Sealers.

D. Section 10105 - Markerboards and Tackboards.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

D. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

E. Architectural Woodwork Standards, Woodwork Institute (WI), 1st Edition; 2009.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
   1. Comply with WI "Guidelines for Architectural Millwork Shop Drawings".

C. Product Data: Provide data for hardware accessories.

D. Mock-ups: Submit actual samples of architectural base cabinet and wall cabinet construction, minimum 18 inches (457.2 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate, edge banding, and plastic laminate finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, locksets, and slides, demonstrating hardware design, quality, and finish. Hardware may be part of mock-ups.

F. Finish Samples: Submit six 6" x 6" samples of selected plastic laminate color(s).

1.05 QUALITY ASSURANCE

A. Standards and Certification:
   1. All millwork shall be manufactured and installed in accordance with the standards of the Woodwork Institute - Manual of Millwork, latest edition, in the grade specified, unless more stringent requirements are described in this Section or on the drawings.

a. All specified millwork shall conform to Section 15, Casework - Laminated Plastic, Premium Grade, Construction Type I, and, Construction Style A - Frameless; and Section 16, Countertops - Laminated Plastic, Premium Grade.
b. Before delivery to the jobsite and after installation of the millwork, the millwork supplier shall issue a Woodwork Institute Certified Compliance Certificate indicating the millwork products being furnished and installed for this project fully meet all the requirements of the grade specified. The first page of shop drawings shall bear the Woodwork Institute Certified Compliance Label; additionally, each unit of casework and each plastic laminate countertop delivered to the project shall bear the Certified Compliance Label.

B. Manufacturer and Installer Qualifications: Members in good standing of the Woodwork Institute. Non-members shall comply with Woodwork Institute Monitored Compliance Program.

C. Comply with ADAAG and CBC, Section 1117B, and Figures 11B-5C, 11B-1D, and 11B-5D for forward reach, side reach, and sink area access.

D. Comply with CBC, Chapter 16A for vertical and seismic design loads. Shelves shall meet 50 lb./sq. ft. load capacity.

1.06 PRE-INSTALLATION MEETING

A. Convene not less than one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

B. Delivery - Do not deliver millwork until building is in proper condition and arrangements are made to properly handle and store at job site. All plaster work and concrete work shall be dry, and the area receiving the millwork broom clean.

C. Storage - Store millwork in sheltered location and protect from rain, fog, and dew until installed in place. Keep millwork dry, loosely stacked and raised above floors and earth. The millwork shall not be subject to abnormal heat, extreme dryness, humid conditions, sudden changes in temperature, or direct sunlight. The Architectural millwork shall be acclimated to building temperatures 72 hours prior to installation.

1.08 WARRANTY

A. All materials shall be warranted for a minimum period of 1 year from date of acceptance for manufacturing defects and workmanship.

1.09 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.

2.02 LAMINATE MATERIALS

A. Decorative Laminates and Laminates with Wood Grains: Provide colors and wood grain patterns as selected by the Architect from the manufacturers standard priced colors. A minimum of three colors for millwork will be selected.

B. Manufacturers:
1. Formica Corporation: www.formica.com.
2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.

3. Wilsonart International, Inc: www.wilsonart.com.
4. Substitutions: See Section 01600 - Product Requirements.

C. Product Composition: Decorative surfaced papers impregnated with melamine resins are pressed over kraft paper core sheets impregnated with phenolic resin. Sheets are then bonded at pressures greater than 1000 pounds per square inch at temperatures approaching 300 degree F. (149 degree C).

D. High Pressure Decorative Laminate (HPDL): ANSI/NEMA LD 3, types as recommended for specific applications and as follows:
1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, color as selected, provide at countertops, splashes, top and bottom surface of shelves in open bookcases, and other work surfaces..
2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, color as selected, provide at cabinet walls, doors, drawer face panels, and other vertical surfaces..
3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch (1.0 mm) nominal thickness, color as selected, provide at formed edges for counters and other curved surfaces..
4. Cabinet Liner: HPL, 0.020 inch (0.51 mm) nominal thickness, color as selected,.
5. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

E. Finishes:
1. Exposed Portions (including cabinet surfaces in open bookcases, open shelves, and knee spaces) - HPL (high-pressure laminate).
2. Semi-exposed Portions - HPL Cabinet Liner except as noted above.
3. Concealed Portions - Any species solid stock or plywood except as noted above.

F. Cores:
1. Countertops and Splashes - A-C EXT softwood plywood meeting or exceeding requirements of U. S. Product Standard PS-1, 3/4" thickness.
2. Cabinets – B-B INT softwood plywood meeting or exceeding requirements of U. S. Product Standard PS-1, 3/4" thickness.
3. Ends and Divisions – B-B INT softwood plywood meeting or exceeding requirements of U. S. Product Standard PS-1, 1" thickness.
4. Drawers – 7 or 9-ply hardwood plywood, ½” minimum thickness, 5/8” maximum thickness.
5. Drawer Bottoms – Hardwood plywood, ¼” thickness (provide ½” thickness at drawers exceeding 30 inches in width).
6. Doors – B-B INT softwood plywood meeting or exceeding requirements of U. S. Product Standard PS-1, ¾” thickness.
7. Shelves – B-B INT softwood plywood meeting or exceeding requirements of U. S. Product Standard PS-1, ¾” thickness (provide 1” thickness at shelves 30 inches and over). All exposed shelving in the same room shall be the same thickness.
8. Stretchers – Solid stock or hardwood plywood, ¾” thickness.
9. Backs – Hardwood Plywood, ¼” thickness (provide ½” thickness at exposed backs).
10. Bases and sleepers – Solid stock or hardwood plywood, ¾” thickness.
11. Security and dust Panels – Hardwood plywood, ½” thickness.

2.03 ACCESSORIES

A. Adhesive: Type II, water resistant, releasable.

B. Edge Banding: Exposed exterior cabinet edges, cabinet shelving (including front and back edge of adjustable shelves in open cabinets), divider components, doors, drawer edges, countertops, splashes, and other exposed portions shall be finished with hot melt applied HPL (high pressure laminate), thickness to match adjacent face laminate, conforming to NEMA LD-3.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel, or chrome-plated finish in

exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

2.04 HARDWARE

A. Hardware: BHMA A156.9, types as indicated for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using recessed metal shelf standards and coordinated shelf rests, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.
   1. Product: No. 255 Heavy Duty shelf standard with No. 256 shelf clip manufactured by Knape & Vogt or equal.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers ("U" shaped wire pull, steel with satin finish, 100 mm centers).
   1. Product: EPCO MC-402 manufactured by EPCO, Inc.
   2. Product: P604BC manufactured by Liberty Hardware Manufacturing Co.

D. Cabinet Locks: Pin tumbler box lock with keyed cylinder, master keyed, two keys per lock. Provide locks on all cabinet doors and drawers, except at doors below sinks and overhead cabinet doors, unless otherwise noted. District will provide keying schedule.
   1. Product: Doors - C8173-US26D manufactured by National Lock Co., or equal.
   2. Product: Drawers - C8179-US26D manufactured by National Lock Co., or equal.

E. Catches: Magnetic. Provide at all active doors.
   1. Product: No. 639-9783-AL manufactured by Amerok.
   2. Product: No. 1000 manufactured by EPCO, Inc.

F. Latches: Inactive door leaf of lower and upper cabinets and tall storage cabinets shall have one finger spring pull latch mounted on the inside door leaf. Mount spring latch at easy to reach locations.
   1. Product: EP1018N manufactured by Epco, Inc., or equal.

G. Drawer Slides:
   1. Type: Full extension.
   2. Static Load Capacity: 150 lbs. minimum.
   3. Mounting: Side mounted.
   4. Stops: Integral type.
   5. Manufacturers:
      a. Accuride International, Inc; Product - Mod. 3832 (Mod. 4034 at file drawers and paper drawers): www.accuride.com.
      b. Knape & Vogt Manufacturing Company; Product -Mod. 8400 (Mod. 8500 at file drawers and paper drawers): www.knapeandvogt.com.

H. Hinges: 5-knuckle 304 stainless steel overlay hinges, 2-3/4 inch in height, hospital tips, 270 degree opening angle, drilled knuckle IDs and machined knuckle edges, and a non-removable knurled pin. Hinges to meet ANSI/BHMA Grade 1, Standard No. 156.9.
   1. Product: Model No. 854 manufactured by Rockford Process Control, Inc., Rockford, Illinois, 815-966-2026, or equal.

I. Grommets: Plastic, 2-3/8" dia. hole. Provide minimum one grommet at each work station and/or computer station.
   1. Product: Executive Cable Grommet No. 429 manufactured by Closet-Masters, Inc., or equal.
   2. Product: 3000 Series manufactured by Mold Rite, Inc.

J. Sliding Door Track Assemblies: Upper and lower track of satin anodized aluminum, with matching shoe equipped with nylon slides.
   1. Product: EP2 manufactured by Epco, Inc., or equal.

K. Sliding Door Pulls: U" shaped wire pull, steel with satin finish, 4 inch centers ("U" shaped wire pull, steel with satin finish, 100 mm centers).
   1. Product: EPCO MC-402 manufactured by Epco, Inc., or equal.

2.05 FABRICATION

A. Laminated Plastic Casework: Premium Grade, Construction Type 1, Construction Style A - Frameless.

B. Field verify all dimensions prior to fabrication of casework and countertops.

C. Fabricate all casework and countertops in accordance with Wood Institute - Manual of Millwork, latest edition, for the grades specified. Comply with "Guidelines to Seismic Casework Fabrication".

D. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

E. Edging: Fit shelves, doors, exposed edges, etc., with specified edging. Do not use more than one piece for any single length.

F. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

G. Shelving: The minimum length of adjustable shelves shall be 1/16" less than the inside dimension of the cabinet. All exposed shelving in the same room shall be the same thickness.

H. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

I. Countertops: Self Edge, Premium Grade. Provide Waterfall Edge, Custom Grade, at all kindergarten classrooms.

J. Splashes: Integrally coved splash, 6 inches high unless otherwise noted.

K. Provide cutouts for plumbing fixtures, inserts, and outlet boxes. Verify locations of cutouts from on-site dimensions. Seal cut edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install all casework in accordance with Woodwork Institute - Manual of Millwork, comply with "Guidelines to Casework Installation Requirements".

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units and countertops.

E. Carefully scribe casework abutting other components, walls, and ceilings, with maximum gaps of 1/32 inch (1 mm). Do not use additional overlay trim for this purpose.

F. Furnish fillers, closures and trim for a complete installation. Provide fillers/scribes in toe space - sides and top, typical. Fill all gaps in cabinetry at all exposed surfaces including: toe spaces, under countertops, at gaps at top or bottom of wall hung cabinetry or tall storage units. Provide

backing for filler/scribe. Plastic laminate alone shall not be acceptable as a filler/scribe. Fill all concealed openings and holes, horizontal or vertical.

G. Fasten wall cabinets to wood blocking or CMU wall at maximum spacing of 32 inches on-centers. Minimum screw size shall be #14 x 3" Truss Head screw at wood or metal stud walls and 1/4" x 3-1/4", Hilti Kwik-Bolt 3 (ICC-ES ESR-1385) fasteners at CMU walls. Provide minimum 1-1/2" penetration into blocking or CMU wall.

H. Adjacent cabinet units shall be fastened together both front and back with a minimum of four (4) #8 x 1-1/4" oval or pan head screws, a maximum of 30" on center.

I. Install trim in as long lengths as possible with running joints mitered and fitted tight. Miter exterior corners. Color and laminate plastic finish shall be same as face of cabinet.

J. Caulk all dissimilar joints. Color as selected by the Architect.

K. Secure cabinets to floor using appropriate angles and anchorages.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

B. Touch up stained, scratched or otherwise discolored surfaces to match original shop finish or samples. Replace portions of work cut or otherwise damaged too badly to repair by touch up.

END OF SECTION

SECTION 06605

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced polyester panel system for adhesive mounting.

B. Moldings, adhesive, and joint sealants.

1.02 RELATED SECTIONS

A. Section 09260 - Gypsum Board Assemblies.

1.03 REFERENCES

A. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2005a.

B. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.

D. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C With a Vitreous Silica Dilatometer; 2003.

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2003.

F. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement; 2000.

G. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor; 1995 (Reapproved 2001).

H. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

C. Maintenance Instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Marlite, Inc., Dover, OH. Product: Marlite FRP Panels, 330-343-6621
   2. Kemlite Company, Inc. Product: Glasbord-P, 800-435-0080.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 PANEL SYSTEM

A. Plastic Panel System: Factory finished panels, trim, sealant, and accessories.

B. Panels: Marlite FRP Panels; fiberglass reinforced polyester, USDA approved for incidental food contact.
   1. Surface Burning Characteristics: Flame spread index of 200 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84 (Class C/III).
   2. Surface Texture: High-gloss, smooth.
   3. Color: As selected from manufacturer's standard selection.
   4. Thickness: 3/32 inch (2.4 mm), nominal.
   5. Width: 48 inches (1220 mm).
   6. Height: 96 inches (2438 mm).
   7. Flexural Strength: 17,000 psi (117 MPa), when tested in accordance with ASTM D 790.
   8. Flexural Modulus: 600,000 psi (4137 MPa), when tested in accordance with ASTM D 790.
   9. Tensile Strength: 8,000 psi (55 MPa), when tested in accordance with ASTM D 638.
   10. Tensile Modulus: 9,430 psi (65 MPa), when tested in accordance with ASTM D 638.
   11. Barcol Hardness: 40, when tested in accordance with ASTM D 2583.
   12. Impact Resistance: 7 ft-lb/in (1225 N/m), when tested in accordance with ASTM D 256, Izod method.
   13. Coefficient of Thermal Expansion: 0.0000157 in/in/degree F (0.0000283 mm/mm/degree C), measured in accordance with ASTM D 696.
   14. Water Absorption: 0.17 percent, when tested in accordance with ASTM D 570.
   15. Specific Gravity: 1.53, when tested in accordance with ASTM D 792.

C. Panel Trim: Extruded PVC, in manufacturer's standard colors.
   1. Outside corners, inside corners, edge trim, and division molding.
   2. Base Molding: Design that simplifies installation and helps seal wall panel system, with factory made corners and splices.

D. Sealant: Marlite Silicone Sealant; gunnable silicone rubber; clear.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Take panels out of cartons and allow to acclimatize to room conditions for at least 48 hours prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Clean surfaces thoroughly prior to installation.

D. Protect existing surfaces from damage due to installation.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use the adhesives recommended by the panel manufacturer unless prohibited by local regulations; obtain manufacturer's approval of alternative adhesives.

C. Install continuous bead of silicone sealant in each joint and trim groove and between trim and adjacent construction, maintaining 1/8 inch (3 mm) expansion space.

D. Avoid contamination of panel faces with adhesives, solvents, or cleaners; clean as necessary and replace if not possible to repair to original condition.

E. Protect installed products until completion of project.

F. Touch-up, repair or replace damaged products after Substantial Completion.

END OF SECTION

SECTION 07130

SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rubberized asphalt sheet membrane waterproofing system for foundations.

B. Cant strips and other accessories.

C. Drainage panels and Protection boards.

1.02 RELATED REQUIREMENTS

A. Section 02316 - Fill and Backfill.

B. Section 03300- Cast-In-Place Concrete.

C. Section 04810 - Unit Masonry Assemblies.

D. Section 07900 - Joint Sealers: Sealant for joints in substrates.

E. Section 15146 - Plumbing Specialties: Roof drain and plumbing vent flashing flanges.

1.03 REFERENCE STANDARDS

A. ASTM C 836 - Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

B. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.

C. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2005).

D. ASTM D 882 - Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.

E. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D 1876 - Standard Test Method for Peel Release of Adhesives (T-Peel).

G. ASTM D 3767 - Standard Practice for Rubber - Measurements of Dimensions.

H. ASTM D 5385 - Standard Test Method for Hyrdostatic Pressure Resistance of Waterproofing Membranes.

I. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.

J. ASTM E 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

C. Samples: Submit representative samples of sheet membrane and prefabricated drainage and protection board.

D. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

E. Certification of data indicating VOC (Volatile Organic Compound) content of all components of

waterproofing system.

F. Certificate: Certify that products meet or exceed specified requirements.

G. Manufacturer's Installation Instructions: Indicate special procedures.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in waterproofing sheet membranes with fifteen years experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.06 MOCK-UP

A. Construct mockup 100 sq ft (10 sq m) of horizontal waterproofed panel; to represent finished work including internal and external corners.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until liquid or mastic accessories have cured.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to District.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. For warranty repair work, remove and replace materials concealing waterproofing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grace Construction Products; Product - Bituthene System 4000 Membrane.

2.02 MEMBRANE MATERIALS

A. Sheet Waterproofing System - a self-adhesive, cold-applied composite sheet consisting of a thickness of 1.5 mm (0.060 in.) of rubberized asphalt and 0.1 mm (0.004 in.) of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner.

B. Sheet Membrane Waterproofing:

Property	Typical Value	Test Method
Thickness	1/16 in. (1.5 mm) nominal	ASTM D3767 - Method A
Flexibility, 180 deg. bend over 1 in. mandrel at -32 deg.F	Unaffected	ASTM D1970
Color	Dark gray-black	
Tensile Strength, Membrane	325 lbs/in.2 (2240 kPa) min.	ASTM D412 Modified

Tensile Strength, Film	5,000 lbs/in.2 (34.5 MPa) min.	ASTM D882 Modified
Elongation, Ultimate Failure of Rubberized Asphalt	300 % minimum	ASTM D412 Modified
Crack Cycling at -25 deg.F,100 cycles	Unaffected	ASTM C836
Peel Strength	9 lbs/in. (1576 N/m)	ASTM D903 Modified
Puncture Resist., Membrane	50 lbs (222 N) minimum	ASTM E154
Resistance to Hydrostatic Head	210 ft (70 m) of water	ASTM D5385
Permeance	0.05 perms maximum	ASTM E96, Sect.12
Water Absorption	0.1% maximum	ASTM D570
Lap Adhesion at Minimum Application of Temperature	5 lbs/in (880 N/m)	ASTM D1876 Modified

C. Seaming Materials: Hydroduct Tape or as recommended by membrane manufacturer.

D. Termination Bars: Aluminum; compatible with membrane and adhesives.

E. Surface Conditioner: System 4000 Surface Conditioner.

F. Adhesives: As recommended by membrane manufacturer.

G. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

2.03 ACCESSORIES

A. Drainage and Protection Board: Hydroduct 220 - Preformed 0.433 in. thick geocomposite drainage sheet system, comprising a hollow studded polystyrene core, covered on one side with a non-woven, needle punched polypropylene filter fabric and on the other side with a smooth polymeric film

B. Cant Strips: Bitumen impregnated fiberboard as recommended by membrane manufacturer.

C. Flexible Flashings: Type recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions. Vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Seal cracks and joints with sealant using depth to width ratio as recommended by sealant manufacturer.

E. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer. Protect conditioner from rain or frost until dry.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing system in accordance with manufacturer's instructions.

B. Roll out membrane. Minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer. Apply to vertical substrate with a mechanical roller to encourage full contact bond.

D. Overlap edges and ends and seal by method recommended by manufacturer, minimum 3 inches (75 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage. Seal joints and seams.

G. Coordinate with drain installation; see Section 15146.

H. Install flexible flashings. Seal items penetrating through membrane with flexible flashings. Seal watertight to membrane.

I. Seal membrane and flashings to adjoining surfaces. Install termination bar at all edges. Install counterflashing over all exposed edges.

3.04 INSTALLATION - DRAINAGE PANEL and PROTECTION BOARD

A. Place composite drainage panel and protection board directly against membrane using Hydroduct Tape, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

3.05 CLEANING AND PROTECTION

A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.

B. Protect completed membrane waterproofing from subsequent construction activities.

END OF SECTION

SECTION 07140

FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid applied membrane waterproofing.

B. Cant strips and other accessories.

C. Composite Protection Board/Drainage panels.

1.02 RELATED REQUIREMENTS

A. Section 02316 - Fill and Backfill.

B. Section 03300 - Cast-in-Place Concrete: Concrete substrate.

C. Section 04810 - Unit Masonry Assemblies: Masonry substrate.

D. Section 07900 - Joint Sealers: Sealant for joints in substrates.

1.03 REFERENCE STANDARDS

A. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use With Separate Wearing Course; 2011.

B. ASTM C 898 - Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension; 2006a.

D. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

E. ASTM D 1644 - Standard Test Method for Nonvolatile Content of Varnishes.

F. ASTM D 3767 - Standard Practice for Rubber-Measurement of Dimensions.

G. ASTM D 5295 - Standard Guide for Preparation of Concrete Surfaces for Adhered Membrane Waterproofing Systems.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certification of data indicating VOC (Volatile Organic Compound) content of all components of waterproofing system.

E. Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied waterproofing membranes with fifteen years experience.

B. Installer Qualifications: Company specializing in installation of fluid-applied waterproofing with minimum five years experience.

1.06 INSPECTIONS

A. Make required notifications and secure required inspections by the manufacturer of the approved materials so as to facilitate issuance of the specified waterproof warranty.

1.07 MOCK-UP

A. Construct mock-up 100 sq ft (10 sq m) of horizontal waterproofed panel; to represent finished work including internal and external corners.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until cured.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures, and construction operations.

B. Protection: Take precautions recommended by the waterproofing manufacturer to protect workmen against health hazard, to protect the structure from fire hazards and to prevent overspray, splash or spillage on adjacent surfaces not indicated to be waterproofed.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to District.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

D. For warranty repair work, remove and replace materials concealing waterproofing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grace Construction Products; Product - Procor 20.

B. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based or accepted equal.

2.02 MEMBRANE AND FLASHING MATERIALS

A. Fluid-applied Elastomeric Membrane: Two-component, self-curing, synthetic rubber based material, complying with ASTM C 836.

2.03 ACCESSORIES

A. Sealant for Substrate Surfaces: As recommended by membrane manufacturer.

B. Tack-Reducing Surfacing: Type 1 Portland cement.

C. Fiberglass Reinforcement: Glass fabric conforming to ASTM D 1666.

D. Prefabricated Protection and Drainage Board: Hydroduct 220 Drainage Composite.

E. Tape: Preprufe Tape - Two-sided, reinforced pressure-sensitive tape designed to adhere to penetrations, protrusions, and end laps.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.

B. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION AND DETAILING

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Locate all holes, joints, and cracks. Point them flush with mortar. Cut off or grind off all high spots greater than 1/16 inch in height.

C. Cleaning: Completely remove dirt, oil, grease, curing compound, laitance, and other materials that would adversely affect the bond of waterproofing material. Clean surfaces with high pressure air.

D. Cracks and Cold Joints: Clean cold joints and visible cracks less than 1/16 inch wide. Apply a minimum 0.060" coating of waterproofing with fiberglass fabric embedded therein extending a distance of at least 6 inches on either side of the joint or crack. Rout out cracks wider than 1/16 inch to at least 1/4 inch wide by 1/4 inch deep and seal as specified for expansion and control joints.

E. Expansion and Control Joints: Clean and prime, install backer rod and seal joints using approved sealant. Place a bond breaker over sealant to prevent waterproofing material from bonding to sealant. Apply a minimum 0.060" coating of waterproofing with fiberglass fabric embedded therein extending at least six inches on either side of the joint.

F. Inside and Outside Corners: Apply 0.060" coating of waterproofing membrane starting at the corner and extending 6 inches from each side.

G. Penetration Openings: Seal penetration and install 1 inch fillet of Procor 20 around the protrusion. Extend waterproofing membrane 6 inches onto the substrate and at least 2 inches onto the penetration. For plastic pipes and other low adhesion substrates, use Preprufe Tape.

H. Masonry Surfaces: Apply Procor Concrete Sealer or a scratch coat of Procor to surfaces to receive waterproofing material.

I. Do not apply waterproofing to surfaces unacceptable to manufacturer.

J. Install cant strips at inside corners.

3.03 INSTALLATION

A. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness.

B. Apply waterproofing in accordance with manufacturer's instructions to specified minimum thickness of 0.060" (1.5mm).

C. Apply extra thickness of waterproofing material at corners, intersections, and angles.

3.04 INSTALLATION - COMPOSITE DRAINAGE PANEL/PROTECTION BOARD

A. Immediately after curing, dust membrane with tack-reducing surfacing at rate of approximately 10 lbs/100 sq ft (4 kg/10 sq m).

B. Place Hydroduct 220 Drainage Composite panel directly against membrane, butt joints, place to

encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

3.05 CLEANING, CURING AND PROTECTION

A. Clean adjacent surfaces of splashed or spilled material. Remove containers and equipment from the site.

B. Allow waterproof membrane to cure at least 24 hours prior to backfill to avoid displacement of the membrane. Use care during the overburden placement operation to avoid damage to the waterproofing system.

C. Maintain all plumbing apparatus day and night, if necessary, to prevent water contact with walls until waterproofing is fully cured and accepted as finished work.

END OF SECTION

SECTION 07190

WATER REPELLENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water repellents applied to exterior masonry surfaces.

B. Pressure washing.

C. Concrete etching.

1.02 RELATED REQUIREMENTS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 04810 - Unit Masonry Assemblies.

C. Section 07900 - Joint Sealers.

D. Section 09220 - Portland Cement Plaster.

1.03 REFERENCE STANDARDS

A. ASTM C 67 - Sampling & Testing Brick & Structural Clay Tile.

B. ASTM C 140 - Water Absorption Concrete Masonry Units.

C. ASTM D 1653 - Moisture Vapor Permeability of Organic Coatings.

D. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005.

E. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2007).

F. ASTM E 514 - Water Penetration and Leakage Through Masonry.

G. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

H. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; 2004.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description and chemical composition.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Field Reports: Report whether manufacturer's "best practices" are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.06 MOCK-UP

A. Prepare a representative surface 36 by 36 inch (1 by 1 m) in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.

1.07 PRE-INSTALLATION MEETING

A. Convene a meeting at least two weeks prior to starting work; require attendance of installers; invite Architect, Inspector, and other contractors whose work will be affected.

1.08 FIELD CONDITIONS

A. Protect liquid materials from freezing.

B. Do not apply water repellent when ambient temperature is lower than 50 degrees F (10 degrees C) or higher than 90 degrees F (22 degrees C).

C. Do not apply water repellents when wind velocity is higher than 2 mph.

1.09 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide two gallons (9 l) of water repellent.

1.10 WARRANTY

A. The material and workmanship in this application shall be warranted jointly and separately, under a single document to the District, signed by the manufacturer and applicator of materials. The applicator shall warrant workmanship for a period of two years, and the manufacturer shall warrant against water intrusion for a period of five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane/Siloxane Water Repellents:
   1. BASF Construction Chemicals; Product - Aqua-Trete Emulsion EM: www.buildingsystems.basf.com.
   2. Rainguard International Products Company; Product - Rainguard Regular.

2.02 MATERIALS

A. Water Repellent: Non-glossy, colorless, penetrating, water-vapor-permeable, non-yellowing sealer, that dries invisibly leaving appearance of substrate unchanged.
   1. Applications: Vertical surfaces and non-traffic horizontal surfaces.

B. Water Repellent: colorless.
   1. Modified Polysilane or Silane/Siloxane based.
   2. VOC Compliant.
   3. Solids by Volume: 7.5 percent, minimum.

C. Test Data:

1.	Water Penetration & Leakage Through Masonry ASTM E514	98.7% min.
2.	Water Absorption Concrete Masonry Units ASTM C140	89.0% min.
3.	Moisture Vapor Permeability of Organic Coatings ASTM D1653	97.0% min.
4.	Sampling & Testing Brick & Structural Clay Tile ASTM C67	97.0% min.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify joint sealants are installed and cured.

C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Prepare surfaces to be coated as recommended by water repellent manufacturer for best results.

B. Do not start work until masonry mortar substrate is cured a minimum of 30 days.

C. Remove oil and foreign substances with a chemical solvent that will not affect water repellent.

D. Pressure wash surfaces to be coated:
   1. Concrete: Jet blast at 10,000 psi (70 MPa), minimum.
   2. Firm Masonry (Concrete Masonry Units, Brick, and Dense Stone): High pressure wash at 1500 to 4000 psi (10 to 30 MPa), at 6 to 12 inches (150 to 300 mm) from surface.
   3. Weathered Masonry (Brick and Stone): Pressure wash at 600 to 1500 psi (4 to 10 MPa) at 6 inches (150 mm) from surface.

E. Acid etch smooth concrete surfaces to be coated, using procedures described in Master Painters Institute Architectural Painting Specifications Manual; match approved mock-up.

F. Allow surfaces to dry completely to degree recommended by water repellent manufacturer before starting coating work. Moisture content shall be no higher than 15% as registered on an electronic moisture meter.

3.03 APPLICATION

A. Apply water repellent in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.

B. Apply at rate recommended by manufacturer, continuously over entire surface.

C. Apply one coat, minimum.

D. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

E. Provide manufacturer's field service representative to inspect preparation and application work for at least 3 hours on first day to ensure that manufacturer's "best practices" for preparation and application are being followed.

3.04 PROTECTION OF ADJACENT WORK

A. Protect adjacent landscaping, property, and vehicles from drips and overspray.

B. Protect adjacent surfaces not intended to receive water repellent.

C. Remove water repellent from unintended surfaces immediately by a method instructed by water repellent manufacturer.

END OF SECTION

SECTION 07212

BATT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thermal batt insulation in exterior wall, ceiling, and roof construction.

B. Thermal batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

C. Acoustical batt insulation for interior walls, floors, and ceilings.

D. Pipe wrap insulation for interior drain pipes.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Supporting construction for batt insulation.

B. Section 07840 - Firestopping.

C. Section 09260 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

B. ASTM C 1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.

C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

D. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2009b.

E. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 DESIGN REQUIREMENTS

A. Recycled Content: Provide certification that insulation materials contain a minimum of 30 percent recycled materials.

B. CHP Low-Emitting Materials Table: Materials submitted for building insulation must be listed as low emitting on the CHPS website, www.CHPS.net, or must be tested by an independent laboratory to meet CHPS Section 01350. All components of an assembly must meet Section 01350 individually or in an assembly.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturers original packaging. Clearly identify manufacturer, contents, brand name, applicable standard, and R-value.

B. Store materials off ground in a dry location.

C. Remove damaged material from site and replace at no additional cost to the District.

1.07 SCHEDULING

A. Coordinate installation with other trades whose work may be affected.

B. Do not install insulation until construction has progressed to the point that inclement weather will not damage or wet the insulation material.

C. Install insulation after electric wiring, plumbing and other concealed work is in place.

D. Insulation shall not be closed in until it has been inspected and approved.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Insulation:
   1. JohnsManville-Building Insulation Division
   2. Owens Corning Corporation
   3. CertainTeed Corporation
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 BATT INSULATION MATERIALS

A. Batt Insulation: ASTM C 665; preformed batt; friction fit, conforming to the following:
   1. Material: Glass or mineral fiber.
   2. Surface Burning Characteristics: Flame spread index of 25 or less; smoke developed index of 50 or less, when tested in accordance with ASTM E 84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E 136, except for facing, if any.

B. Acoustical/Thermal Unfaced fiberglass insulation: Thermal Resistance R-19, Type I, 6 1/4". thickness.

C. Thermal Kraft-faced fiberglass insulation: Thermal Resistance R-19, Type II, Class C (use in nonexposed applications only), 6 1/4" thickness..

D. Thermal Foil-faced (FSK) fiberglass insulation: Thermal Resistance R-30, Type III, Class A, 10" thickness.

2.03 PIPE INSULATION MATERIALS

A. Drain Pipe Insulation: Fiberglass blanket bonded together with thermosetting resin complying with ASTM C 1393 Types I, II, IIIA and IIIB, Category 2, one inch thickness. Joints and facing penetrations shall be sealed with pressure sensitive tape recommended by the manufacturer.
   1. Product: Fiberglas FlexWrap manufactured by Owens Corning Corp.
   2. Product: CrimpWrap Crimped Pipe and Tank Wrap manufactured by CertainTeed Corp.

2.04 ACCESSORIES

A. Staples: Steel wire; electroplated, or galvanized; type and size to suit application.

B. Wire: #12 gage, galvanized steel wire.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

3.02 BATT INSTALLATION

A. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

C. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

D. Unfaced Batts: Where insulation is cut to fit small or irregular spaces, cut pieces slightly larger than the space to ensure a tight friction fit. Friction fit blankets between studs recessed slightly from the face of the studs. Where batts are installed between exposed floor or ceiling joists, provide minimum three No. 12 gage tie wires for each batt or three per 48 inches.

E. Kraft- and Foil-faced Batts: Where insulation is cut to fit irregular spaces, form flanges for attachment to framing members. Insert flanged batts between framing members with membrane facing toward the building interior. Where possible, recess foil faces 3/4 inch from face of framing members. Maintain Kraft or foil facings intact or patch all tears or holes using plastic tape or other approved means.

F. Acoustical Insulation:
   1. Fill all interior walls with full thickness acoustical insulation.
   2. Extend acoustical insulation from slab or floor to underside of roof surface or floor above.
   3. Sound attenuation insulation shall be rigidly secured to framing members, tightly fitted. Where shown or intended to be of sound resistive construction, openings in walls and floors such as phone outlets, electrical and mechanical penetrations, etc. shall have minimum of two layers of insulation lapping openings at least 14 inches.
   4. Sound deaden pipe, equipment, conduit, fixtures and other mechanical and electrical work by wrapping with mineral quilts at hanger straps and where members pass through framing or other wall or floor construction. Contractor may substitute sound isolating and acoustical clamps and sleeves manufactured by Specialty Products Company, Stanton, California, as accepted by the Architect. Refer to specifications on sealants for technical provisions of acoustical sealants to be used in conjunction with sound insulation.

G. Staple or nail facing flanges in place at maximum 6 inches (150 mm) on center.

H. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

I.

3.03 PIPE INSULATION

A. Wrap insulation around all concealed or in-wall roof drain pipes. Butt adjacent sections together and seal with pressure sensitive tape according to manufacturers recommendations.

3.04 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

B. Remove and replace any water damaged insulation at no cost to the District.

3.05 SCHEDULES

A. All exterior walls and walls exposed to outside weather conditions: Kraft-faced batts, R-19.

B. Walls adjacent to non-conditioned spaces: Kraft-faced batts, R-19.

C. All interior walls including toilet room separation walls and plumbing fixture walls: Unfaced batts, R-19.

D. Exposed attics and suspended ceiling areas: Foil-faced batts, R-30.

E. Gypsum board faced ceilings and roofs: Kraft-faced batts. R-30.

F. Ceilings or roofs adjacent to non-conditioned spaces: R-30 unless otherwise noted.

G. Floor/suspended ceiling assemblies: Unfaced batts, R-19.

H. Roof drain pipes: Flexible fiberglass pipe wrap.

END OF SECTION

SECTION 07311

ASPHALT SHINGLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Asphalt shingle roofing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Associated metal flashings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Roof sheathing.

B. Section 07620 - Sheet Metal Flashing and Trim: Edge and cap flashings.

1.03 REFERENCE STANDARDS

A. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

B. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2009.

C. ASTM D 3018 - Standard Specification for Class A Asphalt Shingles Surfaced with Mineral Granules.

D. ASTM D3161 - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method); 2009.

E. ASTM D3462 - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced With Mineral Granules; 2010a.

F. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

G. ASTM D4869 - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2005.

H. ASTM D6380 - Standard Specification for Asphalt Roll Roofing (Organic Felt); 2003 (Reapproved 2009).

I. ASTM E 903 - Standard Tests Method for Solar Absorptance, Reflectance, and Transmission of Materials Using Integrating Spheres.

J. Miami (APD) - Approved Products Directory; Miami-Dade County; database at www.miamidade.gov/buildingcode.

K. NRCA MS104 - The NRCA Steep Roofing Manual; National Roofing Contractors Association; 2001, Fifth Edition, with interim updates.

L. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

M. UL 997 (RMSD) - Roofing Materials and Systems Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings.

D. Samples: Submit six samples of each shingle color indicating color range and finish texture/pattern; for color selection.

E. Manufacturer's Instructions: Indicate installation criteria and procedures.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 REGULATORY REQUIREMENTS

A. Attic ventilation shall comply with CBC Section 1203.2 and 1203.2.1. Net free ventilating area shall not be less that 1/300 of the area of the space ventilated.

1.06 QUALTIY ASSURANCE

A. Manufacturer's Qualifications: Provide all primary roofing products, including shingles, underlayment, leak barrier, and ventilation, by a single manufacturer.

B. Contractor's Qualifications: Contractor shall be a GAF Certified Master Elite Contractor.

C. Perform Work in accordance with the recommendations of NRCA Steep Roofing Manual and OSHA guidelines.

D. Products Required to Comply with Fire and Wind Resistance Criteria: UL listed and labeled Class A; Passes UL 997 Wind Test, rating 90 mph..

1.07 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F (7 degrees C).

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store all products in manufacturer's unopened, labeled packaging until they are ready for installation.

B. Store bundles on a flat surface. Maximum stacking height shall not exceed manufacturer's recommendations. Store all rolls on end.

1.09 PREINSTALLATION MEETING

A. Attendees: Meeting to be called for by manufacturer's certified contractor. Meetings mandatory attendees shall include the certified contractor and the manufacturer's representative. Non-mandatory attendees shall include the District's representative, Architect, and General Contractor.

1.10 WARRANTY

A. Provide manufacturers GAF WeatherStopper Golden Pledge Warranty against material and labor defects:
   1. Material defects: Warranty shall provide 100% non prorated coverage for materials and labor for:
      a. The first 50 years, then prorated thereafter for all lifetime shingles.
   2. Workmanship errors: Warranty shall provide 100% coverage for workmanship errors for the first 20 years.
   3. Installer must register and pay for this warranty.

1.11 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 100 sq. ft. of extra shingles of each color specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by GAF Materials Corporation, Wayne, New Jersey. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer approved as listed, or equal.
   1. Product: Timberline Cool Series Energy-Saving Architectural Shingles.

B. Acceptable Manufacturers:
   1. Owens Corning Corp.
   2. Substitutions: See Section 01600 - Product Requirements.

2.02 SHINGLES

A. Asphalt Shingles: Heavyweight, granule surfaced, self sealing asphalt shingle with a strong fiberglass reinforced Micro Weave core and a mineral granule surfacing, ASTM D 7158, Class H; ASTM D 3462; CSA 123.5-98.
   1. Wind Resistance: UL 790 Class A, when tested in accordance with ASTM D3161.
   2. Miami-Dade County approved.
   3. Algae Resistant.
   4. Self-sealing type, ASTM D 3018, Type 1.
   5. Wind Resistance: ASTM D 3161, Type 1; Tested in accordance with UL 997 Wind Test, 100 mph.
   6. Style: Laminated overlay.
   7. Exposure: 5 or 5 5/8 inches.
   8. Color: As selected from manufacturers standard color selections.

2.03 HIP AND RIDGE CAP SHINGLES

A. Vented hip and ridge cap shingle:

B. Product: Vented RidgeCrest Venting Ridge Cap[Shingle.

2.04 STARTER STRIP

A. Self sealing starter shingle.

B. Product: WeatherBlocker Eave/Rake Starter Strip.

2.05 LEAK BARRIER

A. Self-adhering, self-sealing, bituminous leak barrier surfaced with a smooth polyethylene film complying with ASTM D 1970. Approved by UL and ICC, 60 mils thick.

B. Product: StormGuard Leak Barrier.

2.06 SHINGLE UNDERLAYMENT

A. Premium, water repellant, breather type non-asphaltic underlayment. UV stabilized polypropylene construction. Meet or exceed ASTM D 226 and D 4869. ICC approved.
   1. Product: Deck-Armor Premium Breathable Roof Deck Protection.

2.07 ACCESSORIES

A. Nails: Standard round wire shingle type, of hot-dipped zinc coated steel, 12 gage, 0.105 inch (2.67 mm) shank diameter, 3/8 inch (9.5 mm) head diameter, of sufficient length to penetrate through roof sheathing or 3/4 inch (19 mm) into roof sheathing or decking.

B. Plastic Cement: ASTM D4586, Type I or II, asphalt roof cement.

C. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.

D. Ridge Vents: Rigid plastic, extruded with vent openings that do not permit direct water or weather entry; flanged to receive shingles; Cobra Rigid Vent 3 manufactured by GAF.

2.08 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, gable edge, ridge, open valley flashing, and other flashing indicated.
   1. Form flashings to protect roofing materials from physical damage and shed water.
   2. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance.
   3. Hem exposed edges of flashings minimum 1/4 inch (6 mm) on underside.
   4. Coat concealed surfaces of flashings with bituminous paint.

B. Sheet Metal: Galvanized steel, as specified in Section 07620.

C. Bituminous Paint: Acid and alkali resistant type; black color.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof and vent openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

F. Verify that the proper amount of free area ventilation has been provided in the roof deck.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch (1.5 mm) with deck tape.

B. At areas where leak barrier membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or eave protection.

D. Install eave edge flashings tight with fascia boards. Weather lap joints 2 inches (50 mm) and seal with plastic cement. Secure flange with nails spaced as recommended by the manufacturer.

3.03 INSTALLATION - LEAK BARRIER MEMBRANE

A. Install leak barrier membrane at all eaves, valleys, rakes, hips, ridges, dormers, skylights, and to other vulnerable leak areas in accordance with manufacturer's instructions.

B. Eaves: Install leak barrier membrane from eave edge to minimum 4 ft (1 200 mm) up-slope beyond interior face of exterior wall.

C. Apply 4 inch (100 mm) wide band of plastic cement over deck flange of eave edge flashings, and embed an 18 inch (450 mm) wide strip of leak barrier membrane. Place starter strip with eave edge flush with face of flashings. Secure in place. Lap ends minimum 6 inches (150 mm).
   1. Apply lap cement at rate of approximately 1 1/4 gal/100 sq ft (0.5 L/sq m) over starter strip.
   2. Starting from lower edge of starter strip, lay additional 36 inch (900 mm) wide strips in lap cement, to produce a two ply membrane. Weather lap plies minimum 19 inches (475 mm) and nail in place. Lap ends minimum 6 inches (150 mm). Stagger end joints of each consecutive ply.

3.04 INSTALLATION - UNDERLAYMENT

A. At Roof Slopes Less Than 4:12 (1:3) : Install two layers of underlayment over entire roof area, with ends and edges weather lapped minimum 6 inches (150 mm). Stagger end laps of each consecutive layer. Nail in place.

B. At Roof Slopes Greater Than 4:12 (1:3) : Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 6 inches (150 mm). Stagger end laps of each consecutive layer. Nail in place. Weather lap minimum 12 inches (300 mm) over eave protection.

C. Items projecting through or mounted on roof: Weather lap and seal watertight with plastic cement.

3.05 INSTALLATION - VALLEY PROTECTION

A. Install minimum 36 inches wide leak barrier membrane in accordance with manufacturer's instructions.

B. Weather lap joints minimum 6 inches (150 mm).

C. At Exposed Valleys: Install one layer of sheet metal flashing over leak barrier membrane, minimum 36 inches (900 mm) wide, centered over open valley and crimped to guide water. Weather lap joints minimum 2 inch (50 mm) wide band of lap cement along each edge of first, press roll roofing into cement, and nail in place minimum 18 inches (450 mm) on center, 1 inch (25 mm) from edges.

3.06 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with NRCA requirements.

B. Weather lap joints minimum 2 inches (50 mm) and seal weather tight with plastic cement.

C. Secure in place with nails at 4 inches (100 mm) on center. Conceal fastenings.

D. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.07 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions.
   1. Fasten individual shingles using 6 nails per shingle, in accordance with manufacturer's instructions.

B. Place shingles in straight coursing pattern with 5 inch (125 mm) weather exposure to produce double thickness over full roof area. Provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch (19 mm) beyond fascia boards.

D. Extend shingles 1/2 inch (13 mm) beyond face of gable edge fascia boards.

E. Extend shingles on one slope across valley and fasten. Trim shingles from other slope 2 inches (50 mm) from valley center line to achieve closed cut valley, concealing the valley protection.

F. Cap hips and ridges with individual shingles, maintaining 5 inch (125 mm) weather exposure. Place to avoid exposed nails.

G. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

H. Complete installation to provide weather tight service.

3.08 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07510

BUILT-UP BITUMINOUS ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Built-up roofing membrane, conventional application, Class A.

B. Base flashings.

C. Roofing cant strips, accessories, roofing expansion joints, roofing vents, and walkways.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood nailers and curbs.

B. Section 07620 - Sheet Metal Flashing and Trim: Counterflashings.

C. Section 07724 - Roof Hatches and Vents: Counterflashings.

D. Section 09206 - Metal Lath.

E. Section 09220 - Portland Cement Plaster.

F. Section 15430 - Plumbing Specialties: Roof drains.

1.03 REFERENCE STANDARDS

A. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

B. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

C. ASTM D312 - Standard Specification for Asphalt Used in Roofing; 2000 (Reapproved 2006).

D. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2004.

E. ASTM D3909 - Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules; 1997b (Reapproved 2004).

F. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

G. ASTM D4601 - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004.

H. ASTM E 408 - Standard Test Method for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.

I. ASTM E 903 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Integrating Spheres.

J. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

K. FM DS 1-28 - Wind Design; Factory Mutual Research Corporation; 2007.

L. NRCA ML104 - The NRCA Roofing and Waterproofing Manual; National Roofing Contractors Association; Fifth Edition, with interim updates.

M. UL (RMSD) - Roofing Materials and Systems Directory; Underwriters Laboratories Inc.; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of associated counterflashings installed by other sections as the work of this section proceeds.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating membrane and bitumen materials, base flashing materials, insulation, and surfacing.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and mechanical fastener layout.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Field Reports: Indicate procedures followed.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.06 REGULATORY REQUIREMENT

A. Exterior Fire Test Exposure: Provide a roofing system that will achieve an Underwriters Laboratories rating for roof slopes indicated.
   1. UL Class A.

B. Windstorm Classification: Provide a roofing system which will achieve a Factory Mutual wind uplift rating, as listed in the current FM Approval Guide.
   1. I-90.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty years of documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer. Applicator shall be a currently listed GAF Materials Corporation Master or Master Select Roofing Contractor.

D. Products required to comply with fire resistance criteria: UL (RMSD) listed and labeled Class A.

E. All products shall be asbestos free.

F. Source Limitations: All components listed in this section shall be provided by a single manufacturer or approved by the primary roofing manufacturer.

G. Final Inspection: Manufacturer's representative shall provide a comprehensive final inspection after completion of the roof system. All application errors must be addressed and final punch list completed.

1.08 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

B. Conduct a meeting at the site with the installer, Architect, District, GAFMC representative and General Contractor.

C. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.09 PERFORMANCE REQUIREMENTS

A. Provide an installed roofing membrane and base flashing system that does not permit the passage of water, and will withstand the design pressures calculated in accordance with the most current revision of ASCE 7.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in accordance with manufacturer's written instructions and in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

1.11 PROJECT CONDITIONS

A. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

1.12 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 50 degrees F (21 degrees C).

C. Do not apply roofing membrane to damp deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water in quantities greater than can be weatherproofed the same day.

1.13 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's Diamond Pledge Guarantee with single source coverage and no monetary limitation, where the manufacturer agrees to repair or replace components in the roofing system, which cause a leak due to a failure in materials or workmanship.
   1. Duration: Twenty (20) years from the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by GAF Materials Corporation, Wayne, NJ.
   1. Product: NN-B-4-M/P6

B. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based or the equal products of a manufacturer listed below.
   1. Soprema, Inc.
   2. Firestone Building Products Company.
   3. Siplast, Inc.
   4. Johns Manville Corporation: www.jm.com.

C. Substitutions: See Section 01600 - Product Requirements.

2.02 SHEET MATERIALS

A. Dry Sheathing Paper: Two layers Red Rosin Paper, unsaturated.

B. Base Sheet: High performance, asphalt coated, glass-reinforced base sheet; ASTM D 4601, Type II, UL Type G2 BUR. Product: GAFGLAS #80 Ultima.
   1. ICC ESR-1274.

C. Fiberglass Ply Sheet: Premium glass fiber asphalt saturated ply sheet with flexible design; ASTM D 2178, Type VI; UL Type G1 BUR. Product: GAFGLAS FlexPly 6.
   1. ICC ESR-1274.

D. Mineral Surfaced Felts: Mineral surfaced cap sheet surfaced with extra fine mineral granules and a factory applied layer of Topcoat EnergyCote elastomeric coating; ASTM D 3909, ASTM E 903, ASTM E 408. Product: GAFGLAS EnergyCap BUR Mineral Surfaced Cap Sheet.
   1. UL Class A listed.
   2. Energy Star Qualified.

2.03 BITUMINOUS MATERIALS

A. Asphalt Bitumen: ASTM D 312, Type III.

B. Asphalt/Concrete Primer: ASTM D 41, GAF Materials Corporation Asphalt Concrete Primer.

C. Asbestos-Free Cement: GAF Minerals Corporation ASTM D 4586, Type I, GAF Jetblak Premium Flashing Cement.

2.04 FLEXIBLE FLASHINGS

A. Sheet Flashing: RUBBEROID Membranes Mop Applied and GAFGLAS Mineral Surfaced Cap Sheet.

B. Gafglas EnergyCap BUR Mineral Surfaced Cap Sheet.

2.05 CANTS

A. Cant and Tapered Edge Strips: GAFCANT, sizes 1 through 6 and GAFEDGE Tapered Edge Strip, width as required.

2.06 ACCESSORIES

A. Fasteners: Drill-Tec (Gaftite) Self-Tapping Screw with 3-inch diameter plate, galvanized.

B. Roofing nails: Galvanized or non-ferrous type, size as required to suit application.

C. Traffic Surfacing: Catwalk or Lexpad Walk Pads.

2.07 ROOFING - CONVENTIONAL APPLICATION

A. Built-up Bituminous Roofing: Asphalt felt membrane, three ply plus base sheet.

B. Roofing Assembly Requirements:
   1. Roof Covering External Fire-resistance Classification: UL Class A.
   2. Factory Mutual Classification: Class I and windstorm resistance of I-90, in accordance with FM DS 1-28.

C. Surfacing: Mineral surface cap sheet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips, nailing strips, and reglets are in place.

3.02 WOOD DECK PREPARATION

A. Verify flatness and tightness of joints of wood decking. Fill knot holes with latex filler.

B. Seal joints of plywood with tape recommended by the manufacturer.

C. Confirm dry deck by moisture meter with 12 percent moisture maximum.

3.03 MEMBRANE APPLICATION

A. Equiviscous Temperature (EVT) at Point of Application: In accordance with NRCA recommendations.

B. Install membranes and flashings in accordance with GAF Materials Corporation instructions.

C. Lay Gafglas #80 base sheet:
   1. Starting at low point of the roof, lay one ply of Base Sheet, lapping each sheet 4-inches at edges and not less than 6-inches at end laps. Install fasteners along lap of base ply at intervals not to exceed 9-inches and stagger-nail down center of sheet in two rows with fasteners spaced at 9-inch intervals in each row. Use fasteners with integral metal heads at least 3-inches in diameter as recommended by the manufacturer

D. Apply two membrane plies in shingle fashion, lapping each sheet 20-1/2 inches over the preceding sheet, mop with 25 lb/square (123 kg/100 sq m) of bitumen per ply.

E. Apply one ply of Gafglas EnergyCap BUR Mineral Surfaced Cap Sheet, weather lap edges and ends, and mop with 25 lb/square of bitumin.

F. Apply smooth, free from air pockets, wrinkles, fish-mouths, or tears.

G. At end of day's operation, install two plies membrane and bitumen glaze coat for cut-off. Glaze exposed felts. Remove cut-off before resuming roofing.

H. At intersections with vertical surfaces:
   1. Extend membrane and base sheet over cant strips and up a minimum of 8 inches (203 mm) onto vertical surfaces.
   2. Mop on base flashing of two additional plies of felt and one ply of base flashing material.
   3. Secure base flashing to nailing strips at 4 inches (100 mm) on center.

I. At gravel stops, extend membrane and base sheet under gravel stop and to the outside face of the wall.

J. Around roof penetrations, mop in and seal flanges and flashings with two additional plies of felt.

K. Install walkway pads in hot bitumen at 20 lb/square (98 kg/100 sq m). Set joints 6 inches (150 mm) apart.

L. Install one roof vent per 1,000 sq ft (93 sq m) or part thereof, of roof area.

M. Coordinate installation of roof drains and related flashings.

3.04 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing material manufacturers daily during installation of the Work.

3.05 CLEANING

A. Remove bituminous markings from finished surfaces.

B. In areas where finished surfaces are soiled by bitumen or other source of soiling caused by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

C. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 07620

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, scuppers, and other items indicated in Schedule.

B. Reglets and accessories.

C. Precast concrete splash pads.

1.02 RELATED REQUIREMENTS

A. Section 07311 - Asphalt Shingles: Flashings associated with shingle roofing.

B. Section 07321 - Clay Roof Tiles: Flashings associated with clay roofing tiles.

C. Section 07650 - Flexible Flashings.

D. Section 07710 - Manufactured Roof Specialties: Preformed flashings and manufactured expansion joint covers.

E. Section 07720 - Roof Hatches: Preformed metal curbs.

F. Section 07722 - Roof Vents: Preformed metal curbs.

G. Section 07900 - Joint Sealers.

H. Section 08620 - Unit Skylights: Metal curbs.

I. Section 08630 - Metal-Framed Skylights: Metal curbs.

J. Section 09206 - Metal Lath.

K. Section 09220 - Portland Cement Plaster.

L. Section 09900 - Paints and Coatings: Field painting.

M. Section 15410 - Plumbing Pipe and Fittings: Roof drains and overflow drains.

1.03 REFERENCE STANDARDS

A. ASTM A 53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

B. ASTM A 135 - Standard Specification for Electric-Resistance-Welded Steel Pipe.

C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2009a.

D. ASTM B 32 - Standard Specification for Solder Metal; 2008.

E. ASTM B 749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products; 2003 (Reapproved 2009).

F. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2006.

G. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2004.

H. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning

Contractors' National Association; 2003.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Materials List: Submit complete list of materials proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.

C. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.06 PRE-INSTALLATION CONFERENCE

A. Convene one week before starting work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.08 WARRANTY

A. Provide warranty against materials and workmanship for a period of two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 24 gauge, 0.0236 inch (7 mm) thick base metal, or as noted on the drawings.

B. Lead: ASTM B 749, 2.5 lb/sq ft (0.99 mm) thick.

2.02 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Flexible Flashing: As specified in Section 07650.

C. Underlayment: ASTM D 226, organic roofing felt, Type II ("No. 30").

D. Slip Sheet: Rosin sized building paper.

E. Asphaltic Coating Compound: Approved alkali resistant bituminous paint.

F. Primer: Zinc chromate type, Metalgrip or Tnemec Galv-Gard.

G. Protective Backing Paint: Zinc molybdate alkyd.

H. Sealant: Type as specified in Section 07900.

I. Plastic Cement: ASTM D 4586, Type I.

J. Springlok Flashing System: Springlok Flashing System by Fry Reglet.

K. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

L. Solder: ASTM B 32; Sn50 (50/50) type.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet, 22 gage, minimum two inches (51 mm) wide, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

H. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA Architectural Sheet Metal Manual, Rectangular profile, Style A unless otherwise noted.

B. Downspouts: Schedule 10 galvanized steel conforming to ASTM A 53 and ASTM A 135, Grade A. Weld all joints. Size and profile as indicated on the drawings, NPS 3 inches minimum.

C. Accessories: Profiled to suit gutters and downspouts.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 WORKMANSHIP

A. Make lines, arrises, and angles sharp and true. Free exposed surfaces from visible wave, warp, buckle, and tool marks. Fold back exposed edges neatly to form a 1/2 inch hem on the concealed side. Make sheet metal exposed to the weather watertight with provisions for expansion and contraction.

B. Make surfaces to receive sheet metal plumb and true, clean, even, smooth, dry, and free of defects and projections which might affect the application. For installation of items not shown in detail or not covered by specifications, conform to the applicable requirements of SMACNA Architectural Sheet Metal Manual. Provide sheet metal flashing in the angles formed where roof decks abut walls, curbs, ventilators, pipes, or other vertical surfaces and wherever indicated and necessary to make the work watertight.

3.03 PREPARATION

A. Install starter and edge strips, and cleats before starting installation. Space cleats evenly not over 12 inches on centers unless otherwise specified or indicated. Secure one end of the cleat with two nails and the cleat folded back over the nailheads. Lock the other end into the seam. Pretin cleats for soldered seams.

B. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

D. Where soldering is specified, edges of sheet metal shall be pretinned before soldering is begun.

3.04 INSTALLATION - GENERAL

A. Roof Counterflashing.
   1. Overlap base flashing four inches minimum.
   2. Install bottom edge tight against base flashing.
   3. Lap seam vertical joints three inches minimum, and apply sealant.
   4. Miter, lap seam, and close corner joints with solder or sealant.

B. Base Flashing:
   1. Extend up vertical surface five inches minimum, and onto roof four inches minimum.
   2. Install flashing under each asphalt shingle course at sloping surface.
   3. Secure top edge of flashing by nailing to substrate.
   4. Provide standard "Z" shape at bottom edge of stucco.
   5. At slabs or top of curbs, provide standard continuous weep screeds at bottom edge of stucco, ceramic tile or brick tile exterior finish.

C. Roof Penetration Flashing:
   1. Base Flashing.
      a. Extend flange onto roof six inches minimum away from penetration.
      b. Extend flange upward around penetration to at least eight inches above roofing.
      c. Fold back upper and side roof flange edges 1/2 inch minimum.
      d. Solder lap joints.
   2. Counterflashing:
      a. Overlap base flashing one inch minimum with storm collar sloped away from penetration.
      b. Secure to penetration with draw band and sealant.

D. Insert flashings into reglets to form tight fit. Secure in place with lead wedges. Pack remaining spaces with lead wool. Seal flashings into reglets with sealant.

E. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

F. Apply plastic cement compound between metal flashings and felt flashings.

G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

H. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

I. Flexible flashings: Install flexible flashings in accordance with Section 07650.

J. Secure gutters and downspouts in place using concealed fasteners.

K. Slope gutters 1/4 inch per foot (20 mm/m) minimum.

L. Connect downspouts to downspout boots. Seal connection watertight.

M. Set concrete splash pads under downspouts unless otherwise noted or detailed.

3.05 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation by the Inspector to ascertain compliance with specified requirements.

3.06 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, handling marks, contamination from steel wool, fittings and drilling debris, and scrub clean. Free the exposed metal surfaces of dents, creases, waves, scratch marks, and solder or weld marks.

3.07 SCHEDULE

A. Gravel Stops at Fascia:
   1. Conform to SMACNA Figure 2-1 and Figure 2-5B in accordance with architectural details. If gravel is not used, then the angled lip shall only be as high as the thickness of the built-up plys and cap sheet used. Joint laps shall be set in mastic and lapped 4 inches.

B. Copings:
   1. Conform to SMACNA Figure 3-4A in accordance with architectural details. Slope coping 1" per foot (to the roof side) and provide flexible flashing on top of the wall. Provide continuous cleat on the roof side and fasten coping to wood blocking with screws and watertight washers at 24 inches on center. All seams and joints shall be sealed with sealant. Miter corners and field weld.

C. Gutters:
   1. Conform to SMACNA Figure 1-2A at exposed, concealed SMACNA Figure 1-23 or as detailed on the drawings.
   2. Provide lap type expansion joint per SMACNA Figures 1-5 and 1-6 at 30 feet on-centers maximum.
   3. Provide straps to support top of gutter per SMACNA Figure 1-12 at three feet on-centers.
   4. Provide joints at 10 feet on-centers maximum, lap one inch, rivet on two inch centers and solder.

D. Downspouts:
   1. Install at all gutters.
   2. Attach to wall with 16 gage galvanized steel,1-1/4 wide hangers. Conform to SMACNA Figure 1-35B for rectangular or square profiles and Figure 1-35J for round profiles.Locate hangers at gutter and boot, horizontal connections, and at 10 feet maximum centers.
   3. Connect to gutter conforming to SMACNA Figure 1-33. See plumbing and civil drawings for connection to boot and storm drain. In locations where downspout is not connected to storm drain, install precast concrete splashblock.

E. Scuppers/Overflows:
   1. Conform to SMACNA Figure 1-26 or Figure Figure 1-30 in accordance with architectural details.

F. Conductor Heads:
   1. Fabricate with flat lock seams and solder as required.
   2. SMACNA Figure 1-25F, modified in accordance with architectural details.

G. Flashings Associated with Shingle Roofing, including Valley, Hip, Ridge, and Gable Edge.
   1. Conform to SMACNA Figures 4-10, 4-12, 4-13 and 4-23 in accordance with architectural details.

H. Sheet Metal Roof Expansion Joint Covers:
   1. Conform to SMACNA Figure 5-4 in accordance with architectural details. See Section 07710, Manufactured Roof Specialties.

I. Sheet Metal Expansion Joint - Roof to Wall:
   1. Conform to SMACNA Figure 5-6 in accordance with architectural details.

J. Sheet Metal Expansion Joint - Wall:
   1. Conform to SMACNA Figure 5-7 in accordance with architectural details.

K. Counterflashings at Roofing Terminations (over roofing base flashings):

L. Counterflashings at Curb-Mounted Roof Items, including skylights, roof hatches and smoke or fire vents:
   1. Conform to SMACNA Figures 8-4, 8-5, and 8-6 in accordance with architectural details.

M. Roofing Penetration Flashings, for Pipes, Structural Steel, and Equipment Supports:
   1. Conform to SMACNA Figures 4-15, 4-16, and 4-17 in accordance with architectural details.

END OF SECTION

SECTION 07720

ROOF HATCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated roof hatches, with integral support curbs, operable hardware, counterflashings and safety railing.

1.02 RELATED SECTIONS

A. Section 09900 - Paints and Coatings.

1.03 REFERENCES

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on unit construction, sizes, configuration, jointing methods and locations when applicable, and attachment method.

C. Shop Drawings: Submit shop drawings indicating fabrication and installation details.

D. Manufacturer's Installation Instructions: Indicate special installation criteria, interface with adjacent components.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Hatches:
1. Nystrom Building Products; Product Model RHG: www.nystrom.com.
2. Bilco Co; Product - Type S: www.bilco.com.
3. Dur-Red Products; Product - Model LH: www.dur-red.com.
4. Milcor Inc; Product - Model RBS: www.milcorinc.com.
5. Babcock Davis; Product - Model B-RHG.
6. Substitutions: See Section 01600 - Product Requirements.

2.02 ROOF HATCHES

A. Unit: Single leaf type.
1. 24 minimum x 36 inch (610x914 mm) size, 12 inches in height, formed with 3 1/2" flange.

B. Integral Steel Curb: 14 gage (2 mm) galvanized steel with 1 inch (25 mm) rigid glass fiber insulation; integral cap flashing to receive roof flashing; extended flange for mounting.

C. Flush Steel Cover: 14 gage (2 mm) galvanized steel; 1 inch (25 mm) glass fiber insulation; 22 gage (0.8 mm) steel interior liner; continuous neoprene gasket to provide weatherproof seal.

D. Hardware: Cadmium plated finish:
1. Compression spring operator and shock absorbers.
2. Steel manual pull handle for interior operation.
3. Steel hold open arm with vinyl covered grip handle for easy release.
4. Padlock hasp on interior.
5. Hinges: Heavy duty pintle type.

2.03 ACCESSORIES

A. Safety Railing: Consisting of a top rail, mid-rail, and chain meeting OSHA requirements.
1. Pipe: 1-1/4" ID A53 Grade B seamed steel.
2. Chain: 3/16" proof coil ASTM specification, zinc plated with quick link "S" hook.
3. Bolts: Hex head bolts 3/8", grade Z zinc plated with manufacturer's standard washers

inside and outside.
4. Brackets: galvanized.
5. Pipe Plugs: Weather and light resistant for pipe ends.
6. Curb mounted brackets: Galvanized.

2.04 FABRICATION

A. Fabricate components free of visual distortion or defects. Weld corners and joints.

B. Provide for removal of condensation occurring within components or assembly.

C. Fit components for weather tight assembly.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install with 3/8 inch diameter lag bolts or lag screws at 24 inches on center into framing member or solid blocking with minimum 1 1/2 inch penetration.

C. Coordinate with installation of roofing system and related flashings for weather tight installation.

D. Apply bituminous paint on surfaces of units in contact with cementitious materials or dissimilar metals.

E. Adjust hinges for smooth operation.

END OF SECTION

SECTION 07840

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealants.

B. Section 09260 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

C. Division 15 and 16 Sections - Mechanical, Plumbing and Electrical Work.

1.03 REFERENCE STANDARDS

A. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2009c.

B. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2009.

C. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

D. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.

E. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

G. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

H. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 7, Fire-Resistance-Rated Construction.

1.04 SYSTEM DESCRIPTION

A. Firestopping Materials: Provide firestopping systems to provide and maintain a fire resistance rating, as indicated on the drawings or required by code and in accordance with UL, ITS (WH) or FM design details.

B. Firestopping material shall be free of asbestos, PCB's, ethylene glycol, and lead.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration and fire rating of the penetrated assembly.

C. Product Data: Provide data on product characteristics, performance ratings, and Material Safety Data Sheet (MSDS) for each fire stop product.

D. LEED Report: Submit VOC content documentation for all non-preformed materials.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Comply with requirements of CBC, Chapter 7.

B. Fire Testing: Provide firestopping assemblies of designs which provide the scheduled fire ratings when tested in accordance with ASTM E 814 and ASTM E 119 or UL 1479 and UL 2079.
   1. The Flame (F) rating must be minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. Temperature (T) ratings, when required by code, shall be based on measurement of the temperature rise on the penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
   2. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
   3. Current evaluation reports published by CABO, ICBO, or BOCA will be considered as constituting an acceptable test report.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum fifteen years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section and:
   1. With minimum 3 years documented experience installing work of this type.
   2. Able to show at least 5 satisfactorily completed projects of comparable size and type.
   3. Approved by firestopping manufacturer.

1.07 MOCK-UP

A. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft (1/3 linear m).

B. Obtain approval of Inspector of Record and Architect before proceeding.

C. If accepted, mock-up will represent minimum standard for the Work.

D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

1.08 PRE-INSTALLATION MEETING

A. The Contractor shall schedule a conference two weeks prior to commencement of firestopping installation and review installation procedures for firestopping work.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site in manufacturer's sealed, unopened containers with manufacturer's name, product identification, lot numbers, UL labels and mixing and installation instructions. Handle and store materials in accordance with manufacturer's instructions.

1.10 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

1.11 WARRANTY

A. Firestop Contractor shall warrant that firestopping systems used meet firestopping requirements as herein specified .

1.12 SEQUENCING AND SCHEDULING

A. Coordinate with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestopping materials. Schedule and sequence the work to insure that partitions and other construction, which would conceal penetrations, are not erected prior to the installation of the firestops.

PART 2 PRODUCTS

2.01 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: See Drawings for required systems and ratings.

2.02 MATERIALS

A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; use at construction joints and top of walls, pipes, and conduit.
   1. Manufacturers:
      a. A/D Fire Protection Systems Inc; Product - A/D Firebarrier Silicone and Silicone SL: www.adfire.com.
      b. 3M Fire Protection Products; Product - 3M Fire Barrier Silicone Sealant 2000+ and 2000 N/S: www.3m.com/firestop.
      c. Hilti Firestop Systems; Product - CP601S and CP604.
      d. Metacaulk Firestopping Products; Product - 835+.
      e. Substitutions: See Section 01600 - Product Requirements.

C. Elastomeric Arcrylic Firestopping: Single component, intumescent acrylic water-based compound; use at construction joints, top of wall joints, metallic and non metallic pipes, conduit and cables.
   1. Manufacturers:
      a. Grace Construction Products; Product - FlameSafe FS 1900 Sealant.
      b. USG Fire Stop Systems; Product - Firecode Intumescent Acrylic Firestop Sealant - Type 1A.
      c. Hilti Firestop Systems; Product - CP 606 Flexible Firestop Sealant.
      d. Metacaulk Firestopping Products; Product - Metacaulk 1000 Firestopping Sealant.

D. Foam Firestoppping: Single component foam compound; use at pipes, insulated pipes, cables, and multiple penetrations:
   1. Manufacturers:
      a. 3M Fire Protection Products; Product 3M Fire Barrier Silicone RTV Foam 2001: www.3m.com/firestop.
      b. Hilti Firestop Systems; Product - CP620 Firestop Foam.
      c. Specified Technologies, Inc; Product - Series PEN 200: www.stifirestop.com.
      d. Substitutions: See Section 01600 - Product Requirements.

E. Fiber Packing Material: Mineral fiber packing insulation; use for backing material.
   1. Manufacturers:
      a. A/D Fire Protection Systems Inc; Product - A/D Firebarrier Mineral Wool: www.adfire.com.
      b. Thermafiber, Inc; Product - Thermafiber Safing Insulation: www.thermafiber.com.

F. Firestop Devices/Collars: Mechanical device with incombustible filler and sheet stainless steel jacket; use for PVC, CPVC and ABS pipes through concrete or drywall, horizontal and vertical.
   1. Manufacturers:
      a. Grace Construction Products; Product - Wrap Strip Device: www.na.graceconstruction.com.
      b. 3M Fire Protection Products; Product - 3M Fire Barrier RC-1 Restricting Collar:

www.3m.com/firestop.
c. Specified Technologies, Inc; Product Series : www.stifirestop.com.
d. Substitutions: See Section 01600 - Product Requirements.

G. Intumescent Putty: Compound which expands on exposure to surface heat gain; use for metal pipes, power and data/communication cables.
1. Manufacturers:
a. Grace Construction Products; Product FSP 1000 Intumescent Putty: www.na.graceconstruction.com.
b. 3M Fire Protection Products; Product 3M Fire Barrier Moldable Putty+: www.3m.com/firestop.
c. Specified Technologies, Inc; Product - Series SSP Intumescent Putty: www.stifirestop.com.
d. Substitutions: See Section 01600 - Product Requirements.

H. Firestop Mortars: Specially formulated rapid hardening gypsum/cement compound; use for pipes, conduit, and cable penetrations.
1. Manufacturers:
a. A/D Firestop Systems; Product - A/D Firebarrier Mortar.
b. Metacaulk Firestopping Products; Product - Metacaulk Fire Rated Mortar.
c. 3M Fire Protection Products; Product - 3M Fire Barrier Mortar.
d. Specified Technologies, Inc.; Product - Series SSM Firestop Mortar.

I. Intumescent Wrap Strips: One-part, intumescent elastomeric strip with foil on one side; use for metallic and non metallic pipes, insulated pipe and cables
1. Manufacturers:
a. Grace Construction Products; Product - Intumescent Wrap Strip.
b. Hilti Firestop Systems; CP 645 Firestop Wrap Strip.
c. 3M Fire Protection Products; Product - 3M Fire Barrier FS-195+ Wrap/Strip.
d. Specified Technologies, Inc.; Product - Series SSWBlu Wrap Strip.

J. Non-Intumescent Firestop Spray Sealant: Water-based elastomeric coating designed for spray application; use at construction joints, top of walls joints.
1. Manufacturers:
a. Grace Construction Products; Product - FS 3000 Elastomeric Coating.
b. 3M Fire Protection Products; Product - 3M FireDam Spray 100.

K. Firestop Pillows: Formed mineral fiber pillows; use for cables, cable trays, and bundled cables.
1. Manufacturers:
a. Grace Construction Products; Product - FlameSafe Pillows: www.na.graceconstruction.com.
b. Specified Technologies, Inc; Product - Series SSB Firestop Pillows: www.stifirestop.com.
c. Substitutions: See Section 01600 - Product Requirements.

L. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

PART 3 EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. Interior Walls and Partitions.
1. Where a wall or partition is continuous past a structural floor, such as a stairwell and vertical shaft, and a space would otherwise remain open between the wall face and perimeter edges of the adjoining structural floor, provide firestopping.
a. Provide firestopping whether or not there are any clips, angles, plates or other members bridging or interconnecting the wall and floor systems, and whether or not such items are continuous.
2. Where the top edge of a fire-rated wall or partition abuts fluted-type metal decking, and the

construction is such that it would leave the flute spaces open, provide firestopping.

B. Penetrations.
   1. Penetrations include conduit, cable, cable trays, wire, pipe, duct, or other elements which pass through one or both outer surfaces of a fire rated floor, wall or ceiling.
   2. Where a penetration occurs through a structural floor or roof and a space would otherwise remain open between the surfaces of the penetration and the edge of the adjoining floor or roof, provide firestopping to fill such spaces in accordance with ASTM E 814 and UL 2079 for dynamic movement.
   3. Where penetrations occur at fire-rated walls or partitions of solid type constructuion, provide firestopping to completely fill annular space around the penetration, in accordance with ASTM E 814.
   4. Where penetrations occur at fire-rated walls or partitions of hollow-type construction, provide firestopping to completely fill annular space around the penetration, on each side of the wall or partition, in accordance with ASTM E 814.
   5. These requirements for penetrations shall apply whether or not sleeves have been provided and whether or not penetrations are to be equipped with escutcheons or other trim. If penetrations are sleeved, firestop annular space between sleeve and wall or opening.

C. Provide firestopping to fill miscellaneous voids and openings in fire-rated construction in a manner consistent with the manufacturers requirements.

3.02 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.03 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing and damming materials to arrest liquid material leakage.

3.04 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Remove excess firestopping material promptly as the Work progresses and upon completion.

C. Do not cover installed firestopping until inspected by the Inspector of Record (I.O.R.). Firestopping that has been covered prior to inspection shall be uncovered at the contractor's expense.

D. Install labelling required by code.

3.05 PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior and exterior sealants and joint backing.

B. Acoustical sealants.

C. Precompressed foam sealers.

D. Hollow gaskets.

1.02 RELATED SECTIONS

A. Section 02751 - Portland Cement Concrete Paving.

B. Section 04810 - Unit Masonry Assemblies.

C. Section 06410 - Custom Cabinets.

D. Section 07620 - Sheet Metal Flashing and Trim.

E. Section 08110 - Steel Doors and Frames.

F. Section 08800 - Glazing: Glazing sealants and accessories.

G. Section 09220 - Portland Cement Plaster.

H. Section 09260 - Gypsum Board Assemblies: Acoustic sealant.

I. Section 09300 - Ceramic Tile: Sealant used as tile grout.

1.03 REFERENCE STANDARDS

A. ASTM C 834 - Standard Specification for Latex Sealants; 2010.

B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

D. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

E. ASTM C 1311 - Standard Specifcation for Solvent Release Sealants; 2002

F. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2007.

G. ASTM D 1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell); 2005.

H. ASTM D 2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for concrete Pavements; 1991 (Reapproved 2005).

I. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov; current edition.

J. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.

1.04 DEFINITIONS

A. Sealant specifications are defined as follows:
   1. Type S: Single-component.
   2. Type M: Multicomponent.

3. Grade P: Pourable or self-leveling sealant for horizontal applications.
4. Grade NS: Nonsag for vertical applications.
5. Class 25: Withstands increase and decrease of at least 25 percent of joint width.
6. Class 12.5: Withstands increase and decrease of at least 12.5 percent of joint width.
7. Use T: Pedestrian and vehicular traffic areas such as walkways, plazas, decks, and elevated parking areas.
8. Use NT: Nontraffic areas, horizontal and vertical surfaces.
9. Use M: Meets this specification when used on mortar.
10. Use G: Meets this specification when used on glass.
11. Use A: Meets this specification when used on aluminum.
12. Use O: Meets this specification when used on substrates other than above.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples illustrating sealant colors for each color selection.

D. LEED Report: Submit VOC content documentation for all non-preformed sealants and primers.

E. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

C. Provide sealant that has been tested and found suitable for the substrate to which it will be applied.
   1. Provide joint sealers as specified in this section and as noted on the drawings.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, tightly sealed containers or unopened packages with manufacturer's name, labels, product identification, and lot numbers where appropriate.

B. Store materials out of weather in original containers or unopened packages.

1.08 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.09 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

C. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Type S, Class 25, Uses NT, M, G, O, and A; single component.
   1. Color: Standard colors matching finished surfaces.
   2. Product:
      a. DynaTrol I-XL manufactured by Pecora Corporation.
      b. Dymonic manufactured by Tremco, Inc.
      c. Sikaflex - 1a manufactured by Sika Corporation.
   3. Applications: Provide at vertical joints:
      a. Control, expansion, and soft joints in masonry and between masonry and adjacent work.
      b. Joints between concrete and other materials.
      c. Joints between metal frames and other materials.
      d. Other exterior vertical joints for which no other sealant is indicated.

D. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, Federal Specification TT-S-001657, Type 1, ASTM C 1311, nondrying, nonskinning, noncuring.
   1. Product:
      a. BC-158 manufactured by Pecora Corporation.
      b. Butyl Sealant manufactured by Tremco, Inc..
   2. Applications: Provide at:
      a. Concealed sealant bead in sheet metal work.
      b. Concealed sealant bead in siding overlaps.

E. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type S, Grade NS single component, paintable.
   1. Color: Standard colors matching finished surfaces.
   2. Product:
      a. AC-20+Silicone manufactured by Pecora Corporation.
      b. Tremflex 834 manufactured by Tremco, Inc.
      c. Elasto-tex Caulk manufactured by Pacific Polymers International, Inc.
      d. SA-167 manufactured by Ohio Sealants.
   3. Applications: Provide at:
      a. Interior wall and ceiling control joints.
      b. Joints between door and window frames and wall surfaces.
      c. Other interior joints for which no other type of sealant is indicated.

F. Kitchen/Tile Sealant: White silicone; ASTM C 920, Grade NS, Uses NT, G, Aand O; Fed. Spec. TT-S-00230, Class A and TT-S-001543A, Class A; single component, mildew resistant.
   1. Product:
      a. 898 manufactured by Pecora Corporation.
      b. Tremsil 200 manufactured by Tremco, Inc.
      c. Dow Corning 786 manufactured by Dow Corning
   2. Applications: Provide at:
      a. Joints between plumbing fixtures and floor and wall surfaces.
      b. Joints between kitchen and sink countertops and wall surfaces.
      c. Other joints in wet areas.

G. Acoustical Sealant: Butyl or acrylic sealant; meet or exceed requirements of ASTM C 834, E 90, and C 919; single component, non-sag, gun grade.
   1. Product:
      a. AIS-919 manufactured by Pecora Corporation.

2. Applications: Provide at concealed locations only:
   a. Sealant bead between top stud runner and structure and between bottom stud track and floor in sound walls.

H. Interior Floor Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M, A and O; USDA accepted; single or multi-component.
1. Color: Colors as selected.
2. Product:
   a. Urexpan NR-201 manufactured by Pecora Corporation.
3. Applications: Provide at:
   a. Control and expansion joints in interior concrete slabs and floors.
   b. Under exterior door thresholds.

I. Concrete Paving Joint Sealant: Polyurethane, self-leveling; ASTM C 920, Grade P, Class 25, Uses T, M and O; single or multi-component.
1. Color: Color as selected.
2. Product:
   a. Urexpan NR-200 manufactured by Pecora Corporation.
   b. THC-900/THC-901 manufactured by Tremco, Inc.
   c. Sikaflex-1C SL manufactured by Sika Corporation.
   d. Sonolastic SL-1 manufactured by Degussa Building Systems.
3. Applications: Provide at horizontal expansion joints in concrete and cementitious slabs:
   a. Sidewalks.
   b. Balconies.
   c. Pavements.

J. Fire Rated Sealant: Acrylic latex, ASTM 834, ANSI/UL 263, ASTM E 119, and NFFA No. 251, UL Classified.
1. Product:
   a. AC-20 FTR manufactured by Pecora Corporation.
2. Application: Provide at:
   a. Door and window frames in fire rated walls assemblies.

2.02 EXPANSION JOINT SEALERS

A. Exterior Expansion Joint Sealer: Precompressed foam sealer, urethane with water repellant.
1. Color: Black.
2. Size as required to provide watertight seal when installed.
3. Product: 25V manufactured by Emseal.
4. Application: Provide at:
   a. Exterior wall expansion joints.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC, or ASTM D 1056, expanded rubber; oversized 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Surfaces shall be clean, dry to the touch, and free from dirt, frost, moisture, grease, oil, wax, lacquer, paint, rust, laitance, release agents, or other foreign matter that would tend to destroy or impair adhesion.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.

D. Protect elements surrounding the work of this section from damage or disfigurement by applying masking tape or other suitable masking material. Remove masking within 10 minutes after joint has been filled or tooled.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Perform acoustical sealant application work in accordance with ASTM C 919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker where joint backing is not used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

H. Tool joints concave.

I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

J. Compression Gaskets: Avoid joints except at ends, corners, and intersections; seal all joints with adhesive; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

3.04 PROTECTION AND CLEANING

A. Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after joint is filled.

B. Clean adjacent soiled surfaces. Provide cleaning solvent recommended by the sealant manufacturer for the surfaces to be cleaned.

END OF SECTION

SECTION 08110

HOLLOW METAL DOORS/FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section comprises of furnishing and installing hollow metal frames for doors, windows and hollow metal doors and panels.

1.02 RELATED DOCUMENTS, drawings and general provisions of contract, including General and Supplementary conditions and Division 1 specification sections apply to this section.

1.03 RELATED WORK SECTIONS

A. Section 08710 Finish Hardware

B. Section 08210 Wood Doors

C. Section 08800 Glass and Glazing

D. Section 09900 Painting

1.04 REFERENCES SPECIFIED

A. ISO 9001 – Quality System.

B. UL 10B - Fire Tests of Door Assemblies.

C. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies, UBC 7-2 1997, Fire Tests of Door Assemblies.

D. UL10B or NFPA 252 at Atmospheric Pressure.

E. A1008/A1008A Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

F. ASTM-A568 – General Requirements for Steel, Carbon and High Strength Low Alloy Hot Rolled Strip, and Cold Rolled Sheet.

G. ASTM-A924 -General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.

H. ANSI A250.8/SDI-100 - Recommended Specifications for Standard Steel Doors and Frames.

I. ANSI 250.11 - Recommended Erection Instructions for Steel Frames.

J. SDI-107 - Hardware on Steel Doors (Reinforcement Application).

K. NFPA-80 - Standard for Fire Doors and Windows.

L. NFPA-101 - Life Safety Code.

M. ANSI-A250.4 and ANSI-A250.5 -Test Procedure and Acceptance Criteria for Physical Endurance, Steel Doors and Frames.

N. ANSI-A250.10 - Test Procedure and Acceptance Criteria for Painted Steel Surfaces for Steel Doors and Frames.

O. ADA-The Americans with Disabilities Act - Title III - Public Accommodations.

P. ANSI-A117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities.

Q. U. L. - Underwriter's Laboratories.

R. ITS - Intertek Testing Service [Warnock Hersey].

S. CBC - California Building Code and Local Codes Including Authority Having Jurisdiction.

T. N.F.P.A. 105 - Smoke and draft control assemblies.

U. U.L. - 1784 Air leakage test of door assemblies.

V. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

1.05 SUBMITTALS

A. Shop Drawings: Indicate door and frame elevations and sections, materials, gauges, fire ratings, finishes, fabrication and erection details, location and extent of hardware reinforcement, type and location of frame anchors, locations of finish hardware by dimension and locations/details of all openings and louvers. Do not proceed with any fabrication until all details are approved.

B. Certification of Compliance: Submit any information necessary to indicate compliance to these specifications.

C. Submit samples if requested by the Architect.

D. Job Close-out: Provide 2 (two) complete Manufacturer’s catalog’s to the District

Lockshop and Facilities.

1.06 QUALITY ASSURANCE

A. All hollow metal doors and frames shall be the product of one (1) manufacturer. Exceptions will not be permitted under any circumstances.

B. Certification of label construction: For components exceeding Underwriters Laboratories, Inc. (UL)- furnish inspection certificate stating that component construction conforms to UL rating requirements **only** if Architect is aware of such a limitation and has allowed the non-labeled unit.

C. Certification that the Polystyrene Core Swinging Type Fire Doors – Model 707 as manufactured by The Curries Company, has been investigated by Underwriters Laboratories and certified for Standard(s) of Safety: UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies, UBC 7-2 1997, Fire Tests of Door Assemblies.

D. Hollow metal manufacture shall be a SDI member.

E. The Hollow Metal Manufacturer shall supply doors and frames through a national distribution system as described in 1.06.D herein. Marketing material through a factory direct method will not be acceptable to the Building Owner.

F. Hollow metal supplier shall be a qualified “local direct distributor” of products to be furnished. The distributor shall have in their regular employment an AHC and/or CDC with a local business address, telephone and fax line, who will be available at reasonable times through-out the project, to consult with the Architect, Contractor and District regarding matters affecting the door and frame openings.

G. The Contractor will allow in his bid for the replacement of **one (1) exterior door** which will be selected at random by the Project Architect and District’s Rep. for dismantling and inspection of internal construction and compliance with the specification. Contractor to provide labor and tools for inspection under the Architect's direction.

H. Failure of any hollow metal frame or door to meet specified standards shall be grounds to reject the entire shipment of hollow metal doors and frames, including the hollow metal manufacturer. Items shall be replaced at Contractor’s expense, including two additional doors for dismantling. No extensions of time or additions to the contract will be allowed due to a rejection of material and substitution of the hollow metal manufacturer.

I. Installer requirement: Firm with a minimum of five (5) years experience in the installation of metal doors and frames similar in the type included in this specification.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver doors and frames cardboard wrapped, crated, palletized or otherwise protected during transit and site storage.

B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and accepted by the Architect. Otherwise remove and replace damaged items.

C. Store doors and frames at the building site in a dry, secure place.
   1. Place units on minimum 4 inch high wood blocking.
   2. Avoid non-vented shelters [covering] that can create a humidity chamber.
   3. If cardboard wrapper on door becomes wet, remove carton immediately.
   4. Provide 1/4-inch spaces between stacked doors to promote air circulation.

1.08 SEQUENCING AND SCHEDULING

A. Deliver all doors and frames to the job site in a timely manner so not to delay progress of other trades.

B. Issue purchase orders to frame, door and hardware suppliers in sufficient time so as not to interfere with normal quoted delivery of materials.

1.09 WARRANTY

A. Hollow metal doors and frames shall be supplied with a one (1) year warranty against defects in materials and workmanship.

B. Warranty to commence with substantial completion of the job.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers:
   1. Curries, Division of AADG, Inc.
   2. Door Components, Inc.

B. Or Equal, provided products meet the specified performance and construction requirements, and are acceptable to the District. Such products are subject to California Public Contracts Code Section 3400.

C. Performance criteria as specified in 2.03 will be supported by an independent laboratory cycle and twist test certification document, and will be included in supplier's shop submittals. Any proposed substitution will be reviewed by the District Facilities Supervisor. Requests will include a list of (20) recent institutional installations, date of installation, and the current contact names and facilities telephone number. Additionally, any requests will include a full size door and corner sample containing design and construction requirements as contained in this specification. Samples to remain the

property of SBCUSD.

2.02 MATERIALS

A. Steel requirements, all doors and frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 and A-568 general requirements or galv. to A60 minimum coating weight standard per ASTM-A924 or A653 hot dip galvanized to A60 minimum coating weight standard. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011.

B. Coating Materials Primer: all doors and frames to be bonderized and finished as standard with manufacturer's baked-on primer conforming to ANSI-A259.10.

C. Door Core
1. Polystyrene core. All doors to have:
   a. Non-labeled or labeled doors: polystyrene slab [minimum .24 U Factor], self extinguishing, non-toxic in case of fire.
   b. Permanently bonded to the inside of each face sheet providing rigidity, insulating and sound deadening properties to the door.
   c. Refer to 2.03 for additional specification.
   d. **Steel ribbed doors are not acceptable in the SBCUSD.**
2. Temperature rise rated doors should be provided for stairwell enclosures which indicate “Temperature rise 30 minutes - 450 degrees F maximum or 250 degrees F maximum” as required by the local building code.

D. Glass lite frames in doors fabricated of not less than 18GA. galvanized steel with attachment screws allowed only on the non-secure side, screws not visible when viewing lite frame face.

2.03 FABRICATION

A. General
1. Fabricate all doors and frames in accordance with ANSI A250.8-1998/SDI-100 except where more stringent requirements are specified.
2. As detailed on plans, fabricated "welded" frame units to be delivered to job site as single units. Transoms, sidelights, and window walls which are "oversize" for transportation and installation, shall be furnished with field splices to be field assembled by the general contractor.
3. Supply only doors and frames manufactured by the acceptable manufacturer listed in this specification
4. Doors to be 707 Series as Manufactured by the Curries Co, Mason City, IA. 727 Series at Temperature rise rated doors which indicate “Temperature rise 30 Min.-450F degrees maximum or 250F degrees maximum” as required by local building code.
5. Prepare doors to receive door hardware per approved schedule, including internal reinforcing. Through-Bolts (SNB) are not permitted unless specifically requested by the Architect and/or District. Do not include unnecessary cutouts in door faces not required by hardware template.

B. Door Construction

1. Classification: SDI Level III - Model 2 (16GA. doors).
2. Face sheets formed of cold rolled steel.
3. Exterior doors to be galvanized to A60 minimum weight standard.
4. Seamless construction **[Equal to Curries 707T]** by **continuous wire weld** of both edges full height of door, and to be done at the factory.
5. On louver doors, perimeter channel reinforcement at louver cutouts to be sealed watertight.
6. Lock edges beveled 1/8 inch in 2 inches.
7. Door lock edge reinforcing shall be **one-piece, full height 14GA. Channel.** Door hinge edge reinforcing shall be **one-piece, full height 12GA. Channel** formed and tapped for hinges or as required per listed hardware.
8. Both hinge and lock channels to be welded to each face sheet of the door.
9. Top and bottom channels:
   a. Not less than 16GA. - flush or inverted.
   b. Welded to the face sheet.
   c. Close tops of exterior doors flush by the addition of 16GA. Galvanized. steel channel fillers. Channel filler to sealed watertight.
10. Astragals: Where called for to be flat security type or 'Z' as called for in drawings or specifications.
11. All doors to conform to A.N.S.I.-A 250.4 Test Procedure and Acceptance Criteria for Physical Endurance. Door size cycle tested to be 4070 to minimum Level A performance for 18 or 16GA. door. **Furthermore, doors will have been subjected to an additional one (1) million cycle and twist tests with a combined two (2) million cycles and 46 twist tests. Tests will have been conducted by an independent lab. Certification of this criteria to be submitted with approval drawings by the distributor. Exceptions will not be considered.**
12. Transom Panels: To be constructed similar to doors.
13. Where indicated, provide insert type louvers in bottom of doors. Louvers to be not less than 18 gauge prime coated steel.

C. Door and Window Frame Construction

1. Frames shall comply with ANSI/SDI A250-5 Level A, one million cycle swing test performance for a 4070 door frame.
2. All frames to be formed from cold rolled steel. Furnish 14GA. exterior door and window frames and 16GA. interior door and window frames. Both exterior door and window frames to be galvanized to A60 minimum weight standard.
3. All frames are to be **Full Profile Welded**, ground smooth, and re-primed at the welded area.
4. Window frame glass stops shall be minimum 18GA.steel and 5/8" in height. Exterior stops & countersunk flat-head attachment screws to be galvanized.
5. Provide temporary shipping bars to help protect from damage during transit and

handling.

6. Temporary shipping bars to be removed before setting frames.
7. All welds on frames, transoms and sidelites to be flush with neatly mitered or butted material cuts.
8. Water Penetration: Borrowed lite assemblies, transom, sidelite, and combination transom sidelite frames are not factory sealed to prevent water penetration. In situations where water penetration is a concern, **the Contractor must seal all joints that are exposed to the elements after the frame assembly is installed.**

   Whenever possible, it is strongly recommended that glass and glazing be installed on the exterior rabbet of the frame assembly. This will help act as a deterrent to water penetration.

   The member companies of the hollow metal industry can not control the workmanship associated with the frame installation; therefore, it is the responsibility of the installer to assure all steps are taken to prevent water penetration.

D. Frame Anchors

Provide sufficient anchorage to attach to wall in accordance with ANSI/SDI A250.5 Test Compliance Level A of one million cycles, or anchorage as detailed on plans to specific wall conditions.

1 Wall anchor for frame attachment to masonry construction: Masonry anchors, adjustable, flat, corrugated or perforated 'T' shaped anchors with leg not less than 2 inches wide by 10 inches long or masonry wire type not less than 3/16 inch dia.
2. All frame jamb anchors to be provided: one each jamb per 24 inches of frame height or fraction thereof. Furnish a minimum of two head anchors for frames installed in stud walls and three or more anchors in frame width exceeding 42”.
3. Floor anchors - angle clip type:
   a. Minimum 16GA.
   b. To receive 2 fasteners per jamb.
   c. Welded to the bottom of each jamb.

4. In place masonry or concrete:
   a. 3/8 inch countersunk flat head stove bolt and expansion shields.
   b. Spaced 6 inches from top and bottom of frame and at 26 inches on center maximum between.
   c. Weld pipe spacers or other type of spacers per Manufacturer’s standard design in back of frame soffit to protect frame profile during tightening of bolts and anchors.
5. Head struts: for frames not anchored to masonry or concrete construction provide ceiling struts spot welded to jambs each side extending to building structure where called for on schedule.

E. Hardware Preparation

1. Reinforcements: reinforce components for hardware installation in accord with ANSI-A115. Provide minimum gage hardware reinforcing for mortise or surface applied hardware as follows:

Hinge	- 10GA. or equivalent number of threads on doors.
Hinge	- 7GA. on frames for mortise butt hinges.
	- 12GA. full length on frames for continuous hinges.
Lock	- 12GA. or equivalent number of threads.
Panic Devices	- 12GA.
Surface Closer	- 12GA.
Hold Open Arm	- 12GA.

Field drilling and/or tapping for surface applied hardware is installation Contractor's responsibility.

Additional Door Related Reinforcements:

a. Lock reinforcement shall be 16GA. Channel type typical of Curries G2B [161] and G3 [86] four sided compression resistant design.

b. Panic reinforcement to be 14GA. channel type.

c. Closer reinforcement to be 12GA. Channel type.

d. Hinge and lock reinforcing on doors to be channel type, continuous from top to bottom of door welded to face sheets.

2. Punch single leaf frames to receive three (3) silencers. Double leaf frames to receive one silencer per leaf at head.
3. Factory prepared hardware locations to be in accord with "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames", as adopted by The Steel Door Institute.
4. Supply welded in mortar guards at all hardware cutouts in frames built into masonry or grouted in full.

F. Excess Material

1. Contractor to deliver any unused doors and frames to the District's designated Representative. Review with District.

PART 3 EXECUTION

3.01 FRAME INSTALLATION

A. Erection Installation: Install hollow metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with proper clearances and to achieve the maximum operational effectiveness and appearance of each unit. SDI 122-99 "Installation and Trouble Shooting Guide for Standard Steel Doors and Frames" or "The Installation of Commercial Steel Doors and Steel Frames"

as published by DHI are recommended guidelines.

B. Set welded frames in position prior to beginning partition work. Brace frames until permanent anchors are set.

C. Set anchors for frames as work progresses. Install anchors at hinge and strike levels.

D. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.

E. Install frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion anchors.

F. Install all fire rated frames in accord with requirements of N.F.P.A.-80, there listing and manufacturer's recommendations.

G. Where frames require ceiling struts or other structural overhead bracing, they shall be Anchored securely to structure above, as required.

H. Frames shall be filled solid with Portland cement grout where shown or required by class of opening in masonry or concrete walls. Provide steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings. Protect inside throat of each frame in grout filled wall conditions or where antifreeze additives are used in fill, with a waterproof undercoating type material minimum 1-2 mil thick, field applied by installer.

3.02 DOOR INSTALLATION

A. Install hollow metal doors in frames using hardware specified in Section 08710 Finish Hardware. Doors are to be expertly hung and shall fit snug against all stops. Doors Shall fit accurately and hang free from hinge bind with a uniform clearance of 1/8 inch at head and jambs. After hanging, make all adjustments and then remove respective hardware for finish painting. Reinstall hardware after finish painting.

B. Maximum clearances at edge of doors:
   1. Between door and frame at head and jambs: 1/8 inch.
   2. At meeting edges pairs of doors and at mullions: 1/8 inch.
   3. At transom panels, without transom bars: 1/8 inch.
   4. At sills without thresholds: 5/8 inch max above finish floor.
   5. At sills with thresholds: 1/8 inch above threshold.

C. Hardware Installation: to be installed securely without marking or defacing hardware or Finish work. Protect finish hardware with suitable protective covering until completion of building. Leave all hardware in perfect working order. Clean and polish.

3.03 ADJUSTMENT AND CLEANING

A. Remove dirt and excess sealant, mortar or glazing compounds from exposed surfaces.

B. Adjust for smooth operation as required. Install shims as required to allow for proper closing.

C. Fill all dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces - reprime/paint to match finish.

[END OF SECTION]

SECTION 08210

WOOD DOORS

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire rated and non-rated.

1.02 RELATED SECTIONS

A. Section 06200 - Finish Carpentry: Installation of doors.

B. Section 08100 - Steel Doors and Frames.

C. Section 08710 - Finish Hardware.

D. Section 08800 - Glazing.

E. Section 09900 - Painting Coatings: Site finishing of doors.

1.03 REFERENCES

A. ANSI A208.1 - Building Board (Wood Particleboard) Hard Pressed Vegetable Fiber, American National Standards Institute; 1999.

B. ASTM C 303 - Standard Test Method for Dimension and Density of Preformed Block and Board Type Thermal Insulation; 2007.

C. AWI - American Woodwork Institute, Section 1300, Architectural Flush Doors, and 1500, Factory Finishing.

D. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association; 2003.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; National Fire Protection Association; 2007.

F. NFPA 101 - Life Safety Code; 2006.

G. NWWDA - National Wood Window and Door Association.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.

B. Provide doors meeting or exceeding the minimum standards as set forth by the referenced organizations in their most current editions unless exceeded by this specification.

C. Fire doors shall conform to National Fire Protection Standards, NFPA-80, for fire-rated doors. Required fire-rated doors shall bear the labels approved by Underwriters Laboratories, Inc. or Warnock Hersey International; as required by the door schedule. The manufacturer's self certification labels are strictly forbidden. Any discrepancies between the Architectural drawings and the procedures and limitations as set forth by the testing agencies shall be brought to the Architect's attention during the bidding process. Otherwise, the most stringent requirements apply.

D. Provide each fire-rated door with a label permanently attached to either the hinge stile or the top tail, showing testing agency approval for classification schedule.

1.05 SUBMITTALS

A. Submit schedules and elevations indicating door sizes, construction, swing, label, undercut and applicable hardware locations. Show dimension and detail openings for glass lights, louvers

and grilles.

B. Submit manufacturer's product data showing compliance with AWI, Section 01300, along with finishing instructions, installation instructions and any general recommendations manufacturer may have for the care and maintenance of each door type.

C. Submit six 6" x 6" samples of door finish.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver door(s) to building site after plaster or cement is dry. If doors are stored at job site for more than one week, all edges shall be sealed.

B. Handle doors with clean gloves and do not drag doors across one another or across other surfaces.

C. No doors shall be delivered to the building until weather proof storage space is available. Store doors in a space having controlled temperature and humidity range between 25% to 55%. Stack doors flat and off the floor, supported to prevent warpage. Protect doors from damage and direct exposure to sunlight.

D. Factory finished doors shall be individually wrapped in polybags to protect the finish from damage.

1.07 WARRANTY

A. Provide a full door warranty covering the work in this section from the date the installation is accepted, against defects in material and workmanship, including the following:
   1. Delamination in any degree.
   2. Warp or twist of 1/4" or more in any 3'-0" x 7'-0" section of a door.
   3. Telegraphing of any part of core assembly through face veneer to cause surface variation of 1/100" or more in a 3" span.
   4. Defect materials which impair and affect performance of the door. Replacement under this warranty shall include hanging, installation of hardware and finishing of new door.

B. Periods of full door warranty after installation is accepted:
   1. Interior solid core and mineral core doors - "Life of Installation".

C. Doors shall be stored, finished, hung and maintained in accordance with manufacturer's recommendations set forth in their warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The design is based on the use of products manufactured by Oshkosh Door Company, Oshkosh, WI, 920-233-6161.

B. Doors shall be the product of one manufacturer and shall be either the products upon which the design is based or equivalent products of one of the following manufactures approved in advance, as listed, or equal.
   1. Marshfield Series by Weyerhaeuser, Marshfield, WI

2.02 MATERIALS

A. Face Veneer:
   1. Plain sliced Red Oak - meeting requirements of ANSI/HPMA HP "A" Face or AWI Grade 1, 1/50 inch thick minimum prior to sanding at project site. No sapwood allowed.
   2. Adhere all glue lines with Type 1 adhesive.
   3. Face veneers are to be book matched and installed in a center match pattern on each face of door.

B. Door Grade - Premium.

C. Door Assembly - Doors shall be 5-ply, consisting of a face veneer, crossband(s) along with the core unit, all securely bonded together using type I (moisture proof) adhesive. The grain direction of each layer or ply to be at right angles to the grain of the adjacent ply or plies. Face veneer shall have a minimum thickness of 1/50" after factory sanding and the individual pieces of veneer forming the face veneer shall be edge glued together with a thermosetting adhesive.

D. Door Cores - There shall be one lock block 5" x 12" when a board, unit, or mortise lock is to be used. Two such lock blocks shall be used when the door is equipped with an exit device. A 5" intermediate rail shall be used for impact resistance as required when physical contact with the mineral core doors is a consideration.
   1. Particleboard Core: (Interior, non-fire rated doors) - Shall conform to Type I density (30-32 lbs. per cubic foot), Class 1, commercial standard #236-66 and meet or exceed the requirements described in ANSI A208.1 IL 1 mat formed particle boards. (Cores shall be monolithic for doors over 8'-0" in height. Section loose or tightly fitted and glued are not acceptable.)
   2. Mineral Core: (Labelled doors) - Shall be asbestos free, non-combustible mineral composite monolithic or in sections tightly fitted and glued, with a minimum of nominal 28 pounds per cubic foot density when testing in accordance with ASTM C 303 with 10% maximum absorption by weight with core in equilibrium at 90% relative humidity and 70 degrees Fahrenheit. Flame resistant blocking shall be provided as required by the hardware schedule and wherever hardware is to be attached. The door label shall not limit the size or location of such blocking. No through bolting shall be allowed for hardware attachment purposes.

E. Edge Bandings - The entire perimeter of the vertical and horizontal edges of all solid core doors shall be securely bonded to the core by means of a thermosetting adhesive and then the entire surface shall be abrasively planed (to a uniform thickness tolerance not exceeding + or -.002") before gluing to ensure minimal telegraphing of core components through face veneers.
   1. Vertical edges - (Dimensions given are minimum size allowed after factory trimming to booksize or prefitting.)
      a. Particleboard Core - 1-1/2" double banded laminated hardwood stiles without finger joints in outer band. Outer band to be at least 1/2" wide same species lumber as face veneer with the exception of Birch doors which shall have Hard Maple stiles (or veneered in exact same species wood as face veneer.)
      b. Mineral Core - Stile shall be veneered in exact same wood species as face veneer. 2.4.H.
   2. Horizontal edges - (Dimensions given are minimum size allowed after factory trimming to booksize or prefitting).
      a. Particleboard Core - 1-1/4" minimum mill option hardwood rail.
      b. Mineral Core - Manufacturer's standard rail shall be used to accomplish label required.

F. Crossbands:
   1. Crossband #1 - shall consist of thoroughly dried hardwood flitches extending full width and height of door with grain at right angles to face.
   2. Crossband #2 - shall consist of thoroughly dried hardwood extending full width and height of door with grain running same direction as face veneer.

2.03 LABELED FLUSH DOORS - 20 MINUTE FIRE RATED

A. Regular pair doors shall have meeting vertical edges veneered over fire rated components to match face veneer.
   1. Metal edge guards and/or astragals shall not be required.

B. Door and transom meeting edges shall be constructed with fire-rated components which preclude the necessity of a metal transom bar.
   1. The bottom rail of the transom unit shall be veneered to match transom face.

2.04 LABELED FLUSH DOOR - 45, 60 and 90 MINUTE FIRE RATED

A. Doors shall be manufactured by the listed manufacturers and further subject to the requirements of this specification.

B. Core - shall be asbestos free, non-combustible mineral composite monolithic or in sections tightly fitted and glued, with a minimum of nominal 28 pounds per cubic foot density when testing in accordance with ASTM C 303, with 10% maximum absorption by weight with core in equilibrium at 90% relative humidity and 70 degrees Fahrenheit. Flame resistant blocking shall be provided as required by the hardware schedule and wherever hardware is to be attached. The door label shall not limit the size or location of such blocking. No through bolting shall be allowed for hardware attachment purposes.
   1. There shall be one lock block 5" x 12" when a board, unit, or mortise lock is to be used. Two such lock blocks shall be used when the door is equipped with an exit device. A 5" intermediate rail shall be used for impact resistance as required when physical contact with the mineral core doors is a consideration.

C. Rails: Top 15/16", bottom 1-7/8" rail of flame resistant material.

D. Stiles: UL or WHI approved for labeled doors and meeting the following performance criteria: Stiles to be veneered to match door face.
   1. Split resistance: Average of ten test samples shall be not less than 900 load pounds when tested in accordance with "Test Method to Determine Split Resistance of Hinge Edges of Composite Type Fire Doors" DRT Test Reports 83037 A & B and 87014-A.

E. Do not use salt treated components in the manufacture of such stiles or elsewhere in the door construction.

F. Furnish metal vision frames primed for field painting for doors with lites. Frames shall equal AWI standard, UL, or WHI approved.

G. Door and transom meeting edges shall be constructed with fire-rated components which preclude the necessity of a metal transom bar. The bottom rail of the transom unit shall be veneered to match transom face.

H. Door manufacturer shall furnish metal edges only on pairs of fire doors with two surface-mounted vertical rod exit devices. All other pairs will be furnished with metal edges and overlapping astragal. Metal edges and astragals to be factory primed ready for field painting.

I. Manufacture labeled doors to the required size providing proper clearance without field trimming. Follow this procedure so as to assure the full thickness of the edge bands.

J. Doors shall be suitable for hanging on butt hinges using No. 12 x 1-1/4" steel threaded-to-the-head cadmium plated or rust-resistant wood screws. Coordinate with Hardware Section 08710 and Section 06200 for proper screws and installation. Pilot holes for .134" and .180" templated hinge screws and pivots, if applicable, shall be prepared by the manufacturer.

2.05 FACTORY FINISHING

A. Transparent Finish: Wood doors shall be prefinished by the manufacturer according to AWI TR6 Quality Standards Illustrated, Section 1500.
   1. All stain, sealer, top coats, and additional coatings, as specified, shall be separate and distinct operations individually applied to the wood surface. Automated roll-coat horizontal finishing systems whereby the doorskin or the entire door are finished with combination coatings, sealers, top coats and other specialized materials shall not be acceptable.
   2. Top and bottom of doors to be sealed.
   3. Color: As selected by the Architect.

B. Opaque Finish: Doors shall be factory primed for paint all six sides. Sanding of prime coat will be done in the field just prior to the application of the field applied paint.

2.06 FIELD FINISHING

A. See Section 09900, Paints and Coatings.

B. Field finishing shall be the responsibility of the painting contractor. Immediately before painting finish, the entire surface of the door must be sanded completely with 5/0 180-grit sandpaper while door is in a horizontal position. This shall be followed by the steps necessary to achieve AWI Custom Grade appearance.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate wood doors in accordance with referenced standards. Doors shall be pre-machined.

B. Manufacturer shall machine wood doors for cutouts, hinges, locks, and hardware requiring routing and mortising. Required rabbeting to properly hang doors shall be performed by the manufacturer prior to finishing. Pre-fit doors at factory with following clearance:
   1. 1/8 inch on top and hinge edges.
   2. 1/8 inch on lock edge of single doors.
   3. 1/16 inch per leaf on pair meeting edges.
   4. Bevel both edges of single 1/8 inch in 2 inches.
   5. Verify clearance at bottom of door.

3.02 INSTALLATION

A. Install all doors in accordance with manufacturer's written installation instructions.

B. Immediately after fitting, or cutting for any and all hardware, and/or threshold, and before hanging any interior door on the job, the top and bottom edges shall receive an application of sealer and two coats of a good grade varnish or lacquer. Adequate drying time must be allowed between coats.

C. There shall be no cut outs within 5" of the edge of door. Cut outs for lights, louvers or recessed pulls shall not be done within that 5" limitation.

D. Installation of Hardware - The Contractor shall install hardware according to approved hardware schedule for proper locations.
   1. Install with full-threaded wood screws furnished by hardware manufacturer.
   2. Securely anchor hardware in correct position and alignment.
   3. Adjust hardware and door for proper function and smooth operation and proper latching without force or excessive clearance.

E. Installation of Fire-Rated Doors - shall be installed in accordance with the requirements of the labeling agency and NFPA #80 and #101.

3.03 CLEAN-UP

A. After completion of delivery, clean up all debris resulting from this work and remove from site.

B. Pick up work area daily to maintain area in a hazard free condition.

C. Wipe down doors and leave site clean of all debris related to this trade from site at completion of work.

END OF SECTION

SECTION 08310

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire-rated and non-fire-rated wall access door and frame units.

B. Fire-rated and non-fire-rated ceiling access door and frame units.

C. Accessories

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough-in framing for access panels.

B. Section 07900 - Joint Sealers: Caulking and sealants.

C. Section 09220 - Portland Cement Plaster.

D. Section 09260 - Gypsum Board Assemblies.

E. Section 09900 - Paints and Coatings: Field paint finish.

F. Section 15330 - Fire Protection Systems: Automatic fire sprinkler system.

G. Section 15430 - Plumbing Specialties: Plumbing Specialties requiring access.

H. Section 15820 - Duct Accessories: Mechanical components requiring access.

I. Section 16010 - General Electrical Provisions: Electrical components requiring access.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

B. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

C. CBC - California Code of Regulations (CCR), Title 24, California Building Code; 2010.

1.04 REGULATORY REQUIREMENTS

A. Provide access to attic spaces in accordance with CBC, "Access to Unoccupied Spaces", Section 1209.2 and to mechanical appliances in accordance with Section 1209.3. Minimum opening size shall be 24-inch by 36-inch.

B. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.

C. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

1.05 BIDDING REQUIREMENTS

A. The work of this Section shall include providing access doors and panels for architectural, mechanical, plumbing and electrical components. Bidders shall review all drawings to determine work required prior to submitted bid. The work shall include, but not be limited to, providing access to the following:
   1. Architectural - Through-wall access to attic spaces and attic access in gypsum wallboard ceilings and plaster soffits.
   2. Automatic Fire Sprinkler - Upright sprinkler heads, and shut-off valves.
   3. Mechanical - Fire/smoke dampers, duct detectors, volume control dampers, fan coils units, and other mechanical components.
   4. Electrical - Heat detectors, junction boxes, and other electrical components.

5. Plumbing - Shut-off valves, water hammer arrestors, trap primers, water regulators, filters, strainers, gages, and other plumbing components.

1.06 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Coordinated Mechanical, Electrical, Plumbing (MEP) overlay drawing indicating exact position of all access door units in relation to the components they are providing access to.

D. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.

E. Project Record Documents: Record actual locations of all access units.

1.07 PROJECT CONDITIONS

A. Coordinate the work with other work requiring access doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on products manufactured by Milcor, Inc., Lima, OH.

B. All materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or approved in accordance with Section 01600.

C. Accepted Manufacturers:
1. Acudor Products Inc: www.acudor.com.
2. Larsen's Manufacturing Company.
3. Karp Associates, Inc: www.karpinc.com.
4. Babcock-Davis, Inc.: www.babcock-davis.com
5. JL Industries, Inc.
6. Substitutions: See Section 01600 - Product Requirements.

2.02 ACCESS DOORS AND PANELS

A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

B. Units in Fire Rated Assemblies: Fire rating equivalent to the fire rated assembly in which they are to be installed.

2.03 WALL AND CEILING UNITS

A. Door and Frame Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.
1. Material: Steel.

2.04 ACCESS DOOR UNITS - NON RATED WALLS AND CEILINGS

A. Door and Frame Units: Formed steel.
1. Frames and flanges: 14 or 16 gauge steel.
2. Door panels: 14 gauge, single thickness steel sheet.
3. Sizes: As noted on the drawings or required to give complete access:
   a. Walls: Minimum 12 x 12 inches (300 x 300 mm).
   b. Ceilings: Minimum 12 x 12 inches (300 x 300 mm).

4. Hardware:
   a. Hinge: Non-Fire-Rated Units: 175 degree steel hinges with removable pin.
   b. Lock: Cylinder lock with latch, two keys for each unit.
5. Prime coat with baked on primer.

B. Non-Fire Rated Door and Frame Units in Walls:
1. In Masonry:
   a. Model Style M.
2. In Gypsum Board:
   a. Model Style DW.
3. In Plaster on Metal Furring:
   a. Model Style K.

C. Non-Fire Rated Door and Frame Unit in Ceiling:
1. In Gypsum Board:
   a. Model - Style DW.
2. In Plaster on Metal Furring:
   a. Model - Style K.
3. In Suspended Acoustical Ceiling:
   a. Model - Style AT.

2.05 ACCESS DOOR UNITS - WET AREAS

A. Door and Frame Units: Formed stainless steel.
1. Frames and flanges: 16 gauge, 0.075 inch (1.9 mm) steel.
2. Door panels: 16 gauge 0.036 inch (.91 mm) single thickness steel sheet.
3. Size as indicated or required to provide complete access.
4. Hardware:
   a. Hinge: #304 stainless steel.
   b. Lock: Cylinder lock with latch, two keys for each unit.
5. Finish: No. 4 brushed or satin finish.

B. Non-Fire Rated Door and Frame Units in Toilets, Kitchen, or Wet Areas:
1. In Gypsum Board or Ceramic Tile:
   a. Model - Style MS (Stainless Steel).

2.06 ACCESS DOOR UNITS - FIRE RATED WALLS AND CEILINGS

A. Access door and frame unit shall carry both UL and CUL 1 1/2 hour, Class B fire rating as well as the Warnock Hersey Label for three-hour noncombustible floor/ceiling systems.

B. Door and Frame Units: Formed steel.
1. Frames and flanges: 14 or 16 gauge steel.
2. Door panels: 18 gauge steel with integral non-combustible insulation filler.
3. Sizes: As noted on the drawings or required to give complete access:
   a. Walls: Minimum 12 x 12 inches (300 x 300 mm).
   b. Ceilings: Minimum 12 x 12 inches (300 x 300 mm).
   c. Lay-in Grid Ceilings: To match grid module.
4. Hardware:
   a. Hinge: 175 degree stainless steel piano hinge with pin.
   b. Automatic Panel Closer: Integrated concealed constant force closure spring type.
   c. Lock: Cylinder lock with latch, two keys for each unit.
5. Prime coat with baked on primer.

C. Fire Rated Door and Frame Units in Walls:
1. In Gypsum Board:
   a. Model Style UFR.
2. In Plaster on Metal Furring:
   a. Model Style UFR.

D. Fire Rated Door and Frame Units in Ceilings:
   1. In Gypsum Board:
      a. 1 1/2 hour B label fire rating.
      b. Model Style UFR.
   2. In Plaster on Metal Furring:
      a. Model Style UFR.
   3. In Metal Suspended Ceiling System:
      a. 1 1/2 hour B label fire rating.
      b. Model Style ATR.

2.07 FABRICATION

A. Weld, fill, and grind joints to ensure flush and square unit.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordinate location of access doors and panels with General Contractor. Verify that rough-in openings are correctly sized and located.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings. Secure rigidly in place.

C. Position units to provide convenient access to the concealed work requiring access.

D. Provide minimum 30 inch square access panel at vertical wall or attic separation and 24-inch by 36-inch access panel mounted to ceiling for attic access. Locate said access panel at wall or ceiling where access to the attic space can not be accessible by means through the suspended ceiling or other means. Provide barrier free access through the attic space. Access panels shall bear the same rating as the wall/ceiling rating.

3.03 ADJUSTING AND CLEANING

A. After completion of installation, adjust doors to prevent binding. Adjust latching (and locking) mechanism to operate smoothly.

B. Clean panels and adjacent surfaces as required.

END OF SECTION

SECTION 08330

COILING COUNTER DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead coiling counter doors, operating hardware, fire-rated, manual push-up operation.

1.02 RELATED SECTIONS

A. Section 08710 - Door Hardware: Cylinder cores and keys.

B. Section 16722 - Fire Alarm.

1.03 REFERENCES

A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2002.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, component connections and details, .

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Manufacturer's Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

F. Letter stating that installer is authorized by the manufacturer to install the units.

1.05 QUALITY ASSURANCE

A. All rolling counter fire doors shall be constructed in accordance with testing agency requirements and shall be a 1-1/2 hour rating label.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by the manufacturer.

1.06 WARRANTY

A. Counter doors shall be warranted for a period of 2 years from the date of acceptance by the District against defects in workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by The Cookson Company, Phoenix, AZ.
   1. Product: Series FD10-ST-SS with Firefly III System.

B. Materials shall be the products of one manufacturer and shall be either the products upon which the design is based or the products of one of the following manufacturers approved in accordance with Section 01600 and when complying with the specifications contained herein:
   1. Acceptable Manufacturers:
      a. Cornell Iron Works, Mountaintop, PA.

b. Windsor Door, Marysville, CA.
c. Overhead Door Corporation, Farmers Branch, TX.

2. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. The door curtain shall be constructed of interconnected strip stainless steel slats. The curtain shall be constructed of 22 gauge No. 10 (1-1/4" high by 3/8" deep) steel conforming to ASTM A 666, Type 304, rollable temper.

B. The bottom bar shall be constructed of tubular stainless steel, measuring 2" high by 1-1/4" deep, with a foam astragal on the bottom edge.

C. The integral door frame and guides shall be constructed of 16 gauge stainless steel at the head and jambs and 14 gauge stainless steel at the sill. The sill shall extend 4" on either side of the wall. All frame joints shall be flush and smooth.

D. The brackets shall be constructed of 11 gauge steel plate.

E. The barrel shall be steel tubing of not less than 4" in diameter. Oil tempered torsion springs shall be capable of correctly counter balancing the weight of the curtain. The barrel shall be designed to limit the maximum deflection to .03" per foot of opening width. The finish on the barrel shall be one coat of bronze rust-inhibiting prime paint.

F. The hood shall be fabricated from 24 gauge stainless steel and shall be formed to fit in the square brackets.

G. Finish: All stainless steel shall receive No. 4 finish.

H. Mounting: Within framed opening.

I. Locking Mechanism: Concealed sliding bolt deadlock in the bottom bar operated by a cylinder lock.

J. Manual push-up operation.

2.03 OPERATION

A. All push-up operated counter fire doors shall have an automatic closing device, Sure-Close Release Spring and governor to control the downward speed of the door which shall become operational upon activation of smoke detector. The door shall have an average closing speed of not less than six (6) inches per second and not more than twenty-four (24) inches per second as indicated in NPPA Bulletin 80. Once the door has closed, it should be able to be reset by one person on one side of the door only.

B. Push-up operated doors shall open and close with a maximum of 30 pounds of effort utilizing finger lifts in the bottom bar.

C. All fire doors shall be equipped with the Firefly III Time Delayed Releasing Device.
1. The Firefly III Releasing Device must be powered from 24 volt DC received from an approved UL 1481 regulated power supply with battery backup.
2. During installation and subsequent resetting of the fire door, the Firefly's latching mechanism shall hold the door in the set position. Energizing the alarm system shall automatically set the Firefly III by releasing the latching mechanism.
3. The Firefly III shall hold the fire door in the set position until the alarm or smoke detection system is activated. Upon activation, the Firefly III shall mechanically release the fire door after delay of not more than 10 seconds. If the fire alarm activation is canceled before the 10 second delay, the Firefly III shall automatically reset itself.
4. If the Firefly III mechanically closes the fire door, the door will have to be reset by an authorized trained technician.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

A. Units shall be installed by installers authorized in writing by the manufacturer and in accordance with NFPA Bulletin 80.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Complete wiring from fire alarm system.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

3.03 ERECTION TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

C. Maximum Variation from Level: 1/16 inch (1.5 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft (3 mm per 3 m) straight edge.

3.04 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 08625

TUBULAR SKYLIGHTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular skylights, consisting of skylight dome, reflective tube, and diffuser assembly; configuration as indicated on the drawings.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07510 - Built-Up Bituminous Roofing: Flashing-in of skylight base.

B. Section 07530 - Elastomeric Membrane Roofing: Flashing-in of skylight base.

C. Section 07550 - Modified Bituminous Membrane Roofing: Flashing-in of skylight base.

1.03 REFERENCE STANDARDS

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.

B. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.

C. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2006.

D. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 1996 (Reapproved 2001).

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

F. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings; 2010a.

G. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.

H. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002 (Reapproved 2010).

I. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

J. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. ICC-ES evaluation report.

C. Shop Drawings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engaged in manufacture of tubular skylights for minimum of 10 years.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Skylights: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solatube International, Inc: www.solatube.com.

B. Substitutions: See Section 01600 - Product Requirements.

2.02 TUBULAR SKYLIGHTS

A. Tubular Skylights: Transparent skylight dome and curb mounted cap, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces.
   1. All components made and assembled by one manufacturer.
   2. Design to withstand the following loads without breakage or permanent damage to any parts, when tested in accordance with ASTM E 330:
      a. Positive and negative wind load of 10 psf (475 Pa).
      b. No permanent deflection in excess of 0.2 percent of span.
      c. Live load of 100 psf (4.8 kPa) on dome with safety factor of 3.
   3. Air Infiltration: Maximum 0.10 cfm per foot (0.15 L/s/m) of crack length at 6.24 psf (299 Pa) pressure differential when tested in accordance with ASTM E 283.
   4. Water Resistance: No uncontrolled water leakage at 6.24 psf (299 Pa) pressure differential with water rate of 5 gallons/h/sf (206 L/h/sq m), when tested in accordance with ASTM E 331; design to ensure that water will not accumulate inside assembly.
   5. Thermal Movement: Fabricate to allow for thermal movement resulting from temperature differential from minus 30 to 180 degrees F (minus 34 to 82 degrees C).
   6. Flammability: Non-metal parts complying with the following:
      a. Roof-Top Components: Class B when tested in accordance with ASTM E 108 or UL 790.
      b. Self-Ignition Temperature: Greater than 650 degrees F (343 degrees C), when tested in accordance with ASTM D 1929.
      c. Smoke Developed Index: Maximum of 450, when tested in accordance with ASTM E 84; or maximum rating of 75, when tested in accordance with ASTM D 2843.
      d. Combustibility - Light Transmitting Parts: Burning extent of 1 inch (25 mm) or less (ICC Class CC-1), when tested in accordance with ASTM D 635 in the thickness intended for use.
      e. Combustibility - Non-Light Transmitting Parts: Minimum 2.5 inches/min (64 mm/min) (ICC Class CC-2), when tested in accordance with ASTM D 635.

B. Roof Assemblies: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.

1. Glazing: Polycarbonate plastic, 0.125 inch (3.2 mm) minimum thickness.
2. Low-Angled Sun Reflector: Concentric, light refracting etched lines, minimum 2 inches (51 mm) high, to improve light input when sun is low on horizon.
3. Base Style: Curb mounted, with flashing to cover curb installed by General Contractor.
4. Base Material: Sheet aluminum, ASTM B 209 (ASTM B 209M), 0.060 inch (1.5 mm) thick, minimum.
5. Base Height: 6 inches (150 mm)
6. Flashing Extensions: Provide manufacturer's standard adaptors or extensions for tile applications and slopes greater than 8:12.
7. Dome Ring: Attached to top of base section; 0.090 inch (2.3 mm) nominal thickness injection molded high impact ABS; to prevent thermal bridging between base flashing and tubing and channel condensed moisture out of tubing; weather seal of medium density pile weather stripping.

C. Reflective Tube: ASTM B 209 (ASTM B 209M) aluminum sheet, thickness between 0.015 inch (0.4 mm) and 0.020 inch (0.5 mm).
1. Interior Finish: Exposed interior surfaces of high reflectance specular finish; specular reflectance 92, total reflectance 95 percent.
2. Tube Diameter: 14 inches (356 mm).

D. Diffuser Assemblies: Supporting light transmitting surface at bottom termination of tube, with compression seal to minimize condensation and bug or dirt infiltration.
1. Ceiling Ring: Edge trim for ceiling opening; injection molded high impact ABS.
2. Diffuser Trim: Edge and attachment trim for diffuser lens; injection molded high impact ABS.
3. Diffuser Shape at Solid Ceilings: Round, same diameter as tube.
4. Diffuser Shape in Lay-In Ceiling Grid: Square, 24 by 24 inches, to fit grid; metal transition box.
5. Lens: Flush frosted lens.
6. Lens Material: Polycarbonate plastic
7. Lens Thickness: 0.038 inch, minimum.
8. Visible Light Transmission: Minimum 90 percent.
9. Seal: Closed cell EPDM foam rubber

2.03 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Joint Sealant: As specified in Section 07900..

C. Field fabricated wood curb.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install field fabricated wood curb and roofing material prior to installation of tubulara skylights.

3.03 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Seal joints exposed to weather using procedures specified in Section 07900.

C. Conduct field test for water tightness; conduct water test in presence of Architect. Correct defective work and re-test until satisfactory.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

Section 08710

FINISH HARDWARE

PART 1: GENERAL

1. 01 SUMMARY

A. SECTION INCLUDES:

1. Work under this section comprises the furnishing and installation of hardware specified herein and noted on drawings for a complete and operational system, including any electrified hardware components, systems and controls.
2. Related Documents, drawings and general provisions of contract, including General and Supplementary Conditions, and Division 1.
3. Items include but are not limited to the following:
   a. Hinges
   b. Exit Devices
   c. Locksets
   d. Cylinders
   e. Push/Pull Plates
   f. Automatic Flush Bolts
   g. Closers
   h. Kick, Mop and Protection Plates
   i. Stops and Overhead Controls
   j. Thresholds, Gasketing and Door Bottoms
   k. Miscellaneous Accessories and Trim

B. RELATED WORK:

Section 08210 - Wood Doors
Section 06200 - Finish Carpentry.
Section 08110 - Hollow Metal Work.
Sections within 08800 - Glazing.
Sections within 09900 - Painting.
Electrical Division 16.

1. 02 SUBSTITUTIONS

A. References to specific products are used to establish minimum standards of utility and quality. Unless otherwise approved, furnish only the specified products.

B. Requests for substitutions to be in accordance with Division 1, General Requirements. Proposed substitutions must be submitted in writing and hand delivered to the Architect. Approvals must be by addendum ten [10] days prior to bid opening. District Building Services Director will be notified of any requests.

C. All requests to be accompanied by two [2] copies of the manufacturer's brochures and a physical sample of each item in the appropriate design and finish.

D. Items listed with no substitute have been requested by the Building Owner to match existing building standards.

E. Should the Contractor make any substitutions without the written consent of the Architect, Contractor shall remove all substituted hardware, replacing same with the hardware as specified and at no additional cost to the building owner.

1. 03 REFERENCES

A. References specified in this section subject to compliance as directed and shall meet requirements of Federal, State and local codes having jurisdiction over this project including:
1. CCR - California Code of Regulations Title 24.
2. ADA - American Disabilities Act - Title III - Public Accommodations.
3. NFPA 80 - Standard for Fire Doors and Windows.
4. NFPA 101 - Life Safety.
5. ITS - Intertek Testing Service [Warnock Hersey].
6. UL - Underwriters Laboratories.
7. ANSI/BHMA A156 Product Listing.
8. UBC - Uniform Building Code, State, Local Codes, & Authority having Jurisdiction.
9. UL 10C for Positive Pressure Fire Tests of Door Assemblies and UBC 7-2.

B. Hardware that is furnished and/or installed that does not meet code requirements, shall be removed and replaced with correct material at no additional expense to the district.

1. 04 QUALITY ASSURANCE

A. PRODUCT UNIFORMITY: Except where specified, all hinges, keyed cylinders, electro-mechanical components, locksets, latchsets, exit devices, closers, overhead stop/holders and component parts shall be furnished by one manufacturer.

B. RATED OPENINGS: Hardware used in labeled fire or smoke rated openings to be listed for those types of openings and bear the identifying label or mark indicating U.L. [Underwriter's Laboratories] approved for fire. Exit devices in non-labeled openings to be listed for panic.

C. SUPPLIER: Shall be responsible for detailing hardware that meets project standards and where appropriate, retrofit applications which requires inspection of openings prior to detailing and ordering respective hardware items.

D. PRE-INSTALLATION CONFERENCE: Prior to installation of hardware, arrange a conference between supplier, installers, and related trades to review materials, procedures, hardware mounting locations and related work.

E. INSTALLATION EXERCISE: Contractor/Installer is required to install one complete exterior opening Hardware Set and the respective hollow metal door and frame to establish both know-ledge and skill as required for this project. Door/frame and hardware installation practice will be coordinated with the project architect and building owner's representative, and shall be accomplished to the PA's satisfaction, and prior to the installation of any doors/frames and door hardware. Typical hardware set to be comprised of hinges, panic device, trim, door closer, overhead stop if detailed, flat goods, threshold, sweep, drip cap and perimeter seal or as directed by the architect.

1. Note: **Sargent EU Representative** must be present when door closers are installed [48 hour advance notice is required].
2. Damage resulting in replacement material or repair, including labor, shall be absorbed by the Contractor/Installer.

F. POST-INSTALLATION POLICING: Will be required by the Hardware Supplier, Contractor and Architect to determine compliance with the hardware specification and building standards.

G. SUPPLIER QUALIFICATIONS:

1. Hardware supplier must be a recognized, Southern California based FACTORY DIRECT contract distributor with a minimum five (5) years experience specializing in institutional grade builders hardware of the type specified herein. Distributor's with less than two (2) years of history of furnishing builders hardware in the project's vicinity will not be acceptable.
2. Supplier must have in his/her employment on a full time basis, a Certified Hardware Consultant [AHC] or person of equal experience who is acceptable to the Architect and GC. This individual shall be available for consultation and service to the architect, contractor, and building owner during construction and on an ongoing consulting service to the building owner following the completion of the project.
3. Supplier who does not maintain personnel in a permanent facility within a reasonable driving radius of the project area for consultation and service with the Architect, Contractor and Building Owner will not be acceptable.

1. 05 GENERAL REQUIREMENTS

A. COORDINATION: Coordinate as necessary with other trades to assure proper and adequate provision in the work of those trades for interface with this Section.

B. SEQUENCING AND SCHEDULING: Any part of the finish hardware required by the frame or door manufacturers or other suppliers, that is needed in order to produce doors or frames is to be sent to those suppliers in a timely manner.

C. DEFECTIVE HARDWARE: All hardware shall be new and free from defects affecting both serviceability and appearance. Working parts shall be properly fitted, smooth working and without excessive play.

D. FUNCTION/MODIFICATION:

1. Should any hardware fail to meet the intended operational requirements or require any modification to suit the intended location, this matter, or any other necessary advance information, shall be brought to the

attention of the architect for correction or advice in ample time to avoid delay in the manufacture and delivery of the hardware.

2. Modifications to specified hardware, required by reason of construction characteristics, shall be furnished in the specified operational, functional features, quality and finish. Modifications shall be subject to acceptance of the Architect at no additional cost to the Building Owner.
3. Items of hardware not specified herein but necessary for completion of the work shall be furnished at no additional cost to the Owner. Such items shall be of the type specified and comparable to adjacent hardware.

E. DOORS AND FRAMES: Hollow metal and wood doors shall be manufactured to templates. If required, physical hardware items shall be furnished to related manufacturers in sufficient time to avoid delay in work.

F. Contractor/Installer will deliver all unused finish hardware to the District Lockshop.

1. 06 SUBMITTALS

A. HARDWARE SCHEDULE: Hardware supplier shall submit typewritten copies of schedule in accordance with Division 1, General Requirements. Schedule to be in VERTICAL format, listing each door opening including; location, handing of opening, all hardware scheduled for each opening or otherwise required to allow for proper function of door opening as intended, finish of hardware, and respective manufacturers. Doors with closers or door controls shall require the degree of door opening.

1. Supply six [6] copies of the schedules within fifteen [15] working days from
date of purchase order.
   a. The hardware schedule shall conform with DHI's: *"RECOMMENDED PROCEDURE FOR PROCESSING HARDWARE SCHEDULES AND TEMPLATES."*
   b. Submit manufacturers' catalog cut sheets of all hardware items scheduled and any required special mounting instructions with the hardware schedule.
   c. Include recommended mounting location data for each type of scheduled door hdwe**.** Include electrified hardware where listed.
2. No hardware item shall be delivered until the hardware schedule has been approved by the Project Architect.
3. Approval of the hardware schedule by the Architect does not relieve the hardware supplier from the responsibility of furnishing the job complete.

B. SAMPLES:

1. If directed by the architect, submit physical samples of each item of hardware proposed in work.
2. Samples will be returned on the request of and at the expense of the contractor.

C. MFR'S CATALOG ILLUSTRATIONS AND HARDWARE DATA:

1. Submit, to the architect, two [2] catalog cuts of every item of hardware furnished for this project. Data shall be contained in a binder appropriately divided by the respective manufacturers.

2. Cuts shall include manufacturer's illustrations and shall identify finishes, sizes and product numbers. Abbreviations to be fully explained.

D. OPERATIONAL DATA:
1. Deliver to the district, through the architect,
a. One [1] set of factory catalogues for hardware listed in the approved hardware list.
b. One [1] copy of approved door hardware shop drawings.
c. One [1] copy of door hardware specifications.

E. TEMPLATES: Templates for door hardware items to be sent to related door and frame suppliers within three [3] working days of receipt of approved hardware schedule. Templates **shall not** be issued until the door hardware schedule has been reviewed and approved by the project architect.

F. CERTIFICATION OF COMP7LIANCE: Submit any information necessary to indicate compliance to any or all of these specifications as required.

G. KEYING SCHEDULE:
1. The District will provide permanent keying information to a Door Security Solutions Representative. The **DSS Representative** will coordinate with the distributor who will provide a detailed order for keyed cylinders.

1. 07 DELIVERY, STORAGE AND HANDLING

A. PACKAGING: Each unit of hardware shall be individually packaged in the manufacturer's original containers as required by the respective hardware manufacturers.
1. Packaging shall include factory original installation instructions, fastenings and all items necessary for complete installation.

B. WRAPPING: Wrap and cushion each item to prevent scratches and dents during delivery and storage.

C. ENVIRONMENTAL PACKAGING: Hardware shipped to the jobsite is to be packaged in biodegradable packs, such as paper or cardboard boxes and wrapping. If non-biodegradable packing is utilized, such as plastic, plastic bags or styrofoam, then the contractor will be responsible for the disposal of the non-biodegradable packing to a licensed or authorized collector for recycling of the material.

D. MARKINGS: Each package shall be clearly marked on the outside, identifying contents with specific opening number corresponding to those listed in the hardware schedule. Include door and item number for each product.

E. DELIVERY: Except as dictated otherwise, deliver all hardware to the job site. The contractor and hardware supplier's representative shall check each item of hardware against the approved finish hardware schedule.

F. STORAGE: All hardware shall be stored in a locked storage space until ready for

installation. Hardware shall be protected against damage after application and during construction period.

1. 08 WARRANTY

A. All door hardware shall be supplied with the following warranties against defects in materials, and workmanship commencing with substantial completion of job:

1. SGT 351 Closer: Ten years.
2. SGT 8200 Lock: Ten years.
3. SGT 10L Lock: Seven years.
4. Marks 195 Series Ten years.
5. SGT 80 Series PH: Five years
6. SGT 30 Series PH: Three years.
7. Electromech. Hdwe: Two years.

B. One year warranty for the balance of listed hardware.

PART 2: PRODUCT:

2. 01 MANUFACTURERS

A. ACCEPTABLE MANUFACTURERS:

1. All materials or products specified herein shall be furnished AS SPECIFIED. Refer to Para. 1.02 SUBSTITUTIONS.
2. Any substitution request must be evaluated and approved by S.B.C.U.S.D Building Services management personnel.
3. Following are approved manufacturers which comprise the base bid:

PRODUCT	SPECIFIED MFRS	APPROVED MFRS
Hinge	McKinney	Stanley,Law
Cylindrical Locks	Marks	Sargent **FW10L**
Mortise Locks	Sargent	As Specified
Exit Device	Sargent	As Specified
Cylinder/Keying	Sargent	As Specified
Closer	Sargent	As Specified
Anti-Vandal Pull	Trimco	Sargent **AV**
Push/Pull/KP	Trimco	BBW,Quality
O.H. Stop	Sargent	As Specified
Door Stop	Trimco	BBW,Quality
Thresh/Seal	Pemko	Reese,Zero

2. 02 FASTENINGS

A. Furnish hardware with all necessary screws, bolts or other fastenings of suitable type and size to anchor the hardware in position for long life and heavy use. Fasteners shall include expansion shields, sex bolts, toggle bolts, or other approved anchors according to material to which it is applied and as recommended by the respective manufacturers.

1. Furnish Phillips flat-head screws except as otherwise indicated.

2. Thru-bolts to be furnished for closers, panic and overhead stops per district standard. Doors/frames are to be reinforced per Curries HM 08110 standard.
3. Hdwe applied to concrete shall be installed with RED-HED anchors.
4. **Self tapping** screws are <u>not permitted</u> in S.B.C.U.S.D work.

B. Design of all fastenings shall harmonize with hardware as to material and finish.

2. 03 HINGES

A. All hinges and pivots, including single and double acting types, pocket hinges, electric hinges and continuous aluminum geared hinges to be of one manufacturer as listed for continuity and consideration of warranty.

B. Unless otherwise specified, furnish three-knuckle exposed tip as specified; full mortise template type hinges with non-rising loose pins.

C. Out-swinging exterior doors to be furnished with anchor hinges of stainless steel or solid bronze with non-removable pins [NRP].

D. Interior doors to be furnished with wrought steel, polished and plated to match specified finish.

E. Furnish three [3] hinges up to 90 inches high and one [1] additional hinge for every 30 inches or fraction thereof.

F. Furnish standard weight hinges on doors up to 36 inches in width, and extra heavy weight on doors exceeding 36", or as indicated in the hardware schedule.

G. Furnish 4.5 x 4.5 inch for all 1-3/4 inch thick doors up to 36 inch wide, and 5 x 4.5 over 36 inch wide. Doors over 1-3/4 inch thru 2-1/4 inch thick, use 5 x 5 inch hinges.

H. Where required, furnish hinges of sufficient width to clear trim and/or permit the door to swing 180 degrees as required by the specific opening.

I. Furnish oil-impregnated bearing hinges at all doors.

2. 03B ELECTRIC HINGE

A. Provide electric hinges with ElectroLynx™ standardized plug connectors [QC Suffix] to accommodate up to twelve wires.

B. Plug connectors shall plug directly into ElectroLynx through-door wiring harnesses for connection to electric locking devices and power supplies.

C. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Add for two additional wires for future consideration.

D. Electric hinges shall be located at second hinge from bottom.

E. Provide mortar guard similar to McKinney MG-16 for each electric hinge specified.

2. 04 MORTISE LOCKS

A. All mortise locksets, panic, trim and cylinders to be of one manufacturer as listed for continuity of design and consideration of warranty.

B. Locksets shall be Sargent 8200 Series x LNL trim.

C. All lockset functions shall be manufactured in a single sized case formed from 12 gauge steel minimum. the case shall be closed on all sides and back. The lockset shall have a field-adjustable, beveled armored front, with a .125 inch thickness minimum. the lockset shall be 2 3/4 inch backset standard, with a one piece 3/4 inch throw anti-friction stainless steel latchbolt. The deadbolt shall be a full one inch throw made of stainless steel and have 2 hardened steel roller inserts.

D. Lever return springs shall be internal. Springs used for leveling and lever return shall not be located outside of the lock case. Return springs shall not be located in the exterior rose or trim.

E. Full lever retraction at only 30 degrees for ADA accommodation.

F. Handing shall be field reversible without opening the lock case.

G. Mortise locksets for labeled fire doors shall have a fusible link mechanism to prevent latchbolt retraction in case of fire.

H. Provide curve lip strikes with wrought boxes for all locks. Strikes shall be of sufficient length to protect trim or the inactive leaf of a pair of doors.

2. 05 CYLINDRICAL LOCKS

A. All cylindrical locks to be of one manufacturer as hereafter listed for continuity of design and consideration of warranty.

B. Locksets shall be Mark's 195 Survivor Series with 2-3/4" backset. Lockset's to be furnished with 10L tailpiece compatible with Sargent's 21-13-3266 Cylinder as listed.

C. Locksets and latches shall be heavy duty cylindrical type Grade 1. Latchbolts shall have minimum of ½ inch projection.

E. Lock and latchsets shall be constructed with thru-bolted design and independent spring cartridge system for lever stability and operation.

F. Provide 4-7/8” curve lip strikes with wrought boxes. Strikes shall be of sufficient length to protect trim or the inactive leaf of a pair of doors.

2. 06 EXIT DEVICES

A. All exit devices, lever trim, locksets and cylinders to be of one manufacturer as listed and in the hardware sets for continuity of design and consideration of warranty.

B. Exit devices shall be Sargent 80 Series x ETL and/or Anti-vandal trim as listed, except that 30 Series shall be furnished at utility doors and as listed.

C. Exit devices to be "UL" listed for life safety. All exit devices for labeled doors shall have "UL" label for "Fire Exit Hardware.” All devices mounted on labeled wood doors are to be thru-bolted or per the manufacturer's listing requirements. All devices to conform to NFPA 80 and 101 requirements.

D. All exit devices to be of a heavy duty, chassis mounting design, with one piece removable covers, eliminating necessity of removing the entire device from the door for standard maintenance.

E. All trim to be thru-bolted to the lock stile case.

F. Exit devices shall be push pad devices finished to match that of the locksets. Push pad to be high impact resistant black lexan with a maximum 3 inch projection.

G. Rail assemblies of all exit devices to be of solid stainless steel, as required in the hardware schedule.

H. Removable Mullions to be heavy duty steel 12-L980/L980S x Cylinder Latching.

I. **Refer to 3.02.A for CBC requirements.**

2. 07 CLOSERS

A. All closers to be the product of a single manufacturer for continuity of design and consideration of warranty.

B. Closers shall be Sargent 351 Series x P10/PH10/CPS/CPSH and as specified. Hold-open devices are not to be furnished at air-conditioned spaces.

C. Install door closers to achieve maximum door opening/swing.

D. Exterior closers to be furnished with delayed action [DA].

E. Closers shall be heavy duty, surface mounted, hydraulic type, with high strength cast case. Full rack and pinion constructed of heavy steel.

F. Size closers in accordance with the mr's recommendations at the work site.

G. Closers to have adjustable spring power, which allows for closer sizing. Closers to have separate tamper resistant, non-critical regulating screw valves for closing speed, latching speed and backcheck control as standard features.

H. Closer arms to be forged steel, interchangeable with all closers specified on this project for simplification of future Owner maintenance considerations.

I. Supply appropriate arm assembly for each closer so that closer body and arm are mounted on non-public side of door opening and on the interior side of exterior openings, except where otherwise detailed.

J. All closers to be rectangular, full cover type of non-ferrous, non-corrosive material painted to match lockset finish.

H. **Refer to 3.02.A for CBC requirements.**

2. 08 PUSH PLATES, DOOR PULLS AND KICKPLATES

A. All push plates, door pulls, kickplates and other miscellaneous hardware as listed in hardware sets.

B. Supply 18 [.050] GA. thick stainless steel, beveled 4 sides. Doors with louvers or narrow bottom rails, kickplate height to be 1 inch less than the dimension shown from the door bottom to the bottom of the louver or glass.
1. Kickplates to be 10 inches high and Mop plates to be 6 inches high, both by 2 inches or 1 inch less than the door width as specified.
2. Armor plates, edge guards and protective hardware to be supplied in sizes as scheduled in the hardware sets.

2. 09 DOOR STOPS

A. Door stops to be furnished for every door leaf. OH stops to be furnished when a wall and/or floor stop is unacceptable. Exterior outswing floor stops to be Trimco 1209HA. Exterior inswinging and interior stops to be Trimco 1214CK or 1270PV as dictated by opening conditions.

B. Install door stops in such a position that they permit maximum door swing, but do not present a hazard or obstruction. Floor stops must be installed within (4) four inches of the adjacent wall maximum, and within (4) inches from the strike edge of door.

C. Where overhead stops are specified, or otherwise required for proper door operation, they are to be heavy duty and of extruded brass or bronze with no plastic parts. No steel channels, arms, or brackets allowed.

2. 10 AUTOMATIC FLUSH BOLTS, COORDINATORS AND SILENCERS

A. Furnish automatic flushbolts with dust proof strikes and coordinators as detailed and/or as required in the respective hardware sets. Finish to match adjacent hardware.

B. Silencers to be furnished as follows:
   1. Three [3] each at single doors and two [2] each at pairs of doors.

2. 11 THRESHOLDS AND GASKETING

A. Supply materials and finishes as listed hardware sets. All thresholds must be in accordance with the requirements of the ADA and CBC.
   1. Furnish thresholds with machine screws and lead anchors. Furnish all necessary anchoring devices for gasketing and seal.
   2. Thresholds may require modification based on final drawings and frame/floor details.
   3. All listed thresholds to be verified with final construction drawings/elevations.
   4. Interior 20M rated opening thresholds to be omitted where detailed, unless dictated on plans.

2. 12 FINISH

A. Special care shall be taken to coordinate the finish of the various manufacturers to insure a uniform finish. This finish shall match the finish of the locksets.
   1. Plated hardware shall be **BHMA626 [US26D] or as detailed in US32**D.

B. Painted hardware items shall be lacquered to closely match plated hardware.

2. 13 KEYING

A. Furnish locks and exit devices requiring (6) six pin cylinders which comply with performance requirements of ANSI A156.5.

B. Exit Devices, mortise locks and cylinders to be supplied from the same manufacturer.

C. All cylinders and keys to be stamped per the district stamping requirements. Visual Key Control to consist of stamping cylinder plugs and all keys. **Review w/district**.

D. <u>It shall be the responsibility of the hardware supplier to request permanent keying information from the owner. The owner will provide keying information to a Door Security Solutions Representative for coordination</u>.

E. All locksets, exit devices, padlocks and cylinders to be furnished with existing Sargent restricted keyway [keyway to be identified by the district].
   1. **All locksets, panic devices and cylinders to be factory masterkeyed per District's direction**. Furnish key quantities per 2.13.H.

2. The contractor will be required to furnish temporary construction cylinders necessary to secure doors during the construction period.
3. The contractor will coordinate with the district locksmith for the installation of the permanent cylinders at the conclusion of construction. Installation labor by contractor under the supervision of the district locksmith.
4. All cylinders to be properly tagged to indicate intended locations.

F. Contractor will ensure that cylinders are coordinated under the masterkey system established for this project as dictated by the district.

G. Cylinders for non-Sargent locking components will be shipped loose to include: Marks, accordian, Adams-Rite, operable wall, rolling, sliding doors, and as listed and required in the work. Verify with respective manufacturer's required cylinder, and correct operating cam and/or tailpiece.
1. Prior to Marks lockset installation, Contractor will be responsible for the attachment of Marks' 10L Tailpieces to Sargent's 13-3266 Cylinders, and the installation of the complete cylinder to Marks' locksets.
2. Contractor shall add for labor to install permanent cylinders in locksets.

H. All Masterkeys shall be delivered to the District's designated representative via registered mail "Return Receipt Requested."

I. Supply keys in the following quantities:
1. Two thousand (2000) six-pin factory original nickel silver key blanks in the designated keyway.
2. Seventy (70) Master keys.
3. Four (4) change keys per lockset, panic, and cylinder.
4. Permanently inscribe each key with the Mfrs name and "Do Not Duplicate." Review stamping with District's Lockshop before entering factory P.O.

J. Furnish one (1) wall mounted steel key cabinet complete, similar to model AWS as manufactured by Telkee with a capacity of 125 percent of the number of locks required for project. Provide complete file and cross index file. All indexing and hanging of keys will be by the District. Deliver to the district lockshop.

K. Furnish two (2) complete pin kits [437C] x one thousand (1000) extra of each pin and driver size as required for the manufacturer's key system.

2. 14 PROPRIETARY PRODUCTS

A. Refer to Para 1.02. Unless otherwise approved, furnish only the specified products.

PART 3: EXECUTION

3. 01 INSPECTION

A. After installation has been completed, hardware supplier shall have a qualified Hardware Consultant [AHC] inspect project to determine the proper application of hardware according to the approved hardware and keying schedules.

1. Check operation and adjustment of all hardware items.
2. Recommended hardware adjustments shall be made by the Contractor/Installer.

3. 02 INSTALLATION

A. Installation of finish hardware is specified under other sections. However, the following requirements apply to the work as follows:

1. Hardware shall be installed by a QUALIFIED MECHANIC skilled in the application of institutional grade builders hardware.
2. Install all hardware in full compliance with MFR'S instructions. When cutting and fitting is required to install hardware onto or into surfaces which are to be painted or finished, install each item completely and then remove during application. After completion, re-install each item.
3. Care shall be exercised not to mar or damage adjacent work. Damaged work shall be repaired or replaced to the satisfaction of the Architect.
4. Provide ADEQUATE BACKING in stud partitions for the attachment of all respective finish hardware.
5. If door swing is changed from original drawings during construction, the contractor shall make necessary changes at no cost to the owner.
6. Latches and bolts shall be installed to automatically engage strikes, whether activated by closers or manual push. In no instance should unusual manual pressure be required to engage latch or bolt in strikes. Install locks with keyways in proper position, with levers, roses, and/or escutcheons firmly affixed. Adjust strikes after silencers and/or seal are in place.
7. Predrill pilot holes in wood for screws. Drill and tap for surface mounted hardware on metal. Set hinge leaf snug and flat in mortises, turn screws to flat seat [do not drive].
8. **Closers** are to have opening force adjusted so as to comply with current applicable accessibility requirements as follows: interior doors 5 pounds maximum pressure to operate; exterior doors 5 pounds maximum pressure; The Authority having Jurisdiction may increase the maximum effort to operate doors required to be fire rated to achieve positive latching, but in no case shall the pressure exceed 15 pounds per CBC 2001, Section 1133B.2.5. Door closers to comply with 1133B.2.5.1, closer delay time.
9. Door closers when provided then the sweep period of the closer shall be adjusted to so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3” from the latch, measured to the landing side of the door. Refer to 1133B2.5.1.
10. Mount closers and overhead stops/holders in accordance with the manufacturer's template for the degree of swing indicated on the drawings [180 degree swing where conditions allow].
11. <u>Floor stops must be installed within (4) four inches of the adjacent wall maximum, and within (4) inches from the strike edge of door</u> Policy 99-08.
12. Wall stops to have wall surfaces prepared and reinforced.All hardware shall meet the requirements of CBC Sections 1133B.2.1, 1133B.2.5.1 and 1003.3.1.8.
13. Door Sweeps and Seals to be installed with attachment screws placed

within a minimum of one [1] inch from the end of the seal and sweep.

14. Panic hardware shall comply with UBC standards 10-4 and shall be mounted between 36” and 44” above the finish floor surface.
15. The unlatching force shall not exceed 15# applied in the direction of travel. Panic devices shall comply with CBC Section 1003.3.1.9.
16. All hardware shall meet the requirements of CBC Sections 1133B.2.1, 1133B2.5.1 and 1003.3.1.8.

B. HARDWARE LOCATIONS: Review and verify mounting locations with the Architect before issuing templates and door/hardware purchase orders. Mounting height of latching hardware shall be 30” to 44” FF per CBC Section 1133B.2.5.1. The following hardware locations shall be adhered to unless modified by the Architect. Minor adjustments are permitted to meet specific door mfr’s standards.

1.	40 inches	Locksets, Panic Devices and Roller Latches-centerline of strike from bottom of frame.
2.	42 inches	Pull Plates-centerline of grip from bottom of frame.
3.	42 inches	Combination Push Bars-centerline from btm of frame.
4.	44 inches	Push Plates-centerline from bottom of frame.
5.	Hinges	Per manufacturer’s standard.

C. THRESHOLD AND PERIMETER SEAL:

1. Cut and fit thresholds to profile of door frames, with mitered corners and hairline joints.
2. On exterior doors, set thresholds in a bed of sealant.
3. Before installation, carefully read manufacturer's instructions to assure tight and contiguous seal at the perimeter and corners of doors and frames.
4. Specified thresholds are subject to modification. Review final elevations.
5. Thresholds shall comply with CBC Section 1133B.2.4.1.

3. 03 ADJUSTING AND CLEANING

A. At final completion, all hardware shall be left clean and free from disfigurement. Contractor shall make a final adjustment to all door closers and other items of hardware. Where hardware is found defective, repair or replace or otherwise correct as directed.

1. Following the activation of building heating and air conditioning system, the Contractor shall readjust all exterior and interior door closers.

B. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Adjust hardware so that moving parts operate freely, without bind, or excessive play. Hardware shall be free of paint, corrosion, or damage of any kind.

3. 04 PROTECTION

A. The General Contractor is responsible for the proper protection of all items of hardware until the owner accepts the project as complete.

3. 05 OWNER'S STOCK

A. Refer to 1.06 for close-out requirements.

B. Contractor/Installer to deliver all unused new and/or replaced finish hardware to the
district lockshop.

3. 06 MANUFACTURER'S ABBREVIATIONS OF LISTED HARDWARE:

[HES] HANCHETT
[MAR] MARKS
[MCK] MCKINNEY
[PEM] PEMKO
[RW] RICHARDS WILCOX
[SGT] SARGENT
[STA] STANLEY
[TRM] TRIMCO

NOTE: FURNISH TRIMCO 1270PV STOP@INTERIOR DOORS WHERE APPLICABLE.
NOTE: FURNISH 351-A/D x 125VF CLOSER BKTS AS REQUIRED.
NOTE: PANIC DEVICES REQUIRED@ALL REVERSE BEVEL EXTR DRS.
NOTE: SOME HARDWARE SETS MAY NOT BE USED IN THIS WORK.

Items listed in the following Finish Hardware Schedule shall conform to the specification. The last column in the hardware schedule refers to the manufacturer's abbreviation listed above.

3.07 HARDWARE SETS FIN MFR

HW1 **[EXTERIOR/*PAIR*/PANIC 8804/10/MULLION/690]**

EACH PAIR TO HAVE:

2 SET	ANCHOR HINGE	TA393 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	43-8804xTBxLESS TRIM	630	SGT
1 EA.	EXIT DEVICE	43-8810xTB	630	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	REM MULLION	L980SxCYL	600	SGT
2 EA.	PULL	1097HASP	630	TRM
2 EA.	CLOSER	351DA-P10xTB	689	SGT
2 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
2 EA.	OH STOP	690SxTB [690H@BLDG-K, DR.1]	626	SGT
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
2 EA.	SWEEP	18100CP	628	PEM
2 SET	SEAL	35041CP HD/JAMBS	628	PEM

- **FURNISH TA392 x 1209HA FLOOR STOPS WHERE CONDITIONS PERMIT.**

HW1.1 **[EXTERIOR/DE/PANIC SVR 14-8710/690]**

EACH D.E. TO HAVE:

2 SET	ANCHOR HINGE	TA393 5x4.5 NRP	626	MCK
2 EA.	EXIT DEVICE	43-14-8710xTB	630	SGT
2 EA.	CLOSER	351DA-P10xTB	689	SGT
2 EA.	KICKPLATE/GD	PG8002 10x2 LDW	630	TRM
2 EA.	OH STOP	690HxTB	626	SGT
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
2 EA.	SWEEP	18100CP	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

- **ASTRAGAL BY HM DOOR SUPPLIER.**

HW2 **[EXTERIOR/PANIC 8804]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	TA392 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	43-8804xTBxLESS TRIM	630	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	PULL	1096HASP	630	TRM
1 EA.	CLOSER	351DA-P10xTB [PH10@STUD.RESTRM]	689	SGT
1 EA.	COAT HOOK	3071@SGL OCCUP. RESTRM	626	TRM
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1209HA	630	TRM
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW2.1 **[EXTERIOR/PANIC 8804/690]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	TA393 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	43-8804xTBxLESS TRIM	630	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	PULL	1096HASP	630	TRM
1 EA.	CLOSER	351DA-P10xTB	689	SGT
1 EA.	COAT HOOK	3071@SGL OCCUP. RESTRM	626	TRM
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	OH STOP	690SxTB]	626	SGT
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

- **FURNISH TA392 x 1209HA FLOOR STOP WHERE CONDITIONS PERMIT.**

- **FURNISH 690H AT: STUDENT RESTROOMS AND BLDG-K, DRS.2, 3.**

HW3 **[EXTERIOR/PANIC 3828-04@UTILITY]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	TA392 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	3828-04xLESS TRIMxTB	PEN	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	PULL	1096HASP	630	TRM
1 EA.	CLOSER	351DA-PH10xTB	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1209HA	630	TRM
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW3.1 **[EXTERIOR/PANIC 30/690@UTILITY]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	TA393 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	3828-04xLESS TRIMxTB	PEN	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	PULL	1096HASP	630	TRM
1 EA.	CLOSER	351DA-P10xTB	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	OH STOP/HO	690HxTB	626	SGT
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

- **FURNISH TA392 x PH10 x 1209HA STOP WHERE CONDITIONS PERMIT.**

HW3.2 **[EXTERIOR/*PAIR*/PANIC 30/MULLION/690]**

EACH PAIR TO HAVE:

2 SET	ANCHOR HINGE	TA393 5x4.5 NRP	626	MCK
1 EA.	EXIT DEVICE	3828-04xLESS TRIMxTB	630	SGT
1 EA.	EXIT DEVICE	3828xTB	630	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	REM MULLION	L980SxCYL	600	SGT
1 EA.	PULL	1097HASP	630	TRM
2 EA.	CLOSER	351DA-P10xTB	689	SGT
2 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
2 EA.	OH STOP	690HxTB	626	SGT
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM

1 EA.	DRIP CAP	346C [OMIT@OVERHANG]	628	PEM
2 EA.	SWEEP	18100CP	628	PEM
2 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW4 **[EXTERIOR/*INSWING*/STORAGE 8206]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	STA792 5x4.5	652	MCK
1 EA.	LOCKSET	8206LNL	626	SGT
1 EA.	PULL	1097HA	630	TRM
1 EA.	CLOSER	351DA-HxTB	689	SGT
1 EA.	KICKPLATE	K0050 10x1 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW5 **[EXTERIOR/*INSWING*/PUSH-PULL/DOGGING 8292]**

EACH SGL TO HAVE:

1 SET	ANCHOR HINGE	STA792 5x4.5	652	MCK
1 EA.	LOCKSET	8292LNL	626	SGT
1 EA.	PULL	1097HA	630	TRM
1 EA.	CLOSER	351DA-0xTB	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
1 EA.	THRESHOLD	2/196Ax192AxWELD	628	PEM
1 EA.	SWEEP	18100CP	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW6 **[INTERIOR/PANIC 8813ETL]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA786E 4.5x4.5	652	MCK
1 EA.	EXIT DEVICE	43-8813ETLxTB	630	SGT
1 EA.	CLOSER	351-PH10xTB	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
3 EA.	SILENCER	1229A	GRM	TRM

HW6.1 **[INTERIOR/*RATED*/PANIC 12-8813ETL]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA786E 4.5x4.5	652	MCK
1 EA.	EXIT DEVICE	43-12-8813ETLxTB	630	SGT

1 EA.	CLOSER	351-P10xTB	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
1 EA.	THRESHOLD	2/196Ax191AxWELD@45M+	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW7 **[INTERIOR/STORAGE/CLOSER]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA714E 5x4.5	652	MCK
1 EA.	LOCKSET	195Fx1 0Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	CLOSER	351-CPSHxTB [H-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK@INSWG	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

HW7.1 **[INTERIOR/*RATED*/STORAGE]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA714E 5x4.5 [4.5 TO 36”]	652	MCK
1 EA.	LOCKSET	195Fx10Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	CLOSER	351-CPSxTB [0-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK@INSWG	626	SGT
1 EA.	THRESHOLD	2/196Ax191AxWELD@45M+	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW8 **[INTERIOR/*PAIR*/STORAGE/AFB/COORD]**

EACH PAIR TO HAVE:

6 EA.	HINGE	TA714E 4.5x4.5	652	MCK
1 EA.	LOCKSET	195Fx10Lx3/4”BOLTx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
2 EA.	AUTO FLUSHBOLT	3810/15x3911DPS	626	TRM
2 EA.	CLOSER	351-CPSHxTB [H-ARM@INSWG]	689	SGT
1 EA.	COORDINATOR	3094 [2/3090@CPSH]	600	TRM
2 EA.	KICKPLATE	K0050 10x1 LDW	630	TRM
2 EA.	STOP	1214CK@INSWG	626	TRM
1 EA.	ASTRAGAL	357SP	600	PEM
2 EA.	SILENCER	1229A	GR	TRM

HW8.1 **[INTERIOR/*PAIR*/*RATED*/STORAGE/AFB/COORD]**

EACH PAIR TO HAVE:

6 EA.	HINGE	TA714E 4.5x4.5	652	MCK

1 EA.	LOCKSET	195Fx10Lx3/4”BOLTx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
2 EA.	AUTO FLUSHBOLT	3810/15x3911DPS	626	TRM
2 EA.	CLOSER	351-CPSxTB [0-ARM@INSWG]	689	SGT
1 EA.	COORDINATOR	3094 [2/3090@CPS]	600	TRM
2 EA.	KICKPLATE	K0050 10x1 LDW	630	TRM
2 EA.	STOP	1214CK@INSWG	626	TRM
1 EA.	THRESHOLD	2/196Ax191AxWELD@45M+	628	PEM
1 EA.	ASTRAGAL	357SPx88T	600	PEM
2 EA.	SEAL	35041CP@JAMBS	628	PEM
1 EA.	SEAL	S88T@HEAD	TA	PEM

HW9 **[INTERIOR/OFFICE]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA714E 4.5x4.5	652	MCK
1 EA.	LOCKSET	195Sx10Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

HW9.1 **[INTERIOR/OFFICE/590]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA714E 4.5x4.5	652	MCK
1 EA.	LOCKSET	195Sx10Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	OH STOP/HO	590HxTB	626	SGT
3 EA.	SILENCER	1229A	GR	TRM

HW10 **[INTERIOR/COMMUNICATING]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA786E 4.5x4.5	652	MCK
1 EA.	LOCKSET	195DCx10Lx4-7/8 STK	626	MAR
2 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	CLOSER	351-CPSHxTB [PH10 W/APPL]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK@PH10	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

HW11 **[INTERIOR/CLASSRM/CLOSER]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA786E 4.5x4.5	652	MCK
1 EA.	LOCKSET	195Sx10Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	CLOSER	351-PH10xTB [H-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1214CK [OMIT@CPSH]	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

FURNISH CPSH ARM AT: BLDG-B, DR.19, BLDG-G, DR.19

HW11.1 **[INTERIOR/*RATED*/CLASSRM/RESTRM]**

EACH SGL TO HAVE:

3 EA.	HINGE	TA786E 4.5x4.5 [STA@RESTRM]	652	MCK
1 EA.	LOCKSET	195Sx10Lx4-7/8 STK	626	MAR
1 EA.	PERMANENT CYL	13-3266	619	SGT
1 EA.	CLOSER	351-P10xTB [0-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	MOP PLATE	KM050 6x1 LDW@RESTRM INSWG	630	TRM
1 EA.	STOP	1214CK	626	TRM
1 EA.	THRESHOLD	2/196Ax191AxWELD@45M+	628	PEM
1 SET	SEAL	35041CP HD/JAMBS	628	PEM

HW12 **[INTERIOR/PASSAGE]**

EACH SGL TO HAVE:

3 EA.	HINGE	STA714E 4.5x4.5	652	MCK
1 EA.	PASSAGE	195Nx4-7/8 STK	626	MAR
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	MOP PLATE	KM050 6x1 LDW@INSWG	630	TRM
1 EA	OH STOP	590SxTB	626	SGT
1 EA.	COAT HOOK	3071	626	TRM
1 SET	SD SEAL	332CR HD/JAMBS	628	PEM

HW13 **[INTERIOR/PRIVACY]**

EACH SGL TO HAVE:

3 EA.	HINGE	STA714E 4.5x4.5	652	MCK
1 EA.	PRIVACY LOCK	195Lx4-7/8 STK	626	MAR
1 EA.	CLOSER	351DA-CPSxTB [0-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	MOP PLATE	KM050 6x1 LDW@INSWG	630	TRM
1 EA.	STOP	1214CK [OMIT@CPS]	626	TRM
1 EA.	COAT HOOK	3071	626	TRM
1 SET	SD SEAL	332CR HD/JAMBS	628	PEM

HW14 **[INTERIOR/PUSH-PULL/DOGGING 8292@STUDENT RESTRM]**

EACH SGL TO HAVE:

3 EA.	HINGE	STA786E 4.5x4.5	652	MCK
1 EA.	LOCKSET	8292LNL	626	SGT
1 EA.	PULL	1097HA	630	TRM
1 EA.	PUSH	1001-11	630	TRM
1 EA.	CLOSER	351DA-P10xTB [0-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	MOP PLATE	KM050 6x1 LDW@INSWG	630	TRM
1 EA.	STOP	1214CK	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

HW14.1 **[INTERIOR/PUSH-PULL@ADM.RESTRM]**

EACH SGL TO HAVE:

3 EA.	HINGE	STA786E 4.5x4.5	652	MCK
1 EA.	PULL	1014-3B	630	TRM
1 EA.	PUSH	1001-11	630	TRM
1 EA.	CLOSER	351DA-P10xTB [0-ARM@INSWG]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	MOP PLATE	KM050 6x1 LDW@INSWG	630	TRM
1 EA.	STOP	1214CK	626	TRM
3 EA.	SILENCER	1229A	GR	TRM

HW15 **[<u>EXTERIOR</u>/PANIC 8804@GATE]**

EACH SGL GATE TO HAVE:

4 EA.	HINGE	BB855 5x6 WELDED	600	STA
1 EA.	EXIT DEVICE	43-36-16-8804xCPCxLESS TRIM	630	SGT
1 EA.	CYLINDER	34	626	SGT
1 EA.	PULL	1097HASPxSHS	630	TRM
1 EA.	CLOSER	36-351SRIxCPSHx351-D [PH10 W/APPL]	689	SGT
1 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
1 EA.	STOP	1209HA [OMIT@CPSH]	630	TRM

- **GATE SUPPLIER TO PROVIDE ADEQUATE STILE WIDTH FOR EXIT DEVICE.**
- **SECURITY MESH/SCREEN BY GATE SUPPLIER.**
- **HINGES TO BE DOUBLE COATED WITH ZINC BASED PRIMER.**

HW16 **[<u>EXTERIOR</u>/*PAIR*/PANIC 8804/10/MULLION@GATES]**

EACH PAIR GATE TO HAVE:

8 EA.	HINGE	BB855 5x6 WELDED	600	STA
1 EA.	EXIT DEVICE	43-36-16-8804xCPCxLESS TRIM	630	SGT
1 EA.	EXIT DEVICE	43-36-16-8810xCPC	630	SGT
1 EA.	CYLINDER	34	626	SGT
2 EA.	PULL	1097HASPxSHS	630	TRM

1 EA.	REM MULLION	BY GATE SUPPLIER	N/A	N/A
1 EA.	PADLOCK	758HSC	BR	SGT
2 EA.	CLOSER	36-351SRI-CPSHx351-D [PH10 W/APPL]	PC	SGT
2 EA.	KICKPLATE	K0050 10x2 LDW	630	TRM
2 EA.	STOP	1209HA [OMIT@CPSH]	630	TRM

- **GATE SUPPLIER TO FURNISH MULLION WITH HASP FOR LISTED PADLOCK.**
- **REMOVABLE MULLION TO BE SECURED IN CONCRETE/STEEL SLEEVE.**
- **GATE SUPPLIER TO PROVIDE ADEQUATE STILE WIDTH FOR EXIT DEVICE.**
- **SECURITY MESH/SCREEN BY GATE SUPPLIER.**
- **HINGES TO BE DOUBLE COATED WITH ZINC BASED PRIMER.**

HW17 **[EXTERIOR/PADLOCK@GATE]**

EACH GATE TO HAVE:

8 EA.	HINGE	BB855 5x6 WELDED@PAIR	600	STA
4 EA.	HINGE	BB855 5x6 WELDED @SGL	600	STA
1 EA.	PADLOCK	758HSC	BR	SGT
2 EA.	CANE BOLT	524-P23 [1 ONLY@SGL]	ZC	RW

- **HINGES TO BE DOUBLE COATED WITH ZINC BASED PRIMER.**
- **BALANCE OF HARDWARE BY GATE SUPPLIER.**

HW18 **[MISCELLANEOUS]**

1 EA.	CYLINDER	41/34 [VERIFY CYL W/MFR]	626	SGT

- **BAL OF HDWE BY OVERHEAD AND SPECIALTY DR SUPPLIERS.**

1 EA.	KEY CABINET	REFER TO KEYING SECTION 2.13	600	TEL
2 EA.	PIN KIT	REFER TO KEYING SECTION 2.13	600	SGT

- **REFER TO 2.13 FOR KEY BLANKS, KEY AND CYLINDER BARREL STAMPING, PINS AND MASTERKEYING OF CYLINDERS.**

- **ALL HDWE BY FREEZER AND REFRIGERATOR SUPPLIER.**

EXTRA HDWE TO BE DELIVERED TO THE S.B.C.U.S.D LOCKSHOP. CYLINDERS TO BE FURNISHED AS REQUIRED UNDER 2.13 KEYING:

1 EA.	EXIT DEVICE	43-8804xTBxLESS TRIM [VERIFY.SIZE]	630	SGT
1 EA.	EXIT DEVICE	3838-04xTB	PEN	SGT
1 EA.	LOCKSET	8206LNL	626	SGT
1 EA.	LOCKSET	8292LNL	626	SGT
1 EA.	LOCKSET	195Fx10L	626	MAR
1 EA.	LOCKSET	195Sx10L	626	MAR
1 EA.	PRIVACY	195L	626	MAR
1 EA.	PASSAGE	195N	626	MAR
2 EA.	CYLINDER	13-3266 [FOR MARKS]	619	SGT
1 EA.	CLOSER	351DA-UOxTB	689	SGT
1 EA.	CLOSER	351DA-P10xTB	689	SGT
4 EA.	STOP	1270PV	630	TRM
4 EA.	STOP	1214CK	626	TRM

[END OF SECTION]

SECTION 08800

GLASS AND GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass.

B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers: Sealant and back-up material.

B. Section 08110 - Steel Doors and Frames: Glazed doors and borrowed lites.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2009.

C. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.

D. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

E. ASTM C 1036 - Standard Specification for Flat Glass; 2006.

F. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.

G. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass; 2009.

H. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

I. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2008.

J. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2009.

K. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 2008.

L. GANA (LGDG) - Laminated Glazing Reference Manual; Glass Association of North America; 2009.

M. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 24, Glass and Glazing.

1.04 PERFORMANCE REQUIREMENTS

A. Select type and thickness of exterior glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with ASCE 7. Importance Factor, I, for wind loading shall equal 1.15.
   1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
   2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
   3. Thicknesses listed are minimum.

B. Source Quality Control:
   1. Tests: Materials for which physical characteristics have been stipulated shall have had such characteristics independently confirmed by laboratory tests employing industry recognized procedures. Both the laboratory performing the tests and the test methods

employed will be subject to the approval of the Architect.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of CBC Section 2403.1. Each light or pane shall bear manufacturer's etched label designating type, quality, grade, and thickness of glass. Identification of safety glazing in hazardous locations shall be in accordance with Section 2403.1.1.

1.06 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 8 x 8 inch (203 x 203 mm) in size of glass units.

E. Samples: Submit 2 inch (51 mm) long bead of glazing sealant, color as selected.

F. Manufacturer's Certificate: Certify that glass meets or exceeds specified requirements.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.08 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation.
   1. Comply with manufacturer's instructions for shipping, handling, storing and protecting glass and glazing materials.
   2. Protect glass and edge damage at all times during handling, installation and operation of the building.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.09 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Submit written warranty for a period of two years, agreeing to repair or replace glass and glazing materials which fail to perform as specified, including glass breakage and leakage of water, or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by manufacturer's data as an inherent quality of the material for the exposure indicated. Provide warranty signed by the glazier and Contractor.

C. Polycarbonate Sheet Glazing: Provide a five (5) year warranty to include coverage for breakage, coating failure, abrasion resistance, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

2.02 GLASS MATERIALS

A. Float Glass Manufacturers:
   1. AGC Flat Glass North America, Inc: www.afgglass.com.
   2. PPG Industries, Inc: www.ppgglazing.com.
   3. Guardian Industries Corp.
   4. Visteon Glass Systems: www.visteon.com/floatglass.
   5. Substitutions: Refer to Section 01600 - Product Requirements.

B. Float Glass: All glazing is to be float glass unless otherwise indicated.
   1. Annealed Type: ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. Heat-Strengthened and Fully Tempered Types: ASTM C 1048.
   3. Tinted Types: Color and performance characteristics as indicated.
   4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.

C. Clear Float Glass: Clear, annealed.
   1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
   2. 1/4 inch (6 mm) minimum thick.

D. Safety Glass: Clear; fully tempered.
   1. Laminated with 0.030 inch (0.76 mm) thick plastic interlayer; comply with ASTM C 1172.
   2. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select) and ASTM C 1048.
   3. Comply with 16 CFR 1201 test requirements for Category II.
   4. Where glazing is to be installed in fire-rated partition, provide glazing that is also fire-protection rated in accordance with applicable code.
   5. 1/4 inch (6 mm) minimum thick.
   6. Glass shall be cut to shape and size before tempering, and shall not be cut or trimmed after tempering. Lites not of proper shape and size shall not be used. Edges which will be exposed in the finished work shall be polished, other edges shall be seamed.
   7. Provide this type of glazing in the locations required by code.
      a. Glazed lites in doors except fire doors.
      b. Sliding glass doors.
      c. Glazed sidelights to doors.
      d. Exposed area of an individual pane greater than 9 square feet.
      e. Exposed bottom edge less than 18 inches above the floor.
      f. One or more walking surfaces within 36 inches horizontally of the plane of glazing.

E. Wired Glass: Clear.
   1. Stainless steel wire in diamond mesh pattern.
   2. 1/2 inch (12 mm) grid size.
   3. Comply with ASTM C 1036.
   4. Polished both sides.
   5. 1/4 inch (6 mm) thick.
   6. Provide this type of glazing in one hour fire rated corridors.

2.04 PLASTIC SHEET GLAZING MATERIALS

A. Polycarbonate Sheet: Ultraviolet stabilized.
   1. Type: Monolithic (single layer solid) sheet, 1/4" thickness.
   2. Silicone abrasion resistant coating for scratch resistance.
   3. Color: Dark Gray 135.
   4. Provide in all exterior windows with coated side on interior side of exterior lite. See Details

on Drawings.

B. Manufacturer:
   1. Sheffield Plastics; Makrolon MAK 15: www.sheffieldplastics.com.
   2. Substitutions: Refer to Section 01600 - Product Requirements.

2.05 GLAZING COMPOUNDS

A. Manufacturers:
   1. Bostik Inc: www.bostik-us.com.
   2. GE Plastics: www.geplastics.com.
   3. Pecora Corporation: www.pecora.com.
   4. BASF Construction Chemicals-Building Systems: www.chemrex.com.
   5. Substitutions: Refer to Section 01600 - Product Requirements.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25; color as selected by the Architect.

2.06 GLAZING ACCESSORIES

A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; size as recommended by manufacturer; black color.
   1. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Saint-Gobain Performance Plastics: www.plastics.saint-gobain.com.
      c. Substitutions: Refer to Section 01600 - Product Requirements.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; color as selected by the Architect.

E. Glazing Clips: Manufacturer's standard type.

2.07 SOURCE QUALITY CONTROL AND TESTS

A. Test samples in accordance with ANSI Z97.1.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings for glazing are correctly sized and within tolerance.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.02 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant.

D. Install sealants in accordance with ASTM C 1193 and FGMA Sealant Manual.

E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops, 3/16 inch (5 mm) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

F. Fill gap between glazing and stop withsealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

G. Apply cap bead ofsealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.04 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

D. Place glazing tape on free perimeter of glazing in same manner described above.

E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

F. Knife trim protruding tape.

3.05 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch (600 mm) intervals, 1/4 inch (6 mm) below sight line.

E. Fill gaps between pane and applied stop withsealant to depth equal to bite on glazing, to uniform and level line.

F. Trim protruding tape edge.

3.06 CLEANING

A. Remove glazing materials from finish surfaces.

B. Remove labels after Work is complete.

C. Clean glass and adjacent surfaces.

3.07 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass which is broken, chipped, cracked, scratched, or damaged in other ways during the construction period, including natural causes, accidents and vandalism.

END OF SECTION

SECTION 09206

METAL LATH

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lath for Portland cement and gypsum plaster.

B. Metal lath, paper backing, and accessories for interior and exterior portland cement and gypsum plaster.

C. Furring for metal lath.

D. Flexible membrane flashings.

E. Access panels.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 08310 - Access Doors and Panels: Product requirements for metal access panels integral with metal lath.

C. Section 09220 - Portland Cement Plaster.

D. Section - 09300 - Ceramic Tile.

E. Section 16500 - Lighting Fixtures: Product requirements for metal frames for recessed light fixtures.

1.03 REFERENCE STANDARDS

A. ASTM A 641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

B. ASTM C 841 - Standard Specification for Installation of Interior Lathing and Furring; 2003 (Reapproved 2008).

C. ASTM C 847 - Standard Specification for Metal Lath; 2010.

D. ASTM C 933 - Standard Specification for Welded Wire Lath; 2009.

E. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

F. ASTM C 1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster; 2008.

G. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

H. ASTM D 779 - Standard Test Method for Water Resistance of Paper; Paperboard, and Other Sheet Materials by the Dry Indicator Method.

I. ASTM D 903 - Peel or Stripping Strength of Adhesive Bonds.

J. ASTM E 96 - Water Vapor Transmission of Materials.

K. ASTM E 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

L. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

M. California Code of Regulations (CCR), Title 24, California Building Code (CBC):
   1. Section 2507, Lathing and Plastering.

N. Uniform Building Code (UBC) Standard 14-1, Kraft Waterproof Building Paper.

O. Federal Specifications: UU-B-790a, Building Paper, Vegetable Fiber: Kraft, Waterproofed.

P. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2009.

1.04 REGULATORY REQUIREMENTS

A. Inspection: Lath shall be inspected by Inspector of Record (I.O.R.) in accordance with CBC, Appendix Chapter 1 and Title 24, Part 1. No lath shall be covered until inspection is complete.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on furring and lathing components, structural characteristics, material limitations, and finish.

1.06 QUALITY ASSURANCE

A. Fire Rated Assemblies: Provide components complying with requirements for fire rated assemblies specified in Section 09220.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience.

1.07 COORDINATION

A. Coordinate work with installation of access panels specified in Section 08310.

PART 2 PRODUCTS

2.01 FRAMING MATERIALS

A. Cross Furring Channels: Cold-rolled steel, 0.3 lb./ft., minimum 0.020 inch (0.5 mm) thick, 3/8 inch (10 mm) deep x 3/4 inch (19 mm) high, splicing permitted; galvanized.

B. Main Runner Channels: Cold-rolled steel, 0.475 lb./ft., minimum 0.05 inch (1.2 mm) thick, 3/4 inch (19 mm) deep x 1-1/2 inch (38 mm) high, single piece, no splicing; galvanized.

C. Hangers: Steel wire, 8 gage (.128-inch) minimum size, galvanized.

D. Lateral Bracing: Formed steel, minimum 0.060 inch (1.5 mm) thick, size and length as required; galvanized.

2.02 LATH

A. Diamond Mesh Metal Lath: ASTM C 847, galvanized; self-furring.
   1. Weight: 3.4 lb/sq yd (1.8 kg/sq m).
   2. Galvanized.
   3. Product:
      a. Cemco Self-furring Expanded Metal Lath "3.4" by Cemco Expanded Metal Lath Products Company, City of Industry, CA.
      b. Dimpled Metal Lath by Western Metal Lath, Riverside, CA.
      c. Self-furred Diamond Mesh Lath by Amico, Fontana, CA.

B. High-Rib Metal Lath: ASTM C 847; 3/8 inch thick.
   1. Weight: 3.4 lb/sq yd (1.8 kg/sq m).
   2. Backed with treated paper.
   3. Galvanized.
   4. Product:
      a. Cem-Rib 3/8-inch Lath Paperbacked by Cemco.

b. 3/8" Spray Rib by Western Metal Lath.
c. Cal Spray Rib (3/8" High Rib) by Amico.

C. Welded-Wire Fabric Lath:
1. Welded Wire Fabric: 16 gauge zinc coated, galvanized; with 2 inch (50 mm) square openings, slot perforated separator paper backing, 1/4 furring crimps spaced 6 inch on center vertically, complying with ASTM C 841 and ASTM C 933[<>].

D. Corner Mesh: Welded wire right angle assembly with 2-1/2 inch flanges or nailing strips along both sides, conforming to Federal Specifications QQ-W-461g.
1. Product: Kwik Corner by K-Lath.
2. Product: CemCorner by Cemco.

E. Strip Mesh: General purpose expanded metal lath, same weight as lath, 4 inch (102 mm) wide x 24 inch (606 mm) long; galvanized.

F. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
1. Material: Formed galvanized sheet steel, expanded metal flanges.
2. Casing Beads: Square edges.
a. Product: No. 66 Expanded Flange Casing Bead manufactured by Cemco.
b. Product: X-66 Casing Bead manufactured by Amico.
3. Corner Beads: Radiused corners, 2-5/8 inch flange.
a. Product: No. 1A Expanded Corner Bead manufactured by Cemco.
b. Product: X-1 Corner Bead manufactured by Amico.
4. Expansion Control Joints: Double J design, 2-5/8 inch flange.
a. Product: Double J Expansion Joint (#XJ15) manufactured by Cemco.
b. Product: Expansion Control Joint manufactured by Amico.
5. Expansion Control Joints: Double V or M design, 2-5/8 inch flange.
a. Product: Double V Expansion Joint (#15) manufactured by Cemco.
b. Product: (M) Expansion Joint manufactured by Amico.
6. Adjustable Control Joints: Two-piece sliding type with reveal, 2 inch (50 mm) wide flanges, galvanized.
a. Product: Adjustable Control Joint (#40) manufactured by Cemco.
b. Product: 2-PC Expansion Control Joint manufactured by Amico.
7. Plaster Channel Screed: Plaster stop/control screed with reveal, unvented, aluminum.
a. Product: Plaster Channel Screed, PCS, manufactured by Stockton Products.
b. Product: Channel Screed manufactured by Flannery, Inc.
c. Product: FRY-PCS-75-400 manufactured by Fry Reglet.
8. 'F' Plaster Molding: Plaster stop/control screed with reveal, aluminum, painted.
a. Product: F Plaster Molding, FPM, manufactured by Stockton Products.
b. Product: FRY-FPM-75-100, manufactured by Fry Reglet.
9. Vent Screed: Vented channel screed with 1/8" x 1" vent slots, aluminum, painted.
a. Product: Plaster Channel Screed, PCS, vented, manufactured by Stockton Products.
b. Product: Vented Moldings by Flannery, Inc.
c. Product: FRY-PCS-75-V-200, manufactured by Fry Reglet Corp.
10. Soffit Drip Stop: Plaster screed for soffit and fascia terminations, 24 gauge galvanized steel, painted.
a. Product: Superior Soffit Corner, SSC, manufactured by Superior Metal Trim.
11. Foundation Sill Screed with Weep Holes:
a. Product: No. 7 Foundation Sill Screed manufactured by Cemco.
b. Product: FRY-FWS-875 manufactured by Fry Reglet.

2.03 ACCESSORIES

A. Access Panels: As specified in Section 08310.

B. Anchorage: Tie wire, nails, and other metal supports, of type and size to suit application; to rigidly secure materials in place, galvanized.

C. Fasteners: ASTM C 1002 self-piercing tapping screws.

D. Tie Wire: Annealed galvanized steel, minimum 18 gauge.

E. Flexible Membrane Flashing: 40 mil self-adhesive waterproof membrane composed of a self-sealings SBS modified asphalt core laminated to a cross-laminated, high-density polyethylene film reinforcement with a siliconized paper release sheet. Complies with International Code Council Evaluation Services Acceptance Criteria for Flashing Materials (AC 148) and ASTM D 412.
   1. Product: Fortiflash Waterproofing Flashing Membrane manufactured by Fortifiber Building Products, or accepted equal.
   2. Physical Properties:
      a. Roll widths: 4", 6", 9", 12", 18", and 36".
      b. Lap Adhesion - 10 lb.ft./inch (ASTM D 903).
      c. Mold Growth - 0 Fungal Growth (ASTM G 21).
      d. Puncture Resistance - 40 lbf. (ASTM E 154).
      e. Water Vapor Permeance - <0.05 perms (ASTM E 96).
      f. Water Resistance - >200 hours (ASTM D 779).

F. Weather-resistive Barrier: Water vapor permeable paper backing complying with Federal Specifications UU-B-790a, Building Paper, Type 1, Style 2, Grade D.
   1. Product: 60 Minute Super Jumbo Tex manufactured by Fortifiber Building Products, or accepted equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that substrates are ready to receive work and conditions are suitable for application.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 INSTALLATION - GENERAL

A. Install interior lath and furring in accordance with ASTM C 841.

B. Install lath and furring for portland cement plaster work in accordance with ASTM C 1063 and GA-600.

C. Apply all lath with the long dimension at right angles to supports, unless otherwise specified.

D. Use corner beads to protect all external corners and to establish grounds. Attach them to substrate so as to ensure proper alignment during application of plaster.

E. Install all metal accessories in such a manner that flanges and clips provided for their attachment are completely embedded in the plaster.

F. Control Joints - Install expansion and contraction (control) joints in walls, ceilings, and soffits as shown on the drawings, or if not shown, at intervals that will divide the surface area into approximately 200 square foot sections.

G. Isolate, with casing beads non-load bearing partitions from load bearing members, to avoid transfer of structural loads to partitions.

3.03 WALL FURRING

A. Install furring channels horizontally; secure with fasteners on alternate channel flanges at maximum 24 inches (600 mm) on center.

B. Space furring channels maximum 16 inches (400 mm) on center, and not more than 4 inches (100 mm) away from floor and ceiling lines.

3.04 CEILING AND SOFFIT FURRING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

G. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

H. Laterally brace suspension system.

3.05 ACCESS PANELS

A. Install access panels and rigidly secure in place.

B. Install frames plumb and level in opening. Secure rigidly in place.

C. Position to provide convenient access to concealed work requiring access.

3.06 FLEXIBLE MEMBRANE FLASHING INSTALLATION

A. Install in accordance with manufacturer's published installation instructions and ICC ES Report No. ESR-1591.

B. Wood surfaces shall be clean, dry, and free of contaminants that may adversely affect adhesion.

C. Apply flexible membrane flashing around all windows, doors, and mechanical openings in exterior walls, extending the flashing into the full depth of the framed wall.

D. Apply flashing to top of parapet walls, wrapping the entire width of the wall assembly.

E. Overlap joints a minimum of 4 inches.

F. Overlaps shall run with the flow of water in a shingling manner to prevent water entry.

3.07 WEATHER-RESISTIVE BARRIER INSTALLATION

A. Install weather-resistive barrier in accordance with UBC Standard 14-1. Barrier shall be applied horizontally, with upper layer overlapping lower layer by a minimum of 2 inches, and all vertical joints shall be lapped a minimum of 6 inches. Apply 2 layers.

3.08 LATH INSTALLATION

A. Apply metal lath taut, with long dimension perpendicular to supports. Lath shall be furred out from vertical supports or backing not less than 1/4 inch.

B. Lap ends minimum 1 inch (25 mm). Secure end laps with tie wire where they occur between supports.

C. Lap sides of diamond mesh lath minimum 1-1/2 inches (38 mm).

D. Nest outside ribs of rib lath together.

E. Attach metal lath to wood supports using nails or approved fasteners at maximum 6 inches on center.

F. Attach 3/8" high rib lath to horizontal supports in accordance with CBC, Sections 2507.3. Secure lath to each support with 1/2" wide by 1 1/2" long, No. 9 (W&M) gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches from edge of each sheet and spaced a maximum of 27-inches on center along each support..

G. Attach metal lath to metal supports using tie wire at maximum 6 inches (150 mm) on center.

H. Attach metal lath to concrete using wire hair pins. Attach anchors to backup surface; space at maximum 24 inches (600 mm) on center.

I. Lath shall not be continuous through control joints but shall be stopped and tied at each side. Weather-resistive barrier shall be continuous through joint.

J. Continuously reinforce internal angles with corner mesh, except where the metal lath returns 3 inches (75 mm) from corner to form the angle reinforcement; fasten at perimeter edges only.

K. Place corner bead at external wall corners; fasten at outer edges of lath only.

L. Place base screeds at termination of plaster areas; secure rigidly in place.

M. Place 4 inch (100 mm) wide strips of metal lath centered over junctions of dissimilar backing materials. Secure rigidly in place.

N. Place lath vertically above each top corner and each side of door frames to 6 inches (150 mm) above ceiling line.

O. Place casing beads at terminations of plaster finish. Butt and align ends. Secure rigidly in place.

P. Place additional strip mesh diagonally at corners of lathed openings. Secure rigidly in place.

Q. Provide a 26 gage, galvanized weep screed with vertical attachment flange of 3 1/2 inches at or below the foundation plate line on all exterior stud walls. The screed shall be placed a minimum of 4 inches above earth or 2 inches above paved areas. Provide screed that will allow trapped water to drain to exterior of building.

3.09 TOLERANCES

A. Maximum Variation from True Lines and Levels: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from True Position: 1/8 inch (3 mm).

END OF SECTION

SECTION 09220

PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement plaster for installation over metal lath.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood stud framing for plaster.

B. Section 08310 - Access Doors and Panels: Access panels.

C. Section 09206 - Metal Lath: Metal furring and lathing for plaster and access panels.

D. Section 09300 - Tile

E. Section 09900 - Painting: Painting exterior plaster.

1.03 REFERENCE STANDARDS

A. ASTM C 150 - Standard Specification for Portland Cement; 2007.

B. ASTM C 206 - Standard Specification for Finishing Hydrated Lime; 2003.

C. ASTM C 926 - Standard Specification for Application of Portland Cement-Based Plaster; 2006.

D. PCA EB049 - Portland Cement Plaster/Stucco Manual; Portland Cement Association; 2003.

E. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 25, Gypsum Board and Plaste.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.

C. Samples: Submit two samples, 8 x 8 inch (203 x 203 mm) in size illustrating finish colors and texture.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C 926.

B. Conform to applicable code for fire rated assemblies as indicated on drawings.
   1. Coordinate components of fire rated assemblies with materials specified for support of plaster in other sections.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original, unopened packages or containers with manufacturers label intact and legible. Store packaged materials in a dry, protected, area.

1.07 MOCK-UP

A. Construct mock-up of exterior wall, eight feet (2.4 m) long by eight feet (2.4 m) wide, illustrating surface finish, control joints, and reveals.

B. Locate where directed.

C. Mock-up when accepted by the Architect may remain as part of the Work. Mock-up when not accepted by the Architect must be removed from site.

1.08 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F (10 degrees C) or over 80 degrees F (27 degrees C).

B. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) during installation of plaster and until cured.

PART 2 PRODUCTS

2.01 PLASTER MATERIALS

A. Portland Cement, Aggregates, and Other Materials: In accordance with ASTM C 926.

B. Portland Cement: ASTM C 150, Type I.

C. Lime: ASTM C 206, Type S.
   1. Chemstar Type S Lime manufactured by Chemical Lime Company or equal.

D. Aggregate: In accordance with ASTM C 926.

E. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

F. Premixed Finish Coats: LaHabra Premix Exterior Stucco Coat manufactured by LaHabra Products, Inc., or approved equal. Provide two colors as selected by Architect from manufacturer's standard color palette.

G. Fog-Coat: LaHabra Fog Coat DXT.

2.02 METAL LATH

A. Metal Lath and Accessories: As specified in Section 09206.

B. Beads, Screeds, and Joint Accessories: As specified in Section 09206.

2.03 PLASTER MIXES

A. General: Conform to recommendations of ASTM C 926 and CBC Table 2507.2.

B. Premixed Plaster Materials: Mix in accordance with manufacturer's instructions. Use mechanical mixer free of hardened materials.

C. Scratch Coat over metal lath:
   1. One part Portland cement.
   2. Minimum 3/4 and maximum 1 part hydrated lime.
   3. Minimum 2-1/2 and maximum 4 parts aggregate, per sum of cementitious materials.

D. Brown Coat: Same as scratch coat, except minimum 3 parts and maximum 4-1/2 parts aggregate.

E. Finish Coat:
   1. One part portland cement.
   2. Minimum 3/4 and maximum 1-1/2 parts lime.
   3. 3 parts sand, per sum of cementitious materials.
   4. Integral color agent.

F. Mix only as much plaster as can be used prior to initial set.

G. Mix materials dry, to uniform color and consistency, before adding water.

H. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

I. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the suitability of existing conditions before starting work.

B. Metal Lath and Accessories: Verify lath is flat, secured to substrate, and joint and surface perimeter accessories are in place.

C. Mechanical and Electrical: Verify services within walls have been tested and approved.

3.02 PREPARATION

A. Dampen surfaces to reduce excessive suction.

3.03 PLASTERING

A. Apply plaster in accordance with ASTM C 926.

B. Comply with CBC Section 2511 for interior plaster and Section 2512 for exterior plaster.

C. Machine apply plaster in accordance with ASTM C 926.

D. Three-Coat Application Over Metal Lath:
   1. Apply first coat (scratch) to a thickness of 3/8 inch (9 mm). Apply first coat with sufficient material and pressure to form full keys through, and to embed the metal base, and with sufficient thickness of material over the metal to allow for scoring the surface.
   2. Apply second coat (brown) to a thickness of 3/8 inch (9 mm). Apply second coat with sufficient material and pressure to ensure tight contact with the first coat and to bring the combined thickness of the basecoat to 3/4 inches. Bring the surface of the second coat to a true, even plane with a rod or straightedge, filling surface defects in plane with plaster. Float the surface uniformly to promote densification of the coat and to provide a surface receptive to bonding of the finish coat.
   3. Apply factory-prepared third (finish) coat to a thickness of 1/8 inch (3.2 mm). Apply third coat with sufficient material and pressure to ensure tight contact with, and complete coverage of the basecoat and to the thickness of 7/8 inch.

E. Apply brown-coat immediately following initial set of scratch-coat. Allow sufficient time between coats to permit each coat to cure or develop enough rigidity to resist cracking or other physical damage when the next coat is applied.

F. Moist cure base coat for 48 hours. Provide sufficient moisture to permit continuous hydration of the cementitious materials. Fog the surface with water at the start and again at the end of the work day. During hot, dry, windy weather, moisten the plaster surface and cover it with a single sheet of polyethylene plastic (weighted or taped down) to prevent water loss through evaporation. Allow base coat to cure for at least seven days.

G. After curing, dampen base coat prior to applying finish coat. Do not moist cure finish coat. Allow 28 days for curing.

H. Finish Texture: Float finish coat to a consistent sand finish.

I. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

3.04 FOG COAT

A. Apply colored fog coat over entire wall surface (or as directed by the Architect) to achieve uniform color throughout in the following areas:
   1. Areas where patching has occurred.
   2. Areas where stop/start of finish coat of plaster are dissimilar in color.
   3. Areas where water has stained the finish coat surface.

4. Areas of excessive cracks in the surface.

3.05 PAINTING

A. All plaster shall be primed and painted in accordance with Section 09900.

B. Color: Architect will select minimum of two colors, unless noted otherwise on the Drawings. For bidding purposes, bids shall be based 70 percent of surface area for lighter tone and 30 percent of surface area for darker tone (accent color).

3.06 ADJUSTING AND CLEANING

A. Remove plaster and protective materials from adjacent surfaces. Cut out and patch defective plaster.

B. Completely clean all expansion joint slots of any adhered plaster materials.

END OF SECTION

SECTION 09260

GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shaft wall system.

B. Fire rated assemblies.

C. Acoustic insulation.

D. Gypsum wallboard.

E. Joint treatment and accessories.

F. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Building framing and sheathing.

B. Section 07212 - Batt Insulation: Acoustic insulation.

C. Section 07900 - Joint Sealers: Acoustic sealant.

D. Section 09300 - Tile.

1.03 REFERENCE STANDARDS

A. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).

B. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).

C. ASTM C 557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2009).

D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2009a.

E. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.

F. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2009a.

G. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2008.

H. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

I. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2009.

J. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2009a.

K. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010.

L. California Building Code (CBC), California Code of Regulations, Title 24, Chapter 7, Fire-Resistive Materials and Construction.

M. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association; 2007.

N. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2010.

O. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2008.

P. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2009.

Q. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

R. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

C. Product Data: Provide data on gypsum board, accessories, and joint finishing system.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches (300 by 300 mm) in size, illustrating finish color and texture.

1.05 QUALITY ASSURANCE

A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

B. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five years of documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire rated assemblies as follows:
   1. Fire Rated Partitions: Listed assembly by UL, No. U305; 1 hour rating.
   2. Fire Rated Ceiling: Listed assembly by CBC, Table 7-C, Item No. 21-1.1; 1 hour rating.
   3. Fire Rated Structural Column Framing: Listed assembly by UL, No. X524; 1 hour rating.
   4. Fire Rated Structural Beam Framing: Listed assembly by CBC, Table 7-A, Item No. 2-4.1; 2 hour rating.
   5. Fire Rated Structural Beam Framing: Listed assembly by UL, No. N501; 1 hour rating.
   6. Fire Rated Shaft Wall Requirements: Listed assembly by UL, No. U497; 2 hour rating.
   7. Fire Rated Area Separation Wall Requirements: Listed assembly by UL, No. 301; 2 hour rating.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C 840 and GA-216.

2.02 METAL FRAMING MATERIALS

A. Shaft Wall Studs and Accessories: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754.

B. Shaftwall Duct (Grease Duct) Assemblies and Accessories: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 and specified performance requirements.
   1. I-Stud, non-load bearing, non-combustible, 0.020" (.058 mm) minimum thickness, meeting ICBO ES, ER-3579.
   2. J-Track, 0.020" and 0.329".
   3. Product: I-Stud Cavity Shaftwall System manufactured by National Gypsum Company.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. Georgia-Pacific Gypsum LLC: www.gp.com/gypsum.
   2. National Gypsum Company: www.nationalgypsum.com.
   3. USG Corporation: www.usg.com.
   4. Substitutions: See Section 01600 - Product Requirements.

B. Gypsum Wallboard: ASTM C 1396/C 1396M. Sizes to minimize joints in place; ends square cut.
   1. Regular Type:
      a. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
      b. Thickness: 5/8 inch (16 mm).
      c. Edges: Tapered.
   2. Fire Resistant Type: Complying with Type X requirements; UL or WH rated.
      a. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
      b. Application: Use for vertical surfaces and ceilings at fire rated assemblies.
      c. Thickness: 5/8 inch (16 mm).
      d. Edges: Tapered.
   3. Ceiling Board: Special sag-resistant type.
      a. Application: Ceilings and interior soffits, unless otherwise indicated.
      b. Thickness: 5/8 inch (16 mm).
      c. Edges: Tapered.

C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M; ends square cut.
   1. Application: Vertical surfaces on toilet room walls and behind service sinks, drinking fountains, water heaters; and, vertical surfaces at fire rated assemblies requiring Type X moisture resistant gypsum board.
   2. Core Type: Regular and Type X.
   3. Thickness: 5/8 inch (16 mm).
   4. Edges: Tapered.

D. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (610 mm) wide, beveled long edges, ends square cut.
   1. Paper Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C 1396/C 1396M; water-resistant faces.

E. Gypsum Shaftwall or Coreboard: ASTM C 1396/C 1396M; Type X core; sizes to minimize joints in place; 1 inch (25 mm) thick; double beveled edges, ends square cut.

2.04 ACCESSORIES

A. Acoustic Insulation: As specified in Section 07212.

B. Acoustic Sealant: As specified in Section 07900.

C. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.

D. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
   2. Ready-mixed vinyl-based joint compound.

E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application when used in lieu of skim coat in achieving Level 5 finish.
   1. Product: USG Texture XII Drywall Surfacer, manufactured by USG.

F. Textured Finish Materials: Latex-based compound; plain.
   1. Product: Proform Brand Perfect Spray EM/EF- Orange Peel , manufactured by National Gypsum.

G. Screws: ASTM C 1002; self-piercing tapping type, for application of gypsum board to wood or steel studs.

H. Screws: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.

I. Moldings: No. FDM-625-75, 'F' Reveal Molding by Fry Reglet Corp.

J. Anchorage to Substrate: Screws of type and size to suit application; rigidly secure materials in place using 1 1/4 inch Type W bugle head screws when fastening gypsum board to wood framing, 1 1/8 inch Type S when attaching to steel stud, and 1 1/4 inch Type S for fire rated construction.

K. Adhesive for Attachment to Concrete Curbs: ASTM C 557.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Verify that framing is accurately aligned and spaced and that walls and partitions are straight and true without protrusions of blocking, bridging, or twisted studs. Verify that ceilings are level. Notify the Architect of any defects prior to installation of gypsum board.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

B. Shaft Wall Liner: Cut panels to accurate dimension and install sequentially between special friction studs.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install as follows:
   1. Place two beads continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

3.04 BOARD INSTALLATION

A. Comply with ASTM C 840 and GA-216. Install to minimize butt end joints, especially in highly visible locations.

B. Treat cut edges and holes in moisture resistant gypsum board with sealant.

C. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Installation on Metal Framing: Use screws for attachment of all gypsum board.

F. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For non-rated assemblies, install as follows:

1. Single-Layer Applications: Adhesive application.

G. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

I. Attachment to Concrete Curbs: Apply adhesive according to manufacturer's instructions and apply gypsum board directly to curb where detailed.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Corner Beads: Install at external corners, using longest practical lengths.

B. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C 840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Finish all gypsum board in accordance with GA-214 Level 5.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.

E. Spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Spray apply high build drywall surfacer or skim coat joint compound over entire surface after joints have been properly treated to achieve Level 5 finish.

3.07 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample. Texture shall be orange peel unless otherwise noted, or, where wall covering is indicated.

3.08 ADJUSTING AND CLEANING

A. Remove gypsum wallboard and accessory materials from project and sweep clean all areas affected. Repair any damaged or unacceptable surfaces.

END OF SECTION

SECTION 09300

CERAMIC TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceramic tile (mortar bed) for floor applications.

B. Ceramic tile (thin-set) for wall applications.

C. Wall accent tiles.

D. Ceramic trim.

E. Non-ceramic trim.

F. Waterproofing membranes.

1.02 RELATED SECTIONS

A. Section 04810 - Unit Masonry Assemblies.

B. Section 07900 - Joint Sealers.

C. Section 03300 - Cast-In-Place Concrete.

D. Section 09220 - Portland Cement Plaster: Lath and portland cement scratch coat, where required by TCA Method specified.

E. Section 09260 - Gypsum Board Assemblies:

F. Section 09301 - Porcelain Tile.

G. Section 09302 - Quarry Tile.

1.03 REFERENCES

A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2005.
   1. ANSI A108.01 - General Requirements: Subsurfaces and Preparations by Other Trades.
   2. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2005.
   3. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).
   4. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).
   5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (R2005).
   6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (R2005).
   7. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (R2005).
   8. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005.
   9. ANSI A118.1 - American National Standard Specifications for Dry-Set Portland Cement Mortar; 1999 (R2005).
   10. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).

11. ANSI A118.4 - American National Standard Specifications for Latex-Portland Cement Mortar; 1999 (R2005).
12. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 1999 (R2005).
13. ANSI A118.11 - American National Standard Specifications for EGP (Exterior glue plywood) Latex-Portland Cement Mortar; 1999 (R2005).
14. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 1988.

B. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM C 144 - Specification for Aggregate for Masonry Mortar.

D. ASTM C 150 - Specification for Portland Cement.

E. ASTM C 207 - Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C 241 - Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.

G. ASTM C 503 - Specification for Marble Building Stone.

H. ASTM C 1028 - Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method.

I. TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of North America, Inc.; 2007.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on membranes, tile, mortar, grout, and accessories. Include instructions for installing membranes and grouts.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches (450 x 450 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

A. Maintain one copy of TCA Handbook and ANSI A108 Series/A118 Series on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

1.06 MOCK-UP

A. See Section 01400 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up, incorporating all components specified for the location.
   1. Minimum size of mock-up shall be 4 feet by 8 feet.
   2. Mock-up when accepted by the Architect may remain as part of the Work. Mock-up when not accepted by the Architect must be removed from the Work.
   3. Wall accent tile mock-up may not remain as part of the Work.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation.
   1. Deliver manufactured materials in original sealed containers with manufacturer's name, brand and grade seals affixed or sealed within per ANSI/TCA A137.1.
   2. Keep materials dry until used.
   3. Store and protect products in dry, secure areas.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and substrate temperature between 60 degree F to 90 degrees F during installation of mortar and grout materials.

1.10 WARRANTY

A. Submit a written warranty, executed by the contractor, Installer, and Manufacturer, agreeing to repair or replace tile that fails in materials or workmanship for a period of two years after date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Maintenance Stock: At time of completing the installation, deliver stock of maintenance material to the District. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.
   1. Provide 3% additional tile and trim shapes of each type, color, pattern and size used in the work for District's use in replacement and maintenance. Package securely to prevent damage and label clearly. Provide minimum of one full sealed carton.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. Dal-Tile, Dallas TX: www.daltile.com.

B. Ceramic Mosaic Tile: ANSI A137.1, and as follows:
   1. Keystones manufactured by Dal-tile.
   2. Coefficient of Friction: Slip resistant, ASTM C 1028, greater than or equal to 0.60, wet.
   3. Moisture Absorption: 0 to 0.5 percent.
   4. Size and Shape: 2 inch square (50 mm square).
   5. Edges: Cushioned.
   6. Surface Finish: Unglazed.
   7. Colors: To be selected from manufacturer's standard range. Provide two colors, with 50% of the tile from price group 2, and 50% from price group 4, unless otherwise noted on the drawings. Architect to provide pattern during review of shop drawings.
   8. Mounted Sheet Size: 12 x 24 inches.

C. Glazed Wall Tile: ANSI A137.1, and as follows:
   1. Semi-gloss manufactured by Dal-Tile.
   2. Moisture Absorption: Over 7.0 but less than 20.0 percent.
   3. Size and Shape: 4-1/4 inch (108 mm) square and 6 inch (152 mm) square.
   4. Edges: Cushioned.
   5. Surface Finish: Semi-gloss.
   6. Colors: To be selected from manufacturer's standard range. Provide two colors, with 50% of

the tile from price group 2, and 50% from price group 3, unless otherwise noted on the drawings.

7. Pattern: Architect to provide pattern during review of shop drawings, unless otherwise noted.

D. Unglazed Porcelain Tile (Wall Accent Tile): ANSI A137.1, and as follows:
   1. Product: Dal-Tile Porcealto.
   2. Moisture Absorption: 0 to 0.5 percent.
   3. Size and Shape: 12 inches (450 mm) square, nominal.
   4. Edges: Cushioned.
   5. Surface Finish: Unglazed, coefficient of friction equal to or exceeding 0.6 wet.
   6. Colors: To be selected from manufacturer's standard range.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching bullnose, surface bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
   1. Applications: Use in the following locations:
      a. Open Edges: Bullnose.
      b. Inside Corners: Jointed.
      c. Floor to Wall Joints: Cove base.
   2. Manufacturer: Same as for tile.

B. Non-Ceramic Trim: Stainless steel, style and dimensions to suit application.
   1. Applications: Use in the following locations:
      a. Expansion and control joints at floors.
   2. Manufacturer:
      a. Schluter-Systems: www.schluter.com.
         1) Product: Schluter DILEX-EDP

C. Thresholds: Marble, white or gray, honed finish; 4 inches (101 mm) wide by full width of wall or frame opening; 1/2 inch (12 mm) thick; beveled one long edge at 1:2 slope with radiused corners on top side; without holes, cracks, or open seams. Meet ASTM C 503 and meet a minimum abrasion resistance of 12 per ASTM C 241.
   1. Applications: Provide at the following locations:
      a. At doorways where tile terminates.
      b. At open edges of floor tile where adjacent finish is a different height.

2.03 MORTAR MATERIALS

A. Mortar Bed Materials: ANSI A108.1A, A108.1B, A108.1C
   1. Portland Cement: ASTM C 150, Type 1.
   2. Hydrated Lime: ASTM C 207, Type S.
   3. Sand: ASTM C 144, fine sand.
   4. Water: Clean and potable
   5. Latex mortar additive as recommended by the manufacturer.

B. Epoxy Mortar Bond Coat Materials:
   1. High temperature, chemical-resistant, 100% solids epoxy mortar meeting ANSI A118.3 requirements, and authorized by the USDA for incidental food contact. Use for floor and wall applications.
   2. Acceptable Manufacturers:
      a. 100% Solids Epoxy Mortar by Custom Building Products, Seal Beach, CA.
      b. Kerapoxy (AM) by Mapei Corporation, San Bernardino, CA.
      c. Mer-Krete 400 Epoxy Mortar by Mer-Krete Products, Inc.
      d. Substitutions: See Section 01600 - Product Requirements.

2.04 GROUT MATERIALS

A. Epoxy Grout: ANSI A118.3, modified epoxy emulsion grout, 100% solids, color as selected; use

for floor and wall applications.
1. Acceptable Manufacturers:
   a. 100% Solids Epoxy Grout by Custom Building Products.
   b. Kerapoxy (AM) by Mapei Corporation.
   c. Mer-Krete 420 Epoxy Grout by Mer-Krete Products, Inc.
   d. Latapoxy 2000 Industrial Epoxy Grout by Laticrete International, Inc., Bethany, CT.
   e. Substitutions: See Section 01600 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Waterproof Membrane: Two part elastomeric or liquid rubber and reinforcing fabric, cold applied membrane complying with ANSI A118.10.
   1. Acceptable Manufacturers:
      a. RedGard by Custom Building Products.
      b. Laticrete 9235 by Laticrete International, Inc.
      c. Mapelastic HPG by Mapei Corp.
      d. HydroGuard One by Mer-Krete Products, Inc.

B. Reinforcing Mesh: 2 x 2 inch (50 x 50 mm) size weave of 16/16 wire size; welded fabric, galvanized. Comply with ASTM A 185 except for minimum wire size.

C. Flexible Mortar System: Combination acrylic latex admixture and dry-set mortar complying with ANSI A118.4 and ANSI A118.11. For use with wall accent tile over CMU or plaster.
   1. Product: Kerabond + Keralastic by Mapei Corporation.

D. Mesh Tape: 2-inch (50 mm) wide self-adhesive fiberglass mesh tape.

E. Joint Sealer: Section 07900 - Joint Sealers, provide at joints where tile meets dissimilar materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within 1/4 inch in 10'-0" for mortar bed applications, 1/8 inch in 10'-0" for thin-set applications, and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within 1/4 inch in 10'-0", are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
   2. Alkalinity: pH range of 5-9.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Comply with requirements of ANSI A108.01.

B. Protect surrounding work from damage.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler.

E. Prime substrate when required by manufacturer.

3.03 INSTALLATION - GENERAL

A. Install mortar, grout, tile and thresholds in accordance with applicable requirements of ANSI,

manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings. Extend tile into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions.

C. Cut and fit tile to penetrations through tile so that cover plates, collars, and escutcheons overlap tile. Form corners and bases neatly. Align floor, base, and wall joints. Carefully grind edges of tile abutting built-in items.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles coved and external angles bullnosed.

F. Install expansion joints in accordance with manufacturer's instructions.

G. Install thresholds where indicated in accordance with TCA TR611..

H. Keep control joints free of grout. Install control joints in accordance with manufacturer's instructions.

I. Allow tile to set for a minimum of 48 hours prior to grouting.

J. Grout tile joints. Use epoxy grout.

K. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - MORTAR BED METHOD

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F121 and F132, with epoxy mortar bond coat and epoxy grout.

B. Waterproof Membrane:
   1. Provide waterproofing membrane, install in accordance with manufacturer's written instructions, ANSI A108.13, and TCA Handbook Method F121, with epoxy mortar and grout.
   2. Pre-treat all substrate cracks, cold joints, corners, and penetrations according to manufacturer's recommendations.
   3. Flash waterproofing up adjacent walls in accordance with manufacturer's details, to a height of 5 inches.
   4. Test waterproofing prior to commencing the tile installation.

C. Thick Bed Method - Horizontal surfaces: ANSI 108.1A and ANSI 108.6.
   1. Apply slurry bond coat approximately 1/16 inch thick to substrate surface using flat trowel.
   2. Place thick bed mortar (1-1/2 inch thick nominally) onto slurry bond coat while coat is still wet and tacky.
   3. Spread prepared mortar approximately one-half desired bed thickness and then lay reinforcing mesh. Lap wire 3 inches and place additional mortar on top of wire to bring bed to required thickness.
   4. Rod and compact mortar with steel trowel.
   5. Before placing tiles on green or wet screed bed, apply epoxy slurry bond coat approximately 1/16 inch thick to mortar using flat trowel.
   6. Apply mortar skim coat to back of each tile or sheet of tile immediately prior to placing on bed.
   7. Place tiles in wet slurry coat before surface dries maintaining uniform joints.
   8. After each tile or sheet of tiles is laid, beat tile with wooden block or rubber mallet to level surface and embed tiles.
   9. Perform beating before mortar takes initial set.
   10. Pitch surface to drain where required.
   11. Sound tiles after setting. Replace hollow sounding tiles.
   12. Clean excess mortar from surface of tile with wet cheese cloth (not a sponge) while mortar is fresh.

3.05 INSTALLATION - WALL TILE - THIN-SET METHOD

A. General:
   1. Apply epoxy mortar bond coat with notched trowel using scraping motion to work material in to good contact with surface to be covered. Maintain 90 percent coverage on back of tile and fully bed all corners.
   2. Trowel small quantity of mortar onto back of each tile or sheet of tiles.
   3. Set tiles in place and rub or beat with small beating block.
   4. Beat or rap tile to ensure proper bond and also to level surface of tile.
   5. Align tile to show uniform joints and allow to set until firm.
   6. Sound tile after setting. Replace hollow sounding tiles.

B. Over tile backer board on wood or metal studs install in accordance with TCA Handbook Method W245, Thin-set, with epoxy mortar bond coat and epoxy grout. Conform to requirements of ANSI 108.6.

3.06 INSTALLATION - WALL ACCENT TILE

A. On exterior plaster or CMU walls, install wall accent tiles in accordance with TCA Handbook Method W211, using acrylic latex admixture and specially prepared dry-set mortar and latex-portland cement grout. Conform to requirements of ANSI A108.5 and ANSI A108.10.

3.07 GROUTING

A. Floor and Walls:
   1. Allow tiles to set a minimum of 48 hours before grouting.
   2. Install in accordance with grout manufacturer's recommendations and ANSI A108.6.
   3. Pack joints full and free before mortar takes initial set.
   4. Cure after grouting for a minimum of 72 hours.
   5. Install sealant where tile meets dissimilar materials.

3.08 CLEANING

A. Clean excess grout from tile surfaces with wet cheese cloth. Do not use hydrosponges. Leave finished installation free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

3.09 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 7 days after installation.

B. Cover floor tile with a non-staining, vapor proof paper or membrane.

END OF SECTION

SECTION 09302

QUARRY TILE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Quarry tile for floor applications.

B. Quarry trim.

C. Non-tile trim.

D. Waterproofing membrane.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 09300 - Ceramic Tile.

C. Section 09301 - Porcelain Tile.

1.03 REFERENCES

A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 1999.
   1. ANSI A108.01 - General Requirements: Subsurfaces and Preparations by Other Trades.
   2. ANSI A108.1A - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 1999.
   3. ANSI A108.1B - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar; 1999.
   4. ANSI A108.1C - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar; 1999.
   5. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999.
   6. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 1999.
   7. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 1999.
   8. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 1999.
   9. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 1988.

B. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM C 144 - Specification for Aggregate for Masonry Mortar.

D. ASTM C 150 - Specification for Portland Cement.

E. ASTM C 207 - Specification for Hydrated Lime for Masonry Purposes.

F. ASTM C 241 - Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic.

G. ASTM C 503 - Specification for Marble Building Stone.

H. ASTM C 1028 - Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method.

I. TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of America, Inc.; 2004.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on membranes, tile, mortar, grout, and accessories. Include instructions for installing membranes and grouts.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, and setting details.

D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches (450 x 450 mm) in size illustrating pattern, color variations, and grout joint size variations.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.05 QUALITY ASSURANCE

A. Maintain one copy of TCA Handbook and ANSI A108 Series/A118 Series on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 15 years of documented experience.

C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience and approved by the manufacturer.

D. Material Certificates: Provide Master Grade Certificates for each shipment of quarry tile signed by the tile manufacturer and Installer.

1.06 MOCK-UP

A. See Section 01400 - Quality Requirements, for general requirements for mock-up.

B. Construct tile mock-up, incorporating all components specified for the location.
   1. Minimum size of mock-up shall be 4 feet by 8 feet.
   2. Approved mock-up may remain as part of the Work.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation.
   1. Deliver manufactured materials in original sealed containers with manufacturer's name, brand and grade seals affixed or sealed within per ANSI/TCA A137.1.
   2. Keep materials dry until used.
   3. Store and protect products in dry, secure areas.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

1.10 WARRANTY

A. Manufacturer's Warranty: Submit for the District's acceptance, manufacturer's standard warranty document executed by authorized company official.

1.11 EXTRA MATERIALS

A. Maintenance Stock: At time of completing the installation, deliver stock of maintenance material to the District. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.
   1. Provide 3% additional tile and trim shapes of each type, color, pattern and size used in the work for District's use in replacement and maintenance. Package securely to prevent damage and label clearly. Provide minimum of one full sealed carton.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturer: All products by the same manufacturer.
   1. Dal-Tile Corporation, Dallas, TX: www.daltile.com.
   2. Substitutions: See Section 01600 - Product Requirements.

B. Quarry Tile: ANSI A137.1, and as follows:
   1. QuarryTile manufactured by Dal-Tile.
   2. Coefficient of Friction: Slip resistant, ASTM C 1028, greater than or equal to 0.73, wet.
   3. Moisture Absorption: 0.5 to 3.0 percent.
   4. Size and Shape: 6 inch square (150 mm square).
   5. Thickness: 1/2 inch (13 mm).
   6. Edges: Cushioned.
   7. Surface Finish: Unglazed.
   8. Colors: To be selected from manufacturer's standard range, price group 2.
   9. Pattern: As noted on the drawings.

2.02 TRIM AND ACCESSORIES

A. Quarry Trim: Matching bullnose, surface bullnose, double bullnose, and cove base shapes in sizes coordinated with field tile.
   1. Applications: Use in the following locations:
      a. Open Edges: Bullnose.
      b. Inside Corners: Coved.
      c. Floor to Wall Joints: Cove base. Provide 5 " high base
   2. Manufacturer: Same as for tile.

B. Non-tile Trim: Stainless steel, style and dimensions to suit application, for setting using tile mortar.
   1. Applications: Use in the following locations:
      a. Open edges of floor tile.
      b. Expansion and control joints.
   2. Manufacturer:
      a. Schluter-Systems: www.schluter.com.
         1) Product: Schluter DILEX-EDP

C. Thresholds: Marble, white or gray, honed finish; 4 inches (101 mm) wide by full width of wall or frame opening; 1/2 inch (12 mm) thick; beveled one long edge at 1:2 slope with radiused corners on top side; without holes, cracks, or open seams. Meet ASTM C 503 and meet a minimum abrasion resistance of 12 per C 241.
   1. Applications: Provide at the following locations:
      a. At doorways where tile terminates.

2.03 MORTAR MATERIALS

A. Mortar Bed Materials: ANSI A108.1A
   1. Portland Cement: ASTM C 150, Type 1.
   2. Hydrated Lime: ASTM C 207, Type S.
   3. Sand: ASTM C 144, fine sand.

4. Water: Clean and potable.

B. Epoxy Mortar Bond Coat Materials:
1. High temperature, chemical-resistant, 100% solids epoxy mortar meeting ANSI A118.3 requirements, and authorized by the USDA for incidental food contact.

C. Acceptable Manufacturers:
1. 100% Solids Epoxy Mortar by Custom Building Products, Seal Beach, CA.
2. Kerapoxy (AM) by Mapei Corporation, San Bernardino, CA.
3. Mer-Krete 400 Epoxy Mortar by Mer-Krete Products, Inc.
4. Substitutions: See Section 01600 - Product Requirements.

2.04 GROUT MATERIALS

A. Epoxy Grout: ANSI A118.3, modified epoxy emulsion grout, 100% solids, color as selected; use for floor applications.

B. Acceptable Manufacturers:
1. 100% Solids Epoxy Grout by Custom Building Products.
2. Kerapoxy (AM) by Mapei Corporation.
3. Mer-Krete 420 Epoxy Grout by Mer-Krete Products, Inc.
4. Latapoxy 2000 Industrial Epoxy Grout by Laticrete International, Inc., Bethany, CT.
5. Substitutions: See Section 01600 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Waterproofing Membrane: Two part elastomeric or liquid rubber and reinforcing fabric, cold applied membrane complying with ANSI A118.10.
1. Acceptable Manufacturers:
a. RedGard by Custom Building Products.
b. Laticrete 9235 by Laticrete International, Inc.
c. Mapelastic HPG by Mapei Corp.
d. HydroGuard One by Mer-Krete Products, Inc.

B. Reinforcing Mesh: 2 x 2 inch (50 x 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.

C. Mesh Tape: 2-inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding of setting materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
2. Alkalinity: pH range of 5-9.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Comply width ANSI A108.01.

B. Protect surrounding work from damage.

C. Vacuum clean surfaces and damp clean.

D. Seal substrate surface cracks with filler.

3.03 INSTALLATION - GENERAL

A. Install mortar, grout, tile and thresholds in accordance with applicable requirements of ANSI, manufacturer's instructions, and TCA Handbook recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings. Extend tile into recesses and under or behind equipment and fixtures, to form a complete covering without interruptions.

C. Cut and fit tile to penetrations through tile so that cover plates, collars, and escutcheons overlap tile. Form corners and bases neatly. Align floor and base joints. Carefully grind edges of tile abutting built-in items.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.

E. Form internal angles coved and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Keep control joints free of grout. Install control joints in accordance with manufacturer's instructions.

I. Grout tile joints. Use epoxy grout.

J. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - MORTAR BED METHOD

A. Over interior concrete substrates, install in accordance with TCA Handbook Method F121 and F132, with waterproof membrane, epoxy mortar bond coat, and epoxy grout.

B. Waterproof Membrane:
   1. Install waterproof membrane in accordance with manufacturer's written instructions and ANSI A108.13.
   2. Flash waterproofing up adjacent walls in accordance with manufacturer's details, to a height of 5 inches.
   3. Flood test waterproof membrane after fully cured.

C. Thick Bed Method, Horizontal Surfaces: ANSI A108.1A and A108.6.
   1. Apply slurry bond coat approximately 1/16 inch thick to substrate surface using flat trowel.
   2. Place thick bed mortar (1-1/2 inch thick nominally) onto slurry bond coat while coat is still wet and tacky.
   3. Spread prepared mortar approximately one-half desired bed thickness and then lay reinforcing mesh. Lap wire 3 inches and place additional mortar on top of wire to bring bed to required thickness.
   4. Rod and compact mortar with steel trowel.
   5. Before placing tiles on green or wet screed bed, apply slurry bond coat approximately 1/16 inch thick to mortar using flat trowel.
   6. Apply mortar skim coat to back of each tile or sheet of tile immediately prior to placing on bed.
   7. Place tiles in wet slurry coat before surface dries maintaining uniform joints.
   8. After each tile or sheet of tiles is laid, beat tile with wooden block or rubber mallet to level surface and embed tiles.
   9. Perform beating before mortar takes initial set.
   10. Pitch surface to drain where required.
   11. Sound tiles after setting. Replace hollow sounding tiles.
   12. Clean excess mortar from surface of tile with wet cheese cloth (not a sponge) while mortar

is fresh.

D. Grouting:
   1. Allow tiles to set a minimum of 48 hours before grouting.
   2. Install in accordance with grout manufacturer's recommendations and ANSI A108.6.
   3. Pack joints full and free before mortar takes initial set.
   4. Cure after grouting for a minimum of 72 hours.

3.05 CLEANING

A. Clean excess grout from tile surfaces with wet cheese cloth. Do not use hydrosponges. Leave finished installation free of cracked, chipped, broken, unbonded, or otherwise defective tile work.

3.06 PROTECTION OF FINISHED WORK

A. Do not permit traffic over finished floor surface for 7 days after installation.

B. Cover floor tile with a non-staining, vapor proof paper or membrane.

END OF SECTION

SECTION 09505

ACOUSTICAL TILE CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical tile units.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Wood framing for suspended ceiling system.

B. Section 08310 - Access Doors and Panels: Access panels.

C. Section 09260 - Gypsum Board Assemblies: Suspended ceiling system.

D. Section 16722 - Fire Alarm: Fire alarm components in ceiling system.

E. Section 15855 - Diffusers, Registers and Grills: Air diffusion devices in ceiling.

F. Section 16500 - Lighting Fixtures: Light fixtures in ceiling system.

1.03 REFERENCES

A. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 1998.

B. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 25, Gypsum Board and Plaster.

1.04 DESIGN REQUIREMENTS

A. CHP Low-Emitting Materials Table: Materials submitted for acoustical tile ceilings must be listed as low emitting on the CHPS website, www.CHPS.net, or must be tested by an independent laboratory to meet CHPS Section 01350. All components of an assembly must meet Section 01350 individually or in an assembly.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on acoustical units.

D. Samples: Submit two samples 4 x 4 inch (101 x 101 mm) in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during, and after installation.
   1. Deliver materials to job site in original unopened containers with labels intact stating manufacturer's name, style, lot number, and other pertinent data.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary

to the approval of the Architect and at no additional cost to the District.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.09 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.10 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 2 percent of total acoustical tile area of each type of acoustical tile for use in maintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01600 - Product Requirements.

B. Acoustical Tile: Painted mineral fiber, ASTM E 1264 Type IV, with the following characteristics:
   1. Size: 12 x 12 inches (300 x 300 mm).
   2. Thickness: 3/4 inches (19.05 mm).
   3. Composition: Wet-formed mineral fiber.
   4. Light Reflectance: 83 percent, determined as specified in ASTM E 1264.
   5. NRC Range:.65, determined as specified in ASTM E 1264.
   6. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E 1264.
   7. Joint: Concealed spline.
   8. Edge: Square K4C4.
   9. Surface Color: White.
   10. Surface Pattern: Directional fissured.
   11. Flame Spread: 0-25 (ASTM E 84), Class A.
   12. Smoke Rating: 20
   13. Product: Natural Fissured, No. 554 by Armstrong.

2.02 SUSPENDED CEILING SYSTEM

A. Suspended gypsum wallboard and wood framed ceiling system as detailed on the drawings.

B. Acoustical ceiling tiles per this Section.

2.03 ACCESSORIES

A. Vinyl Trim Moldings: White vinyl with mitered ends for trimming light fixture openings.

B. Wall Springs: Manufacturer's standard.

C. Perimeter Moldings: Same material and finish as grid.
   1. At Concealed Grid: Provide concealed molding.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that suspended wood framing and gypsum wallboard ceiling is ready to receive acoustical tile.

C. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - WOOD FRAMING

A. Install wood framing as shown on the drawings complying with CBC Section 2504.2 for horizontal wood furring strips.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

3.04 ERECTION TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09511

SUSPENDED ACOUSTICAL PANEL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical panels.

1.02 RELATED REQUIREMENTS

A. Section 08310 - Access Doors and Panels: Access panels.

1.03 REFERENCE STANDARDS

A. ASTM A 641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

B. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2009b.

C. ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

D. ASTM E 580/E 580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2009a.

E. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.

F. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.

G. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

H. ASCE 7-05 - American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures.

1.04 DESIGN REQUIREMENTS

A. CHP Low-Emitting Materials Table: Materials submitted for acoustical panel ceilings must be listed as low emitting on the CHPS website, www.CHPS.net, or must be tested by an independent laboratory to meet CHPS Section 01350. All components of an assembly must meet Section 01350 individually or in an assembly.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 4 x 4 inch (101 x 101 mm) in size illustrating material and finish of acoustical units.

E. Samples: Submit two samples each, 6 inches (152 mm) long, of suspension system main runner, cross runner, and perimeter molding.

F. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the

products specified in this section with minimum fifteen years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Metal ceiling suspension systems used primarily to support acoustical tile or other types of lay-in panels shall be designed and installed in accordance with ASTM C 635, ASTM C 636, and DSA IR 25-5.

B. Ceiling grid system and components shall conform to a valid evaluation report issued by a qualified evaluation agency in accordance with DSA IR A-5, and shall meet the requirements of CBC Section 1614A.1.12 and ASCE 7-05, Section 13.5.6.

1.08 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during, and after installation.
   1. Deliver materials to job site in original unopened containers with labels intact stating manufacturer's name, style, lot number, and other pertinent data.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Architect and at no additional cost to the District.

1.09 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.10 PROJECT CONDITIONS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Install acoustical units after interior wet work is dry.

1.11 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 2 percent of total acoustical unit area of each type of acoustical unit for District's use in maintenance of project.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. Substitutions: See Section 01600 - Product Requirements.

B. Acoustical Units - General: ASTM E 1264, Class 1.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly the suspension system is a part of.

C. Acoustical Panels: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
   1. Size: 24 x 24 inches (600 x 600 mm) and 24 x 48 inches.
   2. Thickness: 5/8 inches (15 mm).
   3. Composition: Fiberglass.
   4. Light Reflectance: 72 percent, determined as specified in ASTM E 1264.
   5. NRC Range: 70, determined as specified in ASTM E 1264.

6. Edge: Square.
7. Surface Color: White.
8. Surface Pattern: Random Fissured Unperforated.
10. Fire Rating: Class A.
11. Product: No. 2910 by Armstrong.

D. Acoustical Panels: Plastic faced mineral fiber, ASTM E 1264 Type IV, with the following characteristics:
1. Size: 24 x 48 inches (600 x 1200 mm).
2. Thickness: 3/4 inches (19 mm).
3. Composition: Wet-formed mineral fiber.
4. Light Reflectance: 79 percent, determined as specified in ASTM E 1264.
5. NRC Range: 55, determined as specified in ASTM E 1264.
6. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E 1264.
7. Edge: Square.
8. Surface Color: White.
9. Flame Spread: 25 or under (UL Labeled), Class 1
10. Product: Clean Room Mylar, Nos. 1715 and 1716 Field Units, and Nos. 1720 and 1721 Border Units by Armstrong.

2.02 SUSPENSION SYSTEM(S)

A. Suspended acoustical ceiling system shall conform to a valid evaluation report issued by a qualifiied evaluation agency in accordance with DSA IR A-5, and shall meet the requirements of CBC Section 1614A.1.12 and ASCE 7-05, Section 13.5.6.

B. Manufacturers:
1. Armstrong World Industries, Inc.: www.armstrong.com.
   a. Product: Armstrong Seismic Rx Suspension System with BERC-2 clip; ICC-ES ESR-1308.
2. Chicago Metallic Corporation,: www.chicagometallic.com.
   a. Product: 1200 System with "stake-on end" clip; ICC ES ER-1905.
3. USG Interiors/Donn: www.usg.com.
   a. Product: DXW System; ICC ES ESR 1222.

C. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

D. Exposed Steel Suspension System: Formed electrogalvanized steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face, 1 1/2 inch web height.
2. Construction: Double web.
3. Finish: White baked polyester finish.
4. Product:
   a. Prelude XL System with XL7301 Main Runner, XL7328 and XL7341 Cross Tees by Armstrong.
   b. 1200 System with 200 Main Runner, 1204 and 1226 Cross Tees, by Chicago Metallic.
   c. DXW System with DXW-26 Main Runner, DXW-224 and DXW-424 Cross Tees by USG/Donn.

E. Fire-Rated Exposed Steel Suspension System: Formed electrogalvanized steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
2. Construction: Double web.
3. Fire Rating: Listed and classified for use in a 1 hour fire-resistive assembly.
4. Finish: White baked polyester finish.
5. Product:
   a. Prelude XL Fire Guard with XL8301 Main Runner, XL8323 and XL8341 Cross Tees, by Armstrong.

b. Fire Front 1250 System with 270 Main Runner, 1252 and 1274 Cross Tees, by Chicago Metallic.
c. DXW System with DXW-26 Main Runner, DXW-224 and DXW-424 Cross Tees by USG/ Donn.

2.03 ACCESSORIES

A. Support Channels, Hangers, and Seismic Clips: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Gypsum Board: Fire rated type; 5/8 inch (15 mm) thick, ends and edges square, paper faced.

D. Compression Struts: As detailed on the drawings.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Comply with regulatory codes and Division of the State Architect (DSA) Interpretation of Regulations Document IR 25-2, Metal Suspension Systems for Lay In Panel Ceilings.

B. #12 gage wire shall be 0.106 inches in diameter conforming to ASTM A 641. #12 gage wire shall be soft annealed, galvanized steel wire with a class 1 coating.

C. #12 gage (minimum) hanger wires shall be used for up to and including 4'-0" x 4'-0" grid spacing and shall be attached to main runners.

D. Provide #12 gage hanger wires at the ends of all main and cross runners within eight inches of the support or within one-fourth of the length of the end tee, whichever is least, for the perimeter of the ceiling area.

E. Provide trapeze or other supplementary support members at obstructions to typical hanger spacing. Trapeze suspension shall be constructed of back-to-back 1 1/2 inch cold rolled channels for spans up to six feet. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Hanger wires that are more than 1 (horizontal) in 6 (vertical) out of plumb shall have counter-sloping wires. Wires shall not attach to or bend around interfering material such as duct work.

F. Ceiling grid members shall be attached to two (2) adjacent walls per ASCE 7-05, Section 13.5.6.2(b). Ceiling grid members shall be at least 3/4 clear of other walls. If walls run diagonally to ceiling grid system runners, one end of main and cross runners shall be free, and a minimum of 3/4" clear of wall.

G. The width of the perimeter supporting closure angle shall be not less than 2 inches.

H. At the perimeter of the ceiling area where main or cross runners are not connected to the adjacent wall, provide interconnection between the runners at the free end to prevent lateral spreading. A metal strut or a #16 gage wire with a positive mechanical connection to the runner shall be used. Wall trim angle shall not provide primary support for runners.

I. Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors with lobbies or other similar areas.

J. Provide lateral-force bracing assemblies consisting of a compression strut and four (4) #12 gage splayed bracing wires oriented 90 degrees from each other at a spacing not more than 12 feet by 12 feet on center.

K. Provide bracing assemblies at locations not more than one-half (1/2) the calculated spacing in each direction from each perimeter wall and at the edges of any change in elevation of the ceiling.
   1. Bracing assemblies shall be spaced at a maximum of 12 feet by 12 feet on centers.
   2. The maximum slenderness ratio (kL/R) of the compression strut shall be 200 or less.

L. The slope of bracing wires shall not exceed 45 degrees from the plane of the ceiling and shall be taut. Splices in bracing wires are not permitted.

M. Compression struts shall not be more than 1 (horizontal) in 6 (vertical) out of plumb.

N. For ceiling areas exceeding 2500 square feet a seismic separation joint shall be provided to divide the ceiling into areas not exceeding 2500 square feet.

O. Penetrations through the ceiling for sprinkler heads and other similar devices that are not integrally tied to the ceiling system in the lateral direction shall have a two (2) inch oversized ring, sleeve or adapter through the ceiling tile to allow free movement of one (1) inch in all horizontal directions.

P. Fasten #12 hanger wires not less than three (3) tight turns. Fasten #10 or #12 bracing wires with four (4) tight turns. Make all tight turns within a distance of 1-1/2 inches. Hanger or bracing wire anchors to the structure should be installed in such a manner that the direction of the wire aligns as closely as possible with the direction of the forces acting on the wire.

Q. Separate all ceiling hanging and bracing wires at least six (6) inches from all unbraced ducts, pipes, conduit, etc.

R. When drilled-in concrete anchors or shot-in anchors are used in reinforced concrete for hanger wires, 1 out of 10 wire/anchor assemblies must be field tested for 200 lbs. in tension. When drilled-in concrete anchors are used for bracing wires, 1 out of 2 wire/anchor assemblies must be field tested for 440 lbs. in tension in the direction of the wire. Shot-in anchors in concrete are not be permitted for bracing wires. If any shot-in or drilled-in anchors fail, additional testing shall be conducted in accordance with CBC.

S. Attach all light fixtures and ceiling mounted air terminals or services, to the ceiling grid runners to resist a horizontal force equal to the weight of the fixtures. Screws or approved fasteners are required.

T. Flush or recessed light fixtures weighing less than 56 lbs. and mechanical terminals and services, weighing less than 20 lbs., may be supported directly on the runners of a heavy duty grid system, but, in addition, they must have a minimum of two (2) #12 gage slack safety wires attached to the fixture at diagonal corners and anchored to the structure above. All 4' x 4' light fixtures must have slack safety wires at each corner.
   1. All flush or recessed light fixtures weighing 56 lbs. or more and mechanical terminals and services, weighing 20 lbs. or more, must be independently supported by not less than four (4) taut #12 gage wires, each attached to the fixture and to the structure above regardless of the type of ceiling grid system used.
   2. The four(4) taut #12 gage wires, including their attachment to the structure above, must be capable of supporting four (4) times the weight of the unit.

U. Support surface mounted light fixtures by at least two positive devices which surround the ceiling runner and which are each supported from the structure above by a #12 gage wire. Spring clips or clamps that connect only to the runner are not acceptable.
   1. Provide additional supports when light fixtures are 8 feet or longer. Maximum spacing between supports shall not exceed 8 feet.

V. Support pendant mounted light fixtures directly from the structure above with hanger wires or

cables passing through each pendant hanger and capable of supporting two (2) times the weight of the fixture. A bracing assembly is required where the pendant hanger penetrates the ceiling.

W. The ceiling grid system shall be rated as heavy duty as defined by ASTM C 635.

X. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

Y. Locate system on room axis according to reflected plan. Layout grid from centerlines of room.

Z. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

AA. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

AB. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.
2. Overlap and rivet corners.

AC. Install light fixture boxes constructed of gypsum board above light fixtures in accordance with fire rated assembly requirements and light fixture ventilation requirements.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
1. Cut to fit irregular grid and perimeter edge trim.
2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

END OF SECTION

SECTION 09650

RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete floor slab.

1.03 REFERENCES

A. ASTM C 109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

B. ASTM D 2047 - Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.

C. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2006a.

D. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2005.

E. ASTM F 1066 - Standard Specification for Vinyl Composition Floor Tile; 2004.

F. ASTM F 1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004.

G. ASTM F 1861 - Standard Specification for Resilient Wall Base; 2002.

H. ASTM F 1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2004.

I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2006.

1.04 DESIGN REQUIREMENTS

A. CHP Low-Emitting Materials Table: Materials submitted for resilient flooring must be listed as low emitting on the CHPS website, www.CHPS.net, or must be tested by an independent laboratory to meet CHPS Section 01350. All components of an assembly must meet Section 01350 individually or in an assembly.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plan.

D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

E. Verification Samples: Submit two samples, 9 x 9 inch (229 x 229 mm) in size illustrating color and pattern for each resilient flooring product specified.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Protect roll materials from damage by storing on end.

1.07 PROJECT CONDITIONS

A. Testing for concrete subfloor moisture emission rate and alkalinity as specified in Para. 3.01-D shall be done 4-weeks prior to ordering flooring materials.
   1. If concrete subfloor does not meet specified test conditions, Contractor shall provide concrete vapor emission control system at no additional cost to District.
   2. Concrete Vapor Emission Control System: Seamless, three-component, synthetic polymer coating, applied to concrete surfaces as a concrete moisture, mold, and alkalinity barrier interface for stabilizing moisture rates to 1.5, and pH resistance of up to 14pH.
      a. Product: Vapor-Guard as manufactured by Advanced Moisture Control, Inc., Westminister, CA, 714-903-7086.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

B. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

1.09 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Provide 2% of each type of base in original, appropriately labeled cartons.

C. Provide 100 sq. ft. of sheet vinyl and 100 sq. ft. of vinyl tile flooring of each type and color specified.

PART 2 PRODUCTS

2.01 MATERIALS - SHEET FLOORING

A. Vinyl Sheet Flooring: Homogeneous without backing, with color and pattern throughout full thickness, and:
   1. Minimum Requirements: Comply with ASTM F 1303, Type II, without backing, or ASTM F 1913.
   2. Coefficient of Friction: Slip resistant, ASTM D 2047, greater than or equal to 0.60, wet.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   4. Total Thickness and Wear Layer Thickness: 0.080 inch (2.0 mm) nominal.
   5. Sheet Width: 72 inch (1830 mm) minimum.
   6. Static Load Resistance: 125 psi (860 kPa) minimum, when tested as specified in ASTM F 1303.
   7. Heat welded seams.
   8. Pattern: Solid color.
   9. Manufacturers:
      a. Armstrong; Product - Armstrong Classic Corlon "Suffield".
      b. Substitutions: See Section 01600 - Product Requirements.

B. Feature Strips: Of same material as sheet flooring, in pattern shown on the drawings.

C. Vinyl Welding Rod: Solid vinyl bead produced by manufacturer of vinyl flooring for heat welding seams, in color matching field color.

2.02 MATERIALS - TILE FLOORING

A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness, and:
   1. Minimum Requirements: Comply with ASTM F 1066, of Class corresponding to type specified.
   2. Coefficient of Friction: Slip resistant, ASTM D 2047, greater than or equal to 0.60, wet.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   4. Size: 12 x 12 inch (305 x 305 mm).
   5. Thickness: 0.125 inch (3.2 mm).
   6. Pattern: MultiColor.
   7. Manufacturers:
      a. Armstrong World Industries, Inc; Product -"Standard Excelon MultiColor": www.armstrong.com.
      b. Substitutions: See Section 01600 - Product Requirements.

B. Feature Tile and Strips: Armstrong Excelon Feature Tile & Strips, in pattern shown on the drawings.

2.03 MATERIALS - BASE

A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
   1. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
   2. Height: 4 inch (100 mm).
   3. Thickness: 0.125 inch (3.2 mm) thick.
   4. Finish: Satin.
   5. Color: Color as selected from manufacturer's standards.
   6. Accessories: Premolded external corners, internal corners, and end stops.
   7. Manufacturers:
      a. BurkeMercer Flooring Products: www.burkemercer.com.
      b. Johnsonite, Inc: www.johnsonite.com.
      c. Roppe Corp: www.roppe.com.
      d. Substitutions: See Section 01600 - Product Requirements.

2.04 ACCESSORIES

A. Subfloor Filler: Portland cement-based, self-drying, trowelable finishing underlayment shall be Ardex SD-F Feather Finish as manufactured by Ardex Inc., Aliquippa, PA.
   1. Compressive Strength (ASTM C 109/mod. air-cure only): 4200 psi.

B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.

C. Moldings and Edge Strips: Metal.

D. Filler for Coved Base: Plastic.

E. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat with no more than 1/8 inch variation from the plane within any 10 feet.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Verify that sub-floor surfaces are dust-free and free of substances which would impair bonding

of adhesive materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for resilient flooring installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture emission rate: Not greater than 3 lb per 1000 sq ft (7.1 kg per 100 sq m) per 24 hours when tested using calcium chloride moisture test kit for 72 hours.
   2. Alkalinity: pH range of 5-9.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps using Subfloor Filler. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is cured.

C. Clean substrate.

D. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - SHEET FLOORING

A. Install in accordance with manufacturer's instructions.

B. Spread only enough adhesive to permit installation of materials before initial set.

C. Set flooring in place, press with heavy roller to attain full adhesion.

D. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.

E. Double cut sheet at seams.

F. Lay flooring with tightly butted seams, without any seam sealer unless otherwise indicated.

G. Finish seams in sheet vinyl by heat welding.

H. Double cut sheet; provide heat welded seams.

I. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

J. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Before installation of flooring, secure metal strips with stainless steel screws. Secure resilient strips by adhesive.

K. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

L. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

M. Install flooring in recessed floor access covers. Maintain floor pattern.

N. At movable partitions, install flooring under partitions without interrupting floor pattern.

O. Install feature strips and floor markings where indicated. Fit joints tightly.

3.04 INSTALLATION - TILE FLOORING

A. Install in accordance with manufacturer's instructions.

B. Mix tile from container to ensure shade variations are consistent when tile is placed.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Set flooring in place, press with heavy roller to attain full adhesion.

E. Lay flooring with joints and seams parallel to building lines to produce symmetrical tile pattern.

F. Install tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

G. Where floor finishes are different on opposite sides of door, terminate flooring under centerline of door.

H. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated. Before installation of flooring, secure metal strips with stainless steel screws.

I. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

J. Install flooring in recessed floor access covers. Maintain floor pattern.

K. At movable partitions, install flooring under partitions without interrupting floor pattern.

L. Install feature strips and floor markings where indicated. Fit joints tightly.

3.05 INSTALLATION - BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

E. Install base at all walls, base cabinets, storage cabinets, teacher's cabinets, etc.

3.06 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Adjustment: Remove and replace loose, damaged, mismatched, or misaligned work. Remove adhesive smears.

B. Upon completion of resilient flooring application, protect and allow sufficient time for flooring to seat itself before attempting to clean and finish. Follow flooring manufacturer's recommendations.

C. Cleaning:
   1. After flooring has thoroughly seated itself, sweep and/or vacuum floor thoroughly and damp mop/clean with approved neutral cleaner. If flooring is excessively dirty, use scrubbing machine and, in obstinate areas, #0 steel wool pad. Remove black marks or other blemishes. Vacuum must be insulated from contact with floor by use of a "soft lead".
   2. Use a minimum amount of water. Pick up all water immediately, using either dry mop or vacuum.
   3. Protect flooring after it is cleaned and dry.

D. Finishing:
   1. Follow manufacturer's printed recommendations.
   2. Use absolutely clean mops and buckets for application of manufacturer's recommended floor finish material(s).
   3. Apply two thin coats of floor finish, allowing 1-hour minimum drying time between coats under normal conditions. Previous coat must be completely dry and inspected and approved before application of additional coats. AC/Heat must be in operation to assure adequate drying time and curing of finish between coats. Temperature and humidity level

in building will determine required drying time. Machine buff each coat in accordance with manufacturer's printed instructions.

4. After machine buffing and in a period exceeding five-days but prior to start of District use, vacuum floor and wet mop or scrub gently with lukewarm soapy water and apply an additional 5-6 coats of commercial floor polish/wax. Allow each coat to dry for manufacturer's recommended time period prior to application of next coat.
5. Be careful to not overbuff or finish the floors in such a way as to make the floor slippery.

E. Protection:
1. Protect completed work from traffic and damage immediately after cleaning until acceptance by District.
2. Cover resilient flooring with undyed, untreated, heavy building paper taped in place. Maintain paper until inspection for Substantial Completion.
3. Protect resilient flooring against damage from static or rolling loads following installation by cleaning and covering with plywood or hardboard laid over the heavy building paper. Use dollies to move stationary equipment or furnishings across floors.
4. Provide appropriate instructions to other contractors to prevent damage during construction.
5. Provide cautions and maintenance recommendations for District in writing.

F. Final Cleaning:
1. Just prior to final acceptance of Project, clean work and remove all protective materials and foreign substances. Remove debris and surplus materials from Project site and repair or replace any damaged flooring in accordance with Architect's, District's and flooring manufacturer's requirements using properly trained tradesmen.
2. Do final cleaning by sweeping or mopping with clean, well moistened mop, or as recommended by manufacturer.

3.07 PROTECTION OF FINISHED WORK

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096812
6' Roll Goods Vinyl Backed Carpet

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Carpet removal, new carpet and accessories for direct glue down installation.

B. Alternates or Substitutions: Approval of alternate or substitute products will be considered only under the terms and conditions as outlined below:

Whenever a particular make of material or trade name is specified herein, it shall be regarded as being indicative of the standards required. Regardless of format of specifications, any product other than those named in Part 2 -Products, item number 2.01, must proceed as an alternate or substitute. A bidder who proposes to quote on the basis of an alternate or substitute material or system shall submit to the architect the following information:

1. Written application for approval of alternate or substitute to include specifications of alternate or substitute carpet on company letterhead and signed by company officer.
2. Include completed and signed checklist from Section 2.03.
3. Eight (8) full size samples of the proposed alternate or substitute with recommended backing technology to provide a mock-up of the pattern.
4. A complete sample representation of colors available.
5. Copies of warranties for proposed alternate or substitute.
6. List of a minimum of three (3) jobs, one of which must be in use for at least fifteen (15) years. These jobs shall be located within one hundred (100) miles of the owner's office. Each job shall be available for inspection by the owner's representatives.
7. List of district approved alternates or substitutes will be issued to all bidders prior to bid opening.

C. Performance Assurance - Testing: All products must meet San Bernardino City USD requirements. Test reports for the following performance assurance testing to be submitted upon request. Submitted results shall represent average results for production good of the referenced style. Requirements listed below must be met by all Products.

1. Flooring Radiant Panel – ASTM E-648 / MFPA 253: Class 1 (CRF: 0.45 watts/sq/cm or greater)
2. Federal Flammability – CPSC FF 1-70: must pass
3. Smoke Density – ASTM E-662 / NFPA258: ≤ 450 Flaming Mode
4. Electrostatic Propensity – AATCC 134 (Step & Scuff): 3.0 kV or less
5. Static Coefficient of Friction – ASTM C-1028: Must pass ADA Requirements for Accessible Routes (minimum 0.60)

1.02 SUBMITTALS

A. Layout Drawings: Show layout of each 6' roll carpet type installation, at 1/8" scale.

B. Samples: Submit for verification purposes, one full tile of each carpet required. Samples shall be accompanied by manufacturer's technical specification for each carpet required using terminology characteristics as listed in this specification. Also include a complete representation in sample form of all available colorations.

C. Maintenance Data: Submit manufacturer's printed maintenance recommendations for the care, cleaning, and maintenance of the carpet, including detailed instructions pertaining to hot water extraction methods.

1.03 QUALITY ASSURANCE

A. Flooring Contractor's Qualifications: Firm with not less than ten (10) consecutive years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section.

B. Manufacturer's Qualifications: Firm (carpet mill) with not less than ten (10) consecutive years of production experience with carpet similar to type specified in this section; whose published product literature indicates general compliance of products with requirements of this section.

C. Measurement Verification: Dimensions shown on drawings are approximate. It is the Flooring Contractor's responsibility to verify all dimensions and job site conditions; order sufficient yardage to fully carpet areas as indicated and to fill overage requirements as specified. No substitutions shall be permitted to make up for any shortage of material in overage or in carpet to be installed.

D. Flooring Contractor shall be totally responsible for the accuracy of his measurements of total yardage, individual floor yardage, and dye lot yardage requirements, and extra yardage for pattern match; no additional compensation shall be allowed for shortage of materials.

E. Dye Lots: All carpet of the same type in continuous areas shall be from the same dye lots.

F. Flooring contractor shall be certified by the supplying manufacturer.

1.04 PRODUCT DELIVERY, STORAGE & HANDLING

A. Deliver carpeting materials in original mill protective package with mill register numbers and tags attached. Maintain wrappers and protective covers in place until carpet is ready for installation. Store inside, in well-ventilated area, protected from weather, moisture and soiling.

B. Cutting: Before beginning installation, it shall be inspected for defects, color variations, or shipping damage and be immediately replaced if any of these conditions exist at no additional cost to the Owner. Carpet shall be inspected to insure that all carpet is from the same dye lot.

C. **Deliver all required overages and maintenance stock to owner's specified location prior to beginning installation.**

1.05 JOB CONDITIONS

A. Environmental Conditions: Maintain temperatures in space in accordance with carpet manufacturer's recommendations, but in no case less than 60 degrees F for 24 hours prior to, during and after installation. Subfloor temperature should be a minimum 60 degrees F for 24 hours prior to and after installation.

B. Precondition: All of the carpet shall be stored in a room on site 24 hours prior to actual installation with the room preconditioned at a minimum of 60 degrees F with humidity between 35% to 65%.

1.06 SEAMING REQUIREMENT

A. General: In addition to the requirements and recommendations of the Carpet Manufacturer, the following criteria shall be adhered to:
1. Installation layout shall enable future replacement, especially in large open areas and traffic paths, unless specifically indicated in writing by owner or owner's representative.
2. No carpet pieces smaller than 6” in width or length shall be used.
3. Seams occurring at doors of different types of carpet shall be parallel to closed door, and be centered directly under the closed door.
4. Flooring Contractor is responsible for trimming all loose yarn and fuzzy edges of carpet.

5. All cutting of carpet for telephone and electrical outlets shall be the responsibility of the Flooring Contractor.
6. All seams shall be sealed as required by the supplying manufacturer.

1.07 WARRANTY

General: Provide special warranty, signed by Flooring Contractor, and Carpet Manufacturer, agreeing to repair or replace defective materials and workmanship of carpeting work during a 25-year warranty period following date of Substantial Completion. Attached copies of product warranties as required in Part 2, item 2.01 of this specification section for warranties required.

1.08 EXTRA STOCK

General: Furnish 5% additional yardage of each carpet type required, same dye lot; extra yardage is over and above any overage provided by manufacturer. Deliver to the Owner uncut in clearly marked dust-proof packages **prior to commencement of work**; store where directed.

PART 2 - PRODUCTS

2.01 CARPET

A. Carpet Type CPT-1: Carpet shall meet the following minimum requirements:
1. Construction: Level Loop
2. Surface Texture: Level loop
3. Pile Thickness: .065” avg.
4. Gauge: 1/13”.
5. Face Yarn: Type 6,6 1.5 modification ratio for soil hiding.
7. Dye System: 50% Solution Dyed / 50% Yarn Dyed.
8. Dry Soil Retardant: Ensure.
9. Primary Backing: Synthetic non-woven
10. Secondary Backing: Closed cell cushion
11. Bonding Agent: Premium Vinyl
12. Size: 6’ roll goods
13. Static Control: 1.6 kV (AATCC 134) permanent conductive fiber
14. Flammability:
    a. Passes CPSC FF 1-70 (ASTM D-2859).
    b. Floor Radiant Panel: Meets NFPA Class 1 when tested per ASTM-E-648.
15. Smoke Generation: Less than 450 (ASTM E-662)
16. Color Fastness: Lightfastness - AATCC 16E- $\geq$ 4 after 60 hours
17. Carpet Manufacturers: Subject to compliance with specifications, the following manufacturers and products are approved:
    a. Lees Carpets – Faculty IV 6’ roll goods Thermobond Backed Carpet
       Contact: Customer Service – 800-523-5647
    b. Collins & Aikman (Tandus) – 6’ roll goods Polyvinyl Backed Carpet
       Contact: Customer Service – 800-248-2878
    c. Interface – Aaki Collection 6’ roll goods Polyvinyl Backed Carpet
       Contact: Customer Service – 877-605-1500
18. Pattern and Color: Understanding the importance of pattern and color for aesthetics, as well as appearance retention and maintainability, the architect reserves the right to reject any product or manufacturer based solely on pattern and color considerations.

B. WARRANTIES

1. Manufacturer's 30-year Warranty, non-prorated, against product failure covering all costs including freight, labor, and material for the following:
   - Edge Ravel/Tuft Bind.
   - Back lamination.
   - Static protection as stated above.
   - Wear - No more than 10% Face Yarn Loss.
   - Backing Resiliency
   - Adhesive bond to the floor
   - Permanent stain resistance to acid-type spills
   - Workmanship
2. Installation Warranty: 10-year, non-prorated, against any installation related failure covering all costs including freight, labor, and material co-signed by the flooring contractor and the manufacturer.

C. YARN STAIN RESISTANCE / YARN HARDNESS

1. 100% type 6,6 four core hollow filament
2. 1.5 modification ratio

D. ENVIRONMENTAL ATTRIBUTES – LEED Criteria (When Requested)

1. Environmental claims by manufacturer must comply with FTC guidelines.
2. Recycled Content: Carpet must contain either 20% post-consumer recycled content or minimum 35 - 40% post-industrial recycled content based on total product weight.
3. Environmentally Preferred Product – Carpet must have minimum Silver rating from third party certification (such as Scientific Certification Systems) in accordance with NSF 140 – Sustainable Carpet Assessment Standard
4. Carpet Face Yarn: In accordance with Executive Order 13101, carpet face yarn must be third party certified as an Environmentally Preferred Product (EPP).
5. Low Emitting Materials: Carpet and all installation components including adhesives, sealers, seam welds and seam sealers must meet the *Low Emitting Materials* standards as outlined in U.S. Green Building Council LEED criteria. Adhesives must meet VOC emissions standards per South Coast Air Quality Management District Rule #1168.
6. End of Life Reclamation: Carpet must have an existing methodology actively in place to achieve landfill diversion. Refer to Section 3.01 of this section for specific requirements for reclamation of material.

2.02 ACCESSORIES

A. Adhesives: Peel and stick or wet spread. All adhesives used must meet CHPS 01350 and Green Label Plus Certifications. MSDS and samples required on all products used.

B. Miscellaneous Materials: As recommended and approved in writing by manufacturer of carpet, and selected by Flooring Contractor to meet project circumstance and requirements.

C. Protection Paper: Fortifiber Corporation "Seekure 892", or approved heavy, reinforced, non-staining kraft laminated paper.

2.03 SUBMITTAL CHECKLIST

A. Checklist Instructions: For all submittals for alternates or substitutes, submitter must include the checklist below, completely filled out and signed by an officer of the company. Failure to provide this documentation will result in rejection of submittal.
   1. Fill-in the left column with the actual data as it pertains to your alternate or substitute. If more room is required, attach additional pages.
   2. Circle either yes or no indicating whether or not the submitted product meets or exceeds the

specification requirements for each checklist item.

B. Checklist Form: See next page.

C. Checklist Form:

1. Submitting company's name: _____

2. Checklist preparer's name: _____

3. Submitted product manufacturer: _____

4. Submitted product style name: _____

5. Checklist:

Specification Citation: (Please enter submittal information)	**Circle Answer**
Section 09 68 12 Part 2.01.A, B, and C:	
1. Construction:	YES / NO
2. Surface Texture:	YES / NO
3. Pile Thickness:	YES / NO
4. Gauge:	YES / NO
5. Stitches:	YES / NO
6. Yarn Weight:	YES / NO
7. Density:	YES / NO
8. Face Yarn:	YES / NO
9. Dye System:	YES / NO
10. Dry Soil Retardant:	YES / NO
11. Primary Backing:	YES / NO
12. Secondary Backing:	YES / NO
13. Cushion:	YES / NO
14. Bonding Agent:	YES / NO
15. Size:	YES / NO
16. Static Control:	YES / NO
17. Flammability:	YES / NO
18. NBS Smoke Chamber:	YES / NO
19. Color Fastness:	YES / NO
20. Carpet Manufacturer	YES / NO
21. Carpet Manufacturer Warranty (Part B, Item 1& 2)	YES / NO
22. Carpet Installation Warranty (Part B, Item 3):	YES / NO

23.	Yarn Stain Resistance / Yarn Hardness (Part C, Item 1):	YES / NO

7. Preparer's Signature and Date:_____

PART 3 - EXECUTION

3.01 CARPET REMOVAL & RECLAMATION

This specification is for carpet reclamation and is designed to manage carpet recycling for any type of used carpet or carpet pad. General Contractor to provide covered container(s) for carpet reclamation. General Contractor to remove and transport container(s) from site to reclamation depository for recycling of materials. Waste manifest is to be provided to District listing quantity and types of materials removed, as received by a Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant.

A. CARPET REMOVAL - BROADLOOM
1. Remove used carpet in large pieces, roll tightly, and pack neatly in container. [Include carpet scrap and waste from new installation.] Immediately remove used carpet from Site. Place in covered containers.
2. Deposit only clean, dry used carpets in containers. Clean shall be defined as carpet free from demolition debris or asbestos contamination, garbage, and tack strips.

B. CARPET REMOVAL – CARPET TILE
1. Remove used carpet tile and stack neatly on pallets. Neatly stack carpet tiles or repack in cardboard boxes prior to placing in container. Do not stack higher than 6 feet on pallets. [Include carpet scrap and waste from new installation.] Immediately remove used carpet from Site. Place in covered containers.
2. Deposit only clean, dry used carpets in containers. Clean shall be defined as carpet free from demolition debris or asbestos contamination, garbage, and tack strips.

C. CONTAINER HANDLING
1. Place used carpet in container supplied by General Contractor. Containers shall be fully enclosed and shall be kept locked or supervised.
2. Broadloom carpet must be segregated in separate containers from tile carpeting.
3. Use effective packing techniques to maximize the amount of material in the container. On average the following amounts are the related container capacities.

Container Size	Broadloom Capacity
53' Foot	4,800
48' Foot	4,000
24' Pup Trailer	2,000

D. CONTAINER REMOVAL
When container(s) is (are) full, transport container(s) to approved Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant.

E. RECLAMATION CERTIFICATE
Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant to issue District a reclamation certificate once used carpet is removed from the job site and or dealer location and delivered to reclamation facility.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's instructions and recommendations for installation of this type of

carpet by the glue down method.

B. Moisture suppression system for concrete moisture related issues 5 lbs. – 10 lbs.

C. Prepare the subfloor to insure a successful installation. Provide and install the following system to mitigate high moisture levels:

MOISTURE SUPPRESSION SYSTEM FOR FLOORS

1) CONSTRUCTION
   a) Underlayment: Closed-Cell Cushion
   b) Weight: 35.5 oz/sq yd 1203 g/sq m ASTM D-3574
   c) Density: 18.5 lbs/cu ft 296 kg/cu m ASTM D-3574
   d) Thickness: 0.156 inch / 4 mm / ASTM D-3574
   e) Compression Set: Max. 10% / ASTM D-3574
   f) Compression Deflection: 7 Min. 25 max lbs/sq inch @ 25% 1758 g/sq cm / ASTM D-3574
   g) Width: 72 in. minimum / 182.9 cm
   h) Length: 75 ft. minimum / 22.9 meters
   i) Roll Weight: approximately 120 lbs. per roll, including packaging

2) PRODUCT INFORMATION
   a) Maximum Concrete Moisture Emission: 10.0 lbs. MVER / ASTM F-1869
   b) Maximum Concrete pH: 9 / ASTM F-710-05
   c) Maximum Concrete Relative Humidity: 90% / ASTM F-2170-02
   d) Moisture Vapor Transmission Rate: 2.06 lbs./1000 sq. ft./24 hrs. / ASTM E-96
   e) Permeance Rating: 1.44 / ASTM E-96
   f) Moisture Suppression: Below 3.0 lbs. from a max. of 10.0 lbs./1000 sq. ft./24 hrs. / ASTM F-1869

3) SLAB MOISTURE AND PH TESTING (REQUIRED)
   a) ASTM F-1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride is used to determine the moisture vapor emission rate (MVER) of the concrete.
   b) ASTM F-2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes is used to determine the percentage of relative humidity of the concrete at 40% of the depth of the concrete slab.
   c) ASTM F-710-05 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring is used to determine the surface pH of the concrete.
   d) Testing must be performed according to the referenced ASTM Standards and the results of these tests must be provided to Manufacturer prior to the installation of moisture suppression system in order to qualify for limited warranty coverage.

4) INSTALLATION
   a) Installation over existing multi-purpose adhesives should be scraped to minimize any residue of the old adhesive.
   b) Pressure sensitive adhesive that is not contaminated or compromised by dust, dirt, or debris to be used to adhere the moisture suppression system to the flooring substrate.
   c) Skim coat is not necessary.
   d) The flooring substrate should be free of dust, dirt, debris, or any other substance that would impair adhesion, and floor should be level and smooth.
   e) Determine best direction to unroll the moisture suppression system and then unroll moisture suppression system making sure to overlap the width and length a minimum of 1” to 1.5”.
   f) Fold back one half of the moisture suppression system along the side seams and apply adhesive on the sub-floor.

g) Allow the adhesive to dry in accordance with the adhesive instructions and then re-lay the moisture suppression system.
h) Adhesive coverage should be 2 to 3 times the amount specified on the recommended adhesive container to insure sufficient tack to facilitate double cutting moisture suppression system seams. (Consult Manufacturer's Technical Services for acceptable adhesives.)
i) Repeat this procedure for the other half of the moisture suppression system roll making sure seams overlap.
j) Continue this process until all rolls are adhered to the floor.
k) Using a Double Cutter cut cleanly though both layers of moisture suppression system at the side and end seams.
l) Insure that all cut edges fit flush and tight, but are neither gapped nor compressed at the seam.
m) Using Seam Weld and a Gundlach number 5CS Glue 2 Applicator Nozzle apply a bead of Seam Weld along both cut edges of the moisture suppression system.
n) To insure moisture impermeability, run a putty knife along the surface of the seams to spread the Seam Weld evenly.
o) Once the Seam Weld has dried (1 hour - 18 hours) the moisture suppression system is ready for installation of carpet.
p) These instructions do not cover all possible installation conditions. They are intended for general information on the application of moisture suppression system. For more specific instructions or for flooring substrates or issues not covered within these instructions please contact the manufacturer.

5) PRODUCT NOTES
a) Use a carpet collection/recovery system and a currently operational, commercial scale, recycling process to recycle vinyl backed carpet and other vinyl materials.
b) Carpet and other vinyl materials recycled in this process are used to produce recycled content carpet.
c) Moisture suppression system, when recovered, should be 100% recyclable in this process.
d) Products must meet the flammability requirements for the following nationally recognized building codes: BOCA National Building Code, NFPA Life Safety Code for Safety to Life in Buildings and Structures, Standard Building Code, and the Uniform Fire Code.
e) Product specifications reflect mean averages based on tests of production runs by independent laboratories and may vary within normal.

C. Carpeting shall be installed with pile lying in the same direction. Cut carpet evenly and accurately to fit neatly at walls, columns, and projections. Extend carpet under open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions.

D. Installed carpet shall be free from ripples, ravels, frays, puckers and raw exposed edges. All loop pile carpets will demonstrate some fuzzy edges due to normal manufacturing conditions. It is the carpet installer's responsibility to trim all edges to eliminate fuzzy seams.

E. Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.

F. Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor. Carpet is to be securely adhered in accordance with ADA requirements (Section 4.5.3).

3.03 CLEANING AND PROTECTION

A. Remove and dispose of debris and unusable scraps.

B. Vacuum carpet using two motor, top loading, upright commercial machine with brush-only element, utilizing a high filtration dust bag. Remove spots in accordance with carpet manufacturer's guidelines

and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors. Be certain to trim any loose yarns or fibers at all seams.

C. Following cleaning and vacuum, carefully protect the carpeting from soiling and damage until final acceptance. Protection shall be accomplished by using approved protection paper. Edges shall be lapped 6 inches and secured with non-asphaltic tape. Covering shall be kept in repair and damaged portions replaced during the construction and move-in period.

D. Maintenance Materials: Deliver usable, uncut carpet to Owner's designated storage space, properly packaged and identified. Dispose of smaller pieces as construction waste.

END OF SECTION

SECTION 096813
Vinyl Backed Walk-Off Mat

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Carpet removal, new carpet tile and accessories for direct glue down installation.

B. Alternates or Substitutions: Approval of alternate or substitute products will be considered only under the terms and conditions as outlined below:

Whenever a particular make of material or trade name is specified herein, it shall be regarded as being indicative of the standards required. Regardless of format of specifications, any product other than those named in Part 2 -Products, item number 2.01, must proceed as an alternate or substitute. A bidder who proposes to quote on the basis of an alternate or substitute material or system shall submit to the architect the following information:

1. Written application for approval of alternate or substitute to include specifications of alternate or substitute carpet on company letterhead and signed by company officer.
2. Include completed and signed checklist from Section 2.03.
3. Eight (8) full size samples of the proposed alternate or substitute with recommended backing technology to provide a mock-up of the pattern.
4. A complete sample representation of colors available.
5. Copies of warranties for proposed alternate or substitute.
6. List of a minimum of three (3) jobs, one of which must be in use for at least five (5) years. These jobs shall be located within one hundred (100) miles of the owner's office. Each job shall be available for inspection by the owner's representatives.
7. List of approved alternates or substitutes will be issued to all bidders prior to bid opening.

C. General: The following publications of the issues listed below, but referred to hereinafter by basic designation, form a part of this specification to the extent as if bound herein:

American Society for Testing and Materials (ASTM):

1. E84 – Test Method for Surface Burning Characteristics of Building Materials.
2. E648 – Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

1.02 SUBMITTALS

A. Layout Drawings: Show layout of each carpet type installation, at 1/8" scale.

B. Samples: Submit for verification purposes, one full tile of each carpet required. Samples shall be accompanied by manufacturer's technical specification for each carpet required using terminology characteristics as listed in this specification. Also include a complete representation in sample form of all available colorations.

C. Maintenance Data: Submit manufacturer's printed maintenance recommendations for the care, cleaning, and maintenance of the carpet, including detailed instructions pertaining to hot water extraction methods.

1.03 QUALITY ASSURANCE

A. Flooring Contractor's Qualifications: Firm with not less than five (5) consecutive years of experience in installation of commercial carpeting of type, quantity and installation methods similar to work of this section.

B. Manufacturer's Qualifications: Firm (carpet mill) with not less than five (5) consecutive years of production experience with carpet similar to type specified in this section; whose published product literature indicates general compliance of products with requirements of this section.

C. Measurement Verification: Dimensions shown on drawings are approximate. It is the Flooring Contractor's responsibility to verify all dimensions and job site conditions; order sufficient yardage to fully carpet areas as indicated and to fill overage requirements as specified. No substitutions shall be permitted to make up for any shortage of material in overage or in carpet to be installed.

D. Flooring Contractor shall be totally responsible for the accuracy of his measurements of total yardage, individual floor yardage, and dye lot yardage requirements, and extra yardage for pattern match; no additional compensation shall be allowed for shortage of materials.

E. Dye Lots: All carpet of the same type in continuous areas shall be from the same dye lots.

1.04 PRODUCT DELIVERY, STORAGE & HANDLING

A. Deliver carpeting materials in original mill protective package with mill register numbers and tags attached. Maintain wrappers and protective covers in place until carpet is ready for installation. Store inside, in well-ventilated area, protected from weather, moisture and soiling.

B. Cutting: Before beginning installation, it shall be inspected for defects, color variations, or shipping damage and be immediately replaced if any of these conditions exist at no additional cost to the Owner. Carpet tiles shall be inspected to insure that carpet tiles are from the same dye lot.

C. **Deliver all required overages and maintenance stock to owner's specified location prior to beginning installation.**

1.05 JOB CONDITIONS

A. Environmental Conditions: Maintain temperatures in space in accordance with carpet manufacturer's recommendations, but in no case less than 60 degrees F for 24 hours prior to, during and after installation. Subfloor temperature should be a minimum 60 degrees F for 24 hours prior to and after installation.

B. Precondition: All of the carpet shall be stored in a room on site 24 hours prior to actual installation with the room preconditioned at a minimum of 60 degrees F with humidity between 35% to 65%.

1.06 SEAMING REQUIREMENT

A. General: In addition to the requirements and recommendations of the Carpet Manufacturer, the following criteria shall be adhered to:
1. Installation layout shall enable future replacement, especially in large open areas and traffic paths, unless specifically indicated in writing by owner or owner's representative.
2. No carpet tile pieces smaller than 6” in width or length shall be used.
3. Seams occurring at doors of different types of carpet shall be parallel to closed door, and be centered directly under the closed door.
4. Flooring Contractor is responsible for trimming all loose yarn and fuzzy edges of carpet tiles.

5. All cutting of carpet for telephone and electrical outlets shall be the responsibility of the Flooring Contractor.

1.07 WARRANTY

General: Provide special warranty, signed by Flooring Contractor, and Carpet Manufacturer, agreeing to repair or replace defective materials and workmanship of carpeting work during a 10-year warranty period following date of Substantial Completion. Attached copies of product warranties as required in Part 2, item 2.01 of this specification section for warranties required.

1.08 EXTRA STOCK

General: Furnish 5% additional yardage of each carpet type required, same dye lot; extra yardage is over and above any overage provided by manufacturer. Deliver to the Owner uncut in clearly marked dust-proof packages **prior to commencement of work**; store where directed.

PART 2 - PRODUCTS

2.01 ENTRYWAY MAT SYSTEM - MODULAR

A. Carpet Type CPT-1: Carpet shall meet the following minimum requirements:
1. Construction: Molded Reinforced Needlepunch Textile.
2. Surface Texture: Rubber Reinforced Geometric Pattern.
3. Pile Thickness: .25” avg.
4. Size: 18” x 18”
5. Fiber: 100% Premium Polypropylene
6. Dye Method: Solution Dyed
7. Backing: Special Non-Thermoplastic Tri-Grip Cleated SBR
8. Total Product Weight: 135 oz/ sq yd
9. Surface Flammability: Passes CPSC FF I-70
10. Flooring Radiant Panel: Class 2 (mean average CRF: 0.22 w/sq cm to 0.44 w/sq cm)
11. Installation: Use full spread solvent free releasable or permanent adhesive
12. Carpet Manufacturers: Subject to compliance with specifications, the following manufacturers and products are approved:
    a. Lees Carpets – First Step Walk-Off Thermobond Backed Carpet Tile (L8513)
       Contact: Customer Service – 800-523-5647
    b. Collins & Aikman (Tandus) – Triad Mat Systems Geometric Tile
       Contact: Customer Service – 800-248-2878
    c. Interface Entry Level Walk-Off Polyvinyl Backed Mat Tile
       Contact: Customer Service – 877-605-1500

2.02 ENTRYWAY MAT SYSTEM – ROLL GOODS

A. Carpet Type CPT-2: Carpet shall meet the following minimum requirements:
1. Construction: Accuweave Patterned Loop
2. Face Weight: 24 oz /sq yd
3. Pattern Repeat: N/A
4. Gauge: 1/12”.
5. Stitches: 8.0 per inch.
6. Size: 6’ roll goods
7. Tuft Density: 96.0 tufts per square inch
8. Face Yarn: Type 6,6 1.5 modification ratio for soil hiding.

9. Dye System: Solution Dyed.
10. Dry Soil Retardant: Ensure.
11. Primary Backing: Synthetic non-woven
12. Static Control: 1.5 kV (AATCC 134); Permanent Conductive Fiber
14. Flammability: Passes CPSC FF 1-70 (ASTM D-2859)
15. Floor Radiant Panel: Class 1(mean average CRF: 0.45 w/sq cm or higher) (ASTM E-648)
16. Smoke Generation: Less than 450 (ASTM E-662).
17. Color Fastness to Light: $\geq$ to 4 after 100 hours (AATCC 16E)
18. Carpet Manufacturers: Subject to compliance with specifications, the following manufacturers and products are approved:
    a. Lees Carpets – First Step Walk-Off Thermobond Backed Carpet Tile (L8513)
       Contact: Customer Service – 800-523-5647
    b. Collins & Aikman (Tandus) – Abrasive Action Polyvinyl Backed 6' Roll Goods
       Contact: Customer Service – 800-248-2878
    c. Interface Entry Level Walk-Off Polyvinyl Backed Mat Tile
       Contact: Customer Service – 877-605-1500
19. Pattern and Color: Understanding the importance of pattern and color for aesthetics, as well as appearance retention and maintainability, the architect reserves the right to reject any product or manufacturer based solely on pattern and color considerations.

B. WARRANTIES

1. Manufacturer's 30-year Warranty, non-prorated, against product failure covering all costs including freight, labor, and material for the following:
   - Edge Ravel/Tuft Bind.
   - Back lamination.
   - Static protection as stated above.
   - Wear - No more than 10% Face Yarn Loss.
   - Cup, Dome, Dish
   - Dimensional stability
   - Adhesive bond to the floor
   - Permanent stain resistance to acid-type spills
2. Installation Warranty: 10-year, non-prorated, against any installation related failure covering all costs including freight, labor, and material co-signed by the flooring contractor and the manufacturer.

C. CATIONIC STAIN RESISTANCE

Stain resistant properties must be permanent and not removable by commercial cleanings or abrasive wear. Under GSA requirements stain resistant carpets must score no less than 8.0 (10.0 is the best) on the AATCC Red 40 Stain Scale. Test sample must first be exposed to 100 revolutions on the Taber Abrader (1,000-gram weight per H-18 wheel) and then abraded area must be stain tested using AATCC test method 175. Topical stain resistant treatments will not be acceptable. Stain resistant properties must be inherent.

D. ENVIRONMENTAL ATTRIBUTES – LEED Criteria

1. Environmental claims by manufacturer must comply with FTC guidelines.
2. Recycled Content: Carpet must contain either 20% post-consumer recycled content or minimum 35 - 40% post-industrial recycled content based on total product weight.
3. Environmentally Preferred Product – Carpet must have minimum Silver rating from third party certification (such as Scientific Certification Systems) in accordance with NSF 140 – Sustainable Carpet Assessment Standard

4. Carpet Face Yarn: In accordance with Executive Order 13101, carpet face yarn must be third party certified as an Environmentally Preferred Product (EPP).
5. Low Emitting Materials: Carpet and all installation components including adhesives, sealers, seam welds and seam sealers must meet the *Low Emitting Materials* standards as outlined in U.S. Green Building Council LEED criteria. Adhesives must meet VOC emissions standards per South Coast Air Quality Management District Rule #1168.
6. End of Life Reclamation: Carpet must have an existing methodology actively in place to achieve landfill diversion. Refer to Section 3.01 of this section for specific requirements for reclamation of material.

2.02 ACCESSORIES

A. Adhesives: Waterproof, non-flammable carpet adhesive recommended and approved by carpet manufacturer in writing for compatibility with carpet backing. All floor sealers, seam sealers, and adhesives shall contain no calculated solvents per OSHA Regulation 29 CFRE 1910.1200, have no calculated VOC's, be non-flammable, and meet the criteria of the CRI Green Label Plus Certification Program. MSDS and samples required on products used.

B. Miscellaneous Materials: As recommended and approved in writing by manufacturer of carpet, and selected by Flooring Contractor to meet project circumstance and requirements.

C. Protection Paper: Fortifiber Corporation "Seekure 892", or approved heavy, reinforced, non-staining kraft laminated paper.

2.03 SUBMITTAL CHECKLIST

A. Checklist Instructions: For all submittals for alternates or substitutes, submitter must include the checklist below, completely filled out and signed by an officer of the company. Failure to provide this documentation will result in rejection of submittal.
   1. Fill-in the left column with the actual data as it pertains to your alternate or substitute. If more room is required, attach additional pages.
   2. Circle either yes or no indicating whether or not the submitted product meets or exceeds the specification requirements for each checklist item.

B. Checklist Form: See next page.

C. Checklist Form:

1. Submitting company's name: _____

2. Checklist preparer's name: _____

3. Submitted product manufacturer: _____

4. Submitted product style name: _____

5. Checklist:

Specification Citation: (Please enter submittal information)	**Circle Answer**
Section 09 68 13 Part 2.01.A, B, and C:	
1. Construction:	YES / NO
2. Surface Texture:	YES / NO
3. Pile Thickness:	YES / NO
4. Gauge:	YES / NO
5. Stitches:	YES / NO
6. Yarn Weight:	YES / NO
7. Density:	YES / NO
8. Face Yarn:	YES / NO
9. Dye System:	YES / NO
10. Dry Soil Retardant:	YES / NO
11. Primary Backing:	YES / NO
12. Secondary Backing:	YES / NO
13. Bonding Agent:	YES / NO
14. Size:	YES / NO
15. Static Control:	YES / NO
16. Flammability:	YES / NO
17. NBS Smoke Chamber:	YES / NO
18. Color Fastness:	YES / NO
19. Carpet Manufacturer	YES / NO
20. Carpet Manufacturer Warranty (Part B, Item 1& 2)	YES / NO
21. Carpet Installation Warranty (Part B, Item 3):	YES / NO
22. Cationic Stain Resistance (Part C, Item 1):	YES / NO

6. Preparer's Signature and Date:_____

PART 3 - EXECUTION

3.01 CARPET REMOVAL & RECLAMATION

This specification is for carpet reclamation and is designed to manage carpet recycling for any type of used carpet or carpet pad. General Contractor to provide covered container(s) for carpet reclamation. General Contractor to remove and transport container(s) from site to reclamation depository for recycling of materials. Waste manifest is to be provided to District listing quantity and types of materials removed, as received by a Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant.

A. CARPET REMOVAL - BROADLOOM
1. Remove used carpet in large pieces, roll tightly, and pack neatly in container. [Include carpet scrap and waste from new installation.] Immediately remove used carpet from Site. Place in covered containers.
2. Deposit only clean, dry used carpets in containers. Clean shall be defined as carpet free from demolition debris or asbestos contamination, garbage, and tack strips.

B. CARPET REMOVAL – CARPET TILE
1. Remove used carpet tile and stack neatly on pallets. Neatly stack carpet tiles or repack in cardboard boxes prior to placing in container. Do not stack higher than 6 feet on pallets. [Include carpet scrap and waste from new installation.] Immediately remove used carpet from Site. Place in covered containers.
2. Deposit only clean, dry used carpets in containers. Clean shall be defined as carpet free from demolition debris or asbestos contamination, garbage, and tack strips.

C. CONTAINER HANDLING
1. Place used carpet in container supplied by General Contractor. Containers shall be fully enclosed and shall be kept locked or supervised.
2. Broadloom carpet must be segregated in separate containers from tile carpeting.
3. Use effective packing techniques to maximize the amount of material in the container. On average the following amounts are the related container capacities.

Container Size	Broadloom Capacity	Tile Capacity
53’ Foot	4,800	3,500
48’ Foot	4,000	3,000
24’ Pup Trailer	2,000	1,500

D. CONTAINER REMOVAL
When container(s) is (are) full, transport container(s) to approved Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant.

E. RECLAMATION CERTIFICATE
Carpet America Recovery Effort (CARE), AB2398, recognized carpet reclamation and recycling plant to issue District a reclamation certificate once used carpet is removed from the job site and or dealer location and delivered to reclamation facility.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's instructions and recommendations for installation of this type of matting by the glue down method.

B. Prepare the subfloor to insure a successful installation.

C. Carpeting shall be installed with pile lying in the same direction. Cut carpet evenly and accurately to fit neatly at walls, columns, and projections. Extend carpet under open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions.

D. Installed carpet shall be free from ripples, ravels, frays, puckers and raw exposed edges. All loop pile carpets will demonstrate some fuzzy edges due to normal manufacturing conditions. It is the carpet installer's responsibility to trim all edges to eliminate fuzzy seams.

E. Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.

F. Roll with appropriate roller for complete contact of carpet with mill-applied adhesive to sub-floor. Carpet is to be securely adhered in accordance with ADA requirements (Section 4.5.3).

3.03 CLEANING AND PROTECTION

A. Remove and dispose of debris and unusable scraps.

B. Vacuum carpet using two motor, top loading, upright commercial machine with brush-only element, utilizing a high filtration dust bag. Remove spots in accordance with carpet manufacturer's guidelines and replace carpet where spots cannot be removed. Remove any protruding face yarn using sharp scissors. Be certain to trim any loose yarns or fibers at all seams.

C. Following cleaning and vacuum, carefully protect the carpeting from soiling and damage until final acceptance. Protection shall be accomplished by using approved protection paper. Edges shall be lapped 6 inches and secured with non-asphaltic tape. Covering shall be kept in repair and damaged portions replaced during the construction and move-in period.

D. Maintenance Materials: Deliver usable, uncut carpet tiles to Owner's designated storage space, properly packaged and identified. Dispose of smaller pieces as construction waste.

END OF SECTION

SECTION 09720

WALL COVERING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Wall covering and borders.

1.02 RELATED SECTIONS

A. Section 09260 - Gypsum Board Assemblies: Wall substrate.

B. Section 10121 - Tackable Wall Systems: Vinyl fabric surface.

1.03 REFERENCES

A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2004.

B. ASTM D 751 - Standard Test Methods for Coated Fabrics.

C. ASTM D 1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

D. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

E. Chemical Fabrics and Film Association (CFFA) - CFFA-W-101-A, Quality Standard for Vinyl Coated Fabric Wallcovering.

F. Federal Specifications - CCC-T-191B.

G. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 8, Interior Finishes.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit six samples of wall covering, 8 x 8 inch (203 x 203 mm) in size illustrating color, finish, and texture.

E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.05 QUALITY ASSURANCE

A. Surface burning characteristics of finishes shall comply with CBC, Section 803, Table 803.5.

B. Tests: Material shall meet or exceed tests performed in accordance with Federal Specification CCC-T-191B, except as follows:
   1. Adhesion of vinyl coating to the fabric backing, shall be tested in accordance with ASTM D 751.
   2. Materials shall have a zone inhibition rating of "0" to resist the growth of mildew and bacteria, as determined by test methods ASTM G 21.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum ten years of documented experience.

D. Installer Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 MOCK-UP

A. Provide panel, 3 panel drops wide, full height, illustrating installed wall covering and joint seaming technique.

B. Locate where directed.

C. Approved mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surfaces.

1.09 WARRANTY

A. All wallcovering materials when adhered to a sound surface with the manufacturer's recommended procedures and adhesive, shall be warranted to be free of manufacturing defects for a period of 5 years from the date the Notice of Completion is filed and recorded by the County.

B. Assuming no deterioration in the subsurface, wall covering materials shall be further warranted against permanent surface staining attributed to mildew and/or bleed-through of foreign impurities embedded in the fabric backing, as well as separation of the vinyl from its backing.

C. If such manufacturing defects are claimed in writing during the warranty period, and proper documentation is presented to the manufacturer with regard to date of sale, plus adhesive used and surface applied to, the manufacturer, at its option, will either replace the vinyl wallcovering and assume installation costs, or refund the purchase price.

1.10 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Supply material in quantity equal to one percent or one roll, whichever is more, of material installed for each type, pattern and color used on the work. Furnish full width materials in one roll increments, but not less than one full roll, from the same run as used for the project.

C. Package and label each roll by manufacturer, color and pattern, and destination room number.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Wolf-Gordon, Inc.; Product - The Summit Collection "Sierra".

2.02 MATERIALS

A. Vinyl Wallcovering: Supported vinyl material, consisting of a through-pigmented, mildew-inhibitorized polyvinyl chloride, adhered to a pre-shrunk cotton/cotton-blend fabric backing. All materials shall conform to the CFFA-W-101-A, using test methods as outlined in FedSpec CCC-T-191, except as otherwise specified herein.
   1. Pattern: "Sierra"
   2. Weight Type: Type II.
   3. Total Weight: 14 oz. sq. yd., 21 oz. lin. yd.
   4. Backing Weight: 2.0 oz. sq. yd.
   5. Fabric backing and content: Osnaburg Blend, 65% Polyester, 35% Cotton.
   6. Tensile strength: 92 x 91 (w x f).
   7. Tear strength: 36 x 38 (w x f).
   8. Flame spread: 15 (ASTM E84).
   9. Smoke Developed: 20 (ASTM E 84).
   10. Width : 54 inches.
   11. Cleanability: Meets or exceeds ASTM D1308.
   12. Mildew resistance: Zone inhibition rating of "0" (ASTM G-21).
   13. Color: As selected by Architect.
   14. Staphylococcus resistance: 100% reduction within 24 hours.

B. Adhesive: Heavy Duty Vinyl type as recommended by the wall covering manufacturer.

C. Termination Trim: Extruded aluminum, alloy 6063-T5, long lengths, with fire satin mechanical finish and class 2 clear architectural anodic coating conforming to AA M21A31. Trim shall be designed for use with vinyl wall coverings[], color as selected.

D. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

E. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work, and conform to requirements of the wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Marks: Seal with shellac those that may bleed through surface finishes.

F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall covering surface immediately prior to application of wall covering.

C. Use wall covering in roll number sequence.

D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.

E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tightly.

F. Horizontal seams are not acceptable.

G. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

H. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

I. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

J. Cover spaces above and below windows, above doors, in pattern sequence from roll.

K. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches (150 mm) of wall covering termination. Ensure full contact bond.

L. Install termination trim.

M. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION OF FINISHED WORK

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09900

PAINTS AND COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, varnishes, and other coatings.

C. Upon completion of work under this contract, all interior and exterior surfaces within the contract limits and within view, will have a paint finish except excluded items defined herein.

D. Surfaces to receive high performance coating are indicated in Section 09960.

1.02 RELATED REQUIREMENTS

A. Section 02765 - Pavement Markings: Pavement markings.

B. Section 02825 - Ornamental Steel Fencing.

C. Section 04810 - Unit Masonry Assemblies: CMU scheduled to be painted.

D. Section 05500 - Metal Fabrications: Shop-primed items.

E. Section 05220 - Handrails and Railings.

F. Section 05510 - Metal Stairs: Shop-primed and field painted items.

G. Section 06200 - Finish Carpentry: Standing and running trim.

H. Section 07620 - Sheet Metal Flashing and Trim: Exposed flashing and trim.

I. Section 08110 - Steel Doors and Frames.

J. Section 08210 - Wood Doors.

K. Section 08310 - Access Doors and Panels.

L. Section 09220 - Portland Cement Plaster - Cement plaster finishes.

M. Section 09260 - Gypsum Board Assemblies.

N. Section 10523 - Fire Extinguishers, Cabinets, and Accessories.

O. Section 09960 - High-Performance Coatings. Painting handrails and railings, ornamental steel fencing and gates.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. GreenSeal GS-11 - Architectural Paints; 1993.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; current edition, www.paintinfo.com.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Master Painters and Decorators Association; 2004.

E. ASTM D 4442 - Standard Test Method for Direct Moisture Content Measurement of Wood and Wood-Based Materials.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of all products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. Manufacturer's installation instructions.

C. Certification by manufacturer that products comply with Contract Documents and are compatible with applicable substrates and with each other.

D. Certification: By manufacturer that all paints and coatings do not contain any of the prohibited chemicals specified; GreenSeal GS-11 certification is not required but if provided shall constitute acceptable certification.

E. Samples: Submit six paper "drop" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Prepare wood samples on type and quality of wood specified.

F. LEED Report: VOC content of all interior opaque coatings actually used.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section with minimum five years experience.

B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

1.06 MOCK-UP

A. See Section 01400 - Quality Requirements, for general requirements for mock-up.

B. Provide field sample panels, illustrating color, texture and sheen for each color selection.

C. Provide door and frame assembly illustrating coating color, texture, and finish.

D. Locate where directed.

E. Mock-up may remain as part of the Work when accepted by the Architect. Mock-ups not accepted by the Architect shall be removed from the site at no cost to the District.

1.07 REGULATORY REQUIREMENTS

A. Conform to Environmental Protection Agency (EPA), California Air Resources Board (CARB) and South Coast Air Quality Management District (SCAQMD) regulations

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures.

B. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

C. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

D. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

E. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

F. Minimum Application Temperature for Varnish and Transparent Finishes: 65 degrees F (18 degrees C) for interior or exterior, unless required otherwise by manufacturer's instructions.

G. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

1.10 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Supply 5 gallons (20 L) of each color; store where directed.

C. Label each container with color in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide all paint and coating products from the same manufacturer.

B. Paints: Acceptable manufacturers:
   1. ICI Dulux Paints.
   2. Frazee Industries.
   3. PPG Industries.
   4. Vista Paint.
   5. Dunn-Edwards Paints.

2.02 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. USGBC LEED-NC Rating System, Version 2.2, EQ Credit 4.2; for interior wall and ceiling finish (all coats), anti-corrosive paints on interior ferrous metal, clear wood stains and finishes, sanding sealers, other sealers, shellac, and floor coatings.
         1) Opaque Topcoats, Flat: 50 g/L, maximum.
         2) Opaque Topcoats, Nonflat: 150 g/L, maximum.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate., dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

C. Paints and Coatings: Provide products from one manufacturer, except as otherwise indicated.
1. Provide products complying with regulatory requirements for volatile organic compound (VOC) content in force in jurisdiction where project is located.
2. Provide products having volatile organic compound (VOC) content not greater than that specified for LEED Certification.
3. Provide ready mixed paints and coatings, except field-catalyzed coatings.
4. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified; commercial quality.

E. Patching Material: Latex filler.

F. Fastener Head Cover Material: Latex filler.

2.03 PAINT SYSTEMS

A. Provide Premium Grade systems (2 top coats), except as otherwise indicated.

B. Provide colors as directed by Architect.
1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to District.
2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

PART 3 EXECUTION

3.01 SCOPE -- SURFACES TO BE FINISHED

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.

B. Paint the surfaces described in PART 3, indicated on the Drawings, and as follows:
1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
2. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
3. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
4. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.
5. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
6. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.
7. Paint equipment, piping, conduit, and exposed duct work in utility areas in colors according to the color schedule.
8. Paint all mechanical and electrical equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.
9. Paint shop-primed mechanical and electrical items occurring in finished areas.
10. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

11. Paint interior surfaces of air ducts with flat, nonspecular black paint where visible through registers, grilles, or louvers.
12. Paint dampers exposed behind louvers, grilles, to match face panels.
13. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

C. Do Not Paint or Finish the Following Items:
1. Items fully factory-finished unless specifically noted; factory-primed items are not considered factory-finished.
2. Items indicated to receive other finish.
3. Items indicated to remain naturally finished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Glass, plastic laminate and ceramic tile.
6. Brick, precast concrete, integrally colored plaster, unless otherwise noted.
7. Concrete masonry in utility, mechanical, and electrical spaces.
8. Polished and brushed stainless steel, anodized aluminum, bronze, terne, and lead.
9. Acoustical materials and wall coverings.
10. Concealed piping, ductwork, and conduit.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive Work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials; report incompatible primer conditions and submit recommended changes for Architect's approval.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Plaster and Gypsum Board: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Interior Wood: 15 percent, measured in accordance with ASTM D 4442.
4. Exterior Wood: 15 percent, measured in accordance with ASTM D 4442.
5. Concrete Floors: 8 percent.

E. Measure the ph factor of concrete, masonry, and mortar before starting any finishing process, using the method specified in MPI Architectural Painting Manual.
1. Report results in writing to Architect before starting work.
2. If results of test indicates need for remedial action, provide written description of remedial action. If a different primer or paint systems is required, state the total cost of the change. Do not proceed with remedial action or change without receiving written authorization from Architect.

3.03 PREPARATION

A. Prepare surfaces as required for the surface and coating; comply with coating manufacturer's specific preparation methods or treatments.

B. Coordinate painting work with cleaning and preparation work so that dust and other contaminants do not fall on newly painted, wet surfaces.

C. Surface Appurtenances: Prior to preparing surfaces or finishing, remove electrical plates, hardware, light fixtures, light fixture trim, escutcheons, machined surfaces, fittings, and similar items already installed that are not to be painted.
1. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before preparation and finishing.
2. After completing painting in each space or area, reinstall items removed using workers

skilled in the trades involved.

D. Surfaces: Correct defects and clean surfaces which affect work of this section.

E. Marks: Seal with shellac those which may bleed through surface finishes.

F. Impervious Surfaces: Remove mildew by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete, Cement Plaster and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, efflorescence, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
   1. Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
   2. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
   3. Determine alkalinity and moisture content of surfaces by performing appropriate tests as specified in MPI Manual. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture is present.

H. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.

I. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

J. Asphalt, Creosote, or Bituminous Surfaces to be Painted: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

K. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.

L. Concrete Floors to be Painted: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

M. Aluminum Surfaces to be Painted: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.
   1. Test coat anodized treatments with primer as recommended by anodized treatment manufacturer; if manufacturer can not be reasonably found, test per industry standards.

N. Copper Surfaces to be Painted: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

O. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
   1. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.

P. Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.
   1. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting

Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

Q. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.

R. Interior Wood Items to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

S. Interior Wood Items to Receive Transparent Finish: Sand wood to obtain a uniform appearance before immediately starting work. Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

T. Exterior Wood to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

U. Exterior Wood to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior calking compound after sealer has been applied. Prime concealed surfaces.

V. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

W. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

X. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions using the preparation, products, sheens, textures, and colors as indicated.
   1. Provide completed work matching approved samples for color, texture, and coverage.
   2. Remove, refinish, or repaint work not complying with requirements.

B. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film; do not apply finishes to surfaces that are not dry.

C. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
   1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
   2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
   3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.
   2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.

3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

E. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
1. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
2. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
3. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
4. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
5. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
6. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
7. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
8. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.
9. Stippled Finish: Roll and redistribute paint to even, fine texture; leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections; back roll final coat to achieve a uniform surface.

F. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

3.05 FIELD QUALITY CONTROL

A. See Section 01400 - Quality Requirements, for general requirements for field inspection.

B. Inspector of Record will provide field inspection.

3.06 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

C. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

D. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

E. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in MPI Manual.

3.07 SCHEDULE - COLORS

A. Exterior Cement Plaster/Stucco - Flat, 100% Acrylic Elastomeric Coating, Smooth (Including all exterior plaster with color coat finish, minimum two color selections).

	Dunn-Edwards
1st Coat - Primer	W6315 (Flex-Prime)
2nd Coat - Finish	W321 (Flex-Tex)
3rd Coat - Finish	W321 (Flex-Tex)

	Dunn-Edwards	Vista	ICI
B. Exterior Concrete - Flat, Acrylic			
1st Coat - Sealer	W709	4700	3210
2nd Coat - Finish	W704	2000	2200
3rd Coat - Finish	W704	2000	2200
C. Concrete Block (CMU) - Flat, Acrylic			
1st Coat - Filler	W305	0018	4000
2nd Coat - Finish	W704	2000	2200
3rd Coat - Finish	W704	2000	2200
D. Exterior Galvanized Metal - Gloss, Acrylic (Excluding handrails and railings, ornamental steel fencing and gates. See Section 09960).			
Pretreatment (Not for ferrous metal)	GE123	Jasco	Jasco
1st Coat - Primer	43-7	999	205
2nd Coat - Finish	W 960V8500	3028	
3rd Coat - Finish	W 960V8500	3028	
E. Exterior Ferrous Metal - Gloss, Acrylic			
1st Coat - Primer	43-7	910	4160
2nd Coat - Finish	W 960V8500	3028	
3rd Coat - Finish	W 960V8500	3028	
F. Exterior Exposed Wood Siding and Trim - Semi-Gloss, Acrylic			
1st Coat - Primer	W708	4200	3210
2nd Coat - Finish	W7500 8500	3028	
3rd Coat - Finish	W7500 8500	3028	
G. Exterior Wood - Paint Finish - Gloss, Acrylic			
1st Coat - Primer	W708	4200	3210
2nd Coat - Intermediate	W7600 8500		3028
3rd Coat - Finish	W7600 8500	3028	
H. Exterior Wood - Solid Color Stain Finish - Flat, Acrylic			
1st Coat - Primer/Finish	W704 3000		2210
2nd Coat - Finish	W704 3000	2210	
I. Exterior Wood - Stain Finish - Semi-Transparent, Acrylic			
1st Coat - Finish	Okon WPT3	Olympic Waterquard 2610	
Note: Some woods may require a second coat for desired effect.			
J. Interior Concrete Block (CMU) - Semi-Gloss, Acrylic			
1. 1st Coat - Sealer	W315	0018	4000
2. 2nd Coat - Finish	W602	6400	LM9200
3. 3rd Coat - Finish	W602	6400	LM9200
K. Interior Gypsum Wallboard - Flat, Acrylic			
1st Coat - Sealer	W101	1100	1030
2nd Coat - Finish	W401	8100	1201
3rd Coat - Finish	W401	8100	1201
L. Interior Gypsum Wallboard - Semi-Gloss, Acrylic			
1st Coat - Sealer	W600	6000	LM9116
2nd Coat - Finish	W603	6400	LM9200
3rd Coat - Finish	W603	6400	LM9200
M. Interior Plaster - Semi-Gloss, Acrylic			
1st Coat - Sealer	W709 6000	LM9116	
2nd Coat - Finish	W603	6400	LM9200
3rd Coat - Finish	W603	6400	LM9200

N. Interior Galvanized Metal - Semi-Gloss, Acrylic

1st Coat - Primer	W715	4800	3210
2nd Coat - Finish	W603	6400	LM9200
3rd Coat - Finish	W603	6400	LM9200

O. Interior Ferrous Metal - Semi-Gloss, Acrylic

1st Coat - Primer	W715	4800	4020
2nd Coat - Finish	W603	6400	LM9200
3rd Coat - Finish	W603	6400	LM9200

P. Interior Wood - Paint Finish - Semi-Gloss, Acrylic

1st Coat - Primer	W715	6000	3210
2nd Coat - Finish	W603	6400	LM9200
3rd Coat - Finish	W603	6400	LM9200

END OF SECTION

SECTION 09965

ANTI-GRAFFITI COATING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface Preparation.

B. Non-sacrificial anti-graffiti coating system.

1.02 RELATED SECTIONS

A. Section 04810 – Unit Masonry Assemblies.

B. Section 07190 – Water Repellents.

C. Section 07900 - Joint Sealers.

D. Section 09220 – Portland Cement Plaster.

1.03 REFERENCES

A. Environmental Protection Agency (EPA) Method 24

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Produce Data: Submit manufacturer's product data sheets on all products to be used for the work. Submit description for protection of surrounding areas and non-masonry surfaces, surface preparation, application, and final cleaning.

C. Applicator Qualifications: Submit qualifications of applicator.
   1. Certification stating applicator is experienced in the application of the specified products and approved by the manufacturer.
   2. List of recently completed graffiti resistant coatings projects, including project name and location, names of owner and architect, and description of products used, substrates, applicable local environmental regulations, and application procedures.

D. Environmental Regulations: Submit applicable environmental regulations.

E. VOC Certification: Submit certification that graffiti resistant coatings furnished comply with regulations controlling use of volatile organic compounds (VOC).

1.05 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Experienced in the application of the specified products and approved by the manufacturer.

B. Pre-application Meeting: Convene a pre-application meeting (10 days) before the start of application of graffiti-resistant coatings. Require attendance of parties directly affecting work of this section, including the Contractor, subcontractors, Inspector of Record (I.O.R.), applicator, and manufacturer's representative. Review environmental regulations, test panel procedures, protection of surrounding areas and non-masonry surfaces, surface preparation, application, field quality control, final cleaning, and coordination with other work.

1.06 ENVIRONMENTAL REGULATIONS

A. Comply with applicable U.S. Environmental Protection Agency (EPA), state and local environmental regulations.

1.07 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.

B. Storage and Handling: Store containers upright in a cool, dry, well-ventilated place, out of the sun. Store away from all other chemicals and potential sources of contamination. Keep lights, fire sparks, and heat away from containers. Do not drop containers or slide across sharp objects. Keep containers tightly closed when not in use. Store and handle materials in accordance with manufacturers written instruction.

1.08 WARRANTY

A. Manufacturer's standard warranty in which manufacturer and applicator agree to repair or replace materials that fail to maintain graffiti repellency within a period of ten years from date of Substantial Completion.

1.11 EXTRA MATERIAL

A. Provide the School District with one (1) one gallon container of Rainguard VandlClean Super at completion of project.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Design is based on the use of products manufactured by Monopole, Inc., Los Angeles, CA; 818-500-8585.

1. Product: Monochem Permashield Non-Sacrificial Graffiti Control System.

B. Materials shall be products of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer approved in advance by the Architect prior to Bid Opening.

2.02 GRAFFITI CONTROL COATINGS

A. Control Coating System: One component water based copolymer plastic coating that dries to a clear, hard, non-yellowing film. Coatings shall not support the growth of mildew, mold, fungus or bacteria and treated surfaces when cleaned, shall sustain unlimited graffiti removal without damage.

B. PROPERTIES

1.	Material type	Arcylic Co-Polymer.
2.	Specific Gravity	1.032-1.044 g/cm3.
3.	Solids Content by Weight	Approximately 28.0%.
4.	Application Temperature Range	50 degree to 90 degree F.
5.	Finish	Dries Clear – Low Luster Finish.
6.	V.O.C.	<30 g/L – V.O.C. Compliant.
7.	Flash Point	Non-Flammable.
8.	Surface Dry Time	30 minutes @ 75deg F with 50% Hum.
9.	Recoat	1-2 hours.
10.	Full Chemical Cure	72 –96 Hrs@ 75 deg F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify by examination that surfaces are acceptable to receive the specified graffiti resistant coatings. Notify the Architect if surfaces are not acceptable to receive the specified products.

3.02 PROTECTION

A. Protect surrounding areas, landscaping, building occupants, pedestrians, vehicles, and non-masonry surfaces not designated for protection during the work from contact with graffiti resistant coatings, masonry or concrete cleaners if used, residues, rinse water, fumes, wastes,

and effluents in accordance with manufacturer's written instructions.

3.03 SURFACE PREPARATION

A. Remove all dirt, dust, oil, grease, alkali, efflorescence, and other contaminants from surfaces using chemical cleaning. Use appropriate cleaners approved by the graffiti resistant coating manufacturer where necessary. Rinse thoroughly using pressure water spray to remove residues and other contaminants. Allow surfaces to dry completely before application of graffiti resistant coatings.

3.04 APPLICATION OF GRAFFITI CONTROL COATINGS

A. Apply graffiti resistant coatings to substrates that have been prepared in accordance with manufacturers written instructions, environmental regulations, and application procedures determined from test panel results accepted by the Architect.

B. Apply to clean, dry, cured, and properly prepared surfaces.

C. Do not apply to surfaces below 50 degree F or above 90 degree F. Do not apply in direct sun.

D. Consult manufacturer's written instructions for information on application equipment to be used and precautions to be taken with the specified products.

E. Do not dilute or alter graffiti resistant coatings. Apply as packaged.

F. Avoid overspray, wind drift, and splash of graffiti resistant coatings.

G. Spray Application Instructions:
   1. Apply at recommended coverage rates using a crosshatch spray pattern to create uniform and pinhole free surface film. Apply materials avoiding runs and sags.

H. Brush or Roller Application Instructions:
   1. Immediately roll or brush runs and sags using a clean roller or brush.

I. Second Coat Application Instructions: All surfaces require minimum 2 coats of VandlGuard to adequately protect against graffiti. Apply second coat as soon as the previous coat is dry to the touch. Do not allow more than 2 hours between coats.

J. Coverage Rates: Coverage rates will vary depending upon surface porosity and texture. Apply minimum 2 coats at manufacturer's recommended rates. Determine actual material requirements by test applications.

3.05 GRAFFITI REMOVAL INSTRUCTION:

A. Provide the School District with two (2) copies of removal and installation instructions for all products specified. Submit date in notebook form with sheet protectors for use of the maintenance personnel.

3.06 FIELD QUALITY CONTROL:

A. Inspection: Inspect the graffiti resistant coating work with the Contractor, Architect, I.O.R., applicator, and manufacturer's representative, and compare with test panel results accepted by the Architect. Determine if the graffiti resistant coatings suitably protect the substrates.

3.07 FINAL CLEANING:

A. Clean site of all unused graffiti resistant coatings, residues, rinse water, wastes, and effluents in accordance with environmental regulations.

B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the work of this section.

C. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to graffiti resistant coatings.

3.08 SCHEDULE:

A. All exterior metal signage.

END OF SECTION

SECTION 10105

MARKERBOARDS AND TACKBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards and Tackboards.

B. Horizontal Sliding Units.

C. Accessories.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Concealed supports in wood stud walls.

B. Section 09260 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCES

A. AHA A135.4 - Basic Hardboard; American Hardboard Association; 2004.

B. ANSI A208.1 - American National Standard for Particleboard; 1999.

C. ASTM A 424 - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2000.

D. ASTM D 1037 - Standard Test Methods for Evaluating Properties of Wood-Base and Particle Panel Materials.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2004.

F. ASTM F 793 - Standard Classification of Wallcovering by Durability Characteristics; 1993 (Reapproved 2004).

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, accessories, and particleboard core.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch (50 by 50 mm) in size illustrating materials and finish, color and texture of markerboard, tackboard, tackboard surfacing, and trim.

E. Test Reports: Show conformance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. Maintenance Data: Include data on regular cleaning, stain removal.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years documented experience.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Markerboards:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   2. Polyvision Corporation (Nelson Adams): www.polyvision.com.
   3. Tri-Best Visual Display Products, Inc..
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 MARKERBOARDS

A. Markerboards: "LCS" or "p3 ceramicsteel" on steel face sheet, laminated to core.
   1. Color: As selected from manufacturer's full range.
   2. Metal Face Sheet Thickness: 0.024 inch, 24 gage (0.61 mm).
   3. Core: Particleboard, 1/2 inch (13 mm) thick, laminated to face sheet.
   4. Backing: Aluminum sheet, 0.015 inch thick, laminated to core.
   5. Height: 48 inches (1220 mm) unless otherwise noted.
   6. Length: As indicated on drawings.
   7. Frame: Extruded aluminum with concealed fasteners. Fabricate frame and trim of not less than 0.062 inch thick aluminum alloy. Provide manufacturers' standard "wide" trim units, approximately 1-1/2 inches wide.
   8. Frame Profile: As indicated on drawings
   9. Frame Finish: Satin anodized aluminum.
   10. Accessories: Provide chalk tray, map rail, flag holder, and map hooks.

B. Tackboards: Fabric laminated to cork.
   1. Cork Thickness: 1/4 inch (6 mm).
   2. Fabric: Vinyl coated fabric.
   3. Color: As selected from manufacturer's full range.
   4. Surface Burning Characteristics: Flame spread index of 10, maximum, and smoke developed index of 5, maximum, when tested in accordance with ASTM E 84.
   5. Height: 48 inches (1220 mm).
   6. Length: As indicated on drawings.
   7. Frame: Extruded aluminum, with concealed fasteners.
   8. Frame Profile: As indicated on drawings
   9. Frame Finish: Anodized, natural.
   10. Accessories: Provide map rail.

C. Combination Units and Units Made of More Than One Panel: Factory-assembled markerboards, and tackboards in a single frame, of materials specified above.
   1. Join panels of different construction with H-shaped extruded aluminum molding finished to match frame.
   2. Join panels of similar construction with butt joints, aligned and secured with steel spline concealed in edge of core.
   3. Configuration: As indicated on drawings.
   4. Units Too Large to Ship Assembled: Fully assembled in factory, then disassembled for shipping.

D. Horizontal Sliding Units:
   1. Provide the size and arrangement of horizontal sliding units as shown on the Drawings.
   2. Sliding panels to be fabricated of materials and finishes as specified for markerboards using manufacturer's standard honeycomb core construction.
   3. Provide nylon ball bearing rollers of sufficient size and number to enable smooth and easy operation.
   4. Markerboards shall be reversible. Provide same face sheet on each side of core construction.
   5. Accessories: Provide map rail and marker tray.

2.03 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A 424, Type I, Commercial Steel, with fired-on vitreous finish.

B. Vinyl Coated Fabric: Type II, Class A, 24 oz./lin. yd., .032" thickness, (ASTM E 84) Flame Spread 10, Smoke Developed 5.

C. Cork: Premium grade, pure grain, natural cork, flame-retardant, meeting ASTM E 84 (Fuel Contribution) - Class B, and NFPA 255 (Critical Radiant Flux), Class II.

D. Particleboard Core: Industrial Grade, 1/2 inch thick high density particleboard, ANSI A208.1, grade 1-M-1; wood chips, set with waterproof resin binder, sanded faces.
   1. Physical Properties: ASTM D 1037.
      a. Density: 45 lbs./cu. ft.minimum.
      b. Internal Bond: 80 psi, minimum.
      c. Modulus of Rupture: 1900 psi, minimum.
      d. Modulus of Elasticity: 340,000 psi, minimum.
      e. Face Screw - Pull: 235 lbs., minimum.

E. Aluminum Sheet Backing: 0.015 inch (0.38 mm) thick.

F. Aluminum Extrusions: #6063T5 alloy, clear satin anodized finish.

G. Adhesives: Type used by manufacturer.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch (25 mm) wide overall, full width of frame.

B. Map Supports: Formed aluminum sliding hooks to fit map rail. Provide 1 hook per foot of markerboard.

C. Temporary Protective Cover: Sheet polyethylene, 8 mil (0.2 mm) thick.

D. Flag Holders: Cast aluminum bored to receive 1 inch (25 mm) diameter flag staff, bracketed to fit top rail of board.

E. Marker Tray: Aluminum, manufacturer's standard profile closed ends; concealed fasteners, same finish as frame.

F. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Install with top of chalk tray at 30 inches (760 mm) above finished floor.

C. Secure units level and plumb.

D. Butt Joints: Install with tight hairline joints.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at date of Substantial Completion.

END OF SECTION

SECTION 10121

TACKABLE WALL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory fabricated, fabric-covered tackable wall system.

B. Accessories as required for complete installation.

1.02 RELATED REQUIREMENTS

A. Section 09260 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2010b.

C. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 8, Interior Finishes.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Test Reports: Certified test data from an independent test agency verifying that wall systems meet specified requirements for fire performance.

D. Shop Drawings: Elevations indicating proposed locations of fabric seams and details indicating typical transitions to other finish surfaces.

E. Selection Samples: Fabric swatches representing manufacturer's full range of available colors, textures, and patterns. Submit six samples of selected color(s).

F. Verification Samples:
   1. For each fabric specified, minimum size 8 inches (200 mm) square, representing actual product in color, texture, and pattern.
   2. Tackable core backing material, minimum 12 inches (300 mm) square.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all components of tackable wall systems by a single manufacturer, including recommended primers, adhesives, and sealants.

B. Installer Qualifications: Firm specializing in site-fabricated wall systems, with not less than 5 years of documented experience in installing wall systems of the type specified, and approved by the manufacturer.

C. Surface burning characteristics of finishes shall comply with CBC, Section 803, Table 803.5. Provide system with flame spread index of 25, maximum, and smoke developed index of 450,

maximum, when tested in accordance with ASTM E 84.

D. Mock-Up: Provide a mock-up for evaluation of application workmanship.
   1. Finish areas designated by Architect.
   2. Do not proceed with remaining work until workmanship and overall appearance are approved by Architect.
   3. Refinish mock-up area as required to produce acceptable workmanship.
   4. Approved mock-up may remain as part of the completed Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect fabric, core, and track from excessive moisture in shipment, storage, and handling. Do not deliver materials to project until wet work such as concrete and plaster has been completed.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Do not begin installation until interior conditions have reached temperature and humidity that will be maintained during occupancy. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 5-year period after Date of Substantial Completion.

1.09 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Supply an additional 2 percent of fabric installed for District's use in maintenance of project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tackable Wall Systems:
   1. Tri-Best Visual Display Products.
   2. Substitutions: See Section 01600 - Product Requirements.

2.02 DESIGN REQUIREMENTS

A. Provide factory fabricated tackwall system comprised of vinyl covered fiberboard with self wrapped edges.

B. Verify that all adhesives and sealants employed in installation of tackable wall systems are low-emission types, with low VOC ratings.

2.03 MATERIALS

A. Vinyl Wallcovering: "Grande" as manufactured by Koroseal/RJF International. Supported vinyl material, consisting of a through-pigmented, mildew-inhibitorized polyvinyl chloride, surfaced with "Koroklear", a protective delustered acrylic liquid resin top coating, adhered to a pre-shrunk cotton/cotton-blend fabric backing. All materials shall conform to the CFFA-W-101-A, using test methods as outlined in FedSpec CCC-T-191, except as otherwise specified herein.
   1. Total Weight: 14 oz. sq. yd. 21 oz. lin. yd.
   2. Backing Weight: 2.0 oz. sq. yd.
   3. Fabric backing an content Osnaburg Blend: 65% Polyester, 35% Cotton.
   4. Adhesion of coating to fabric 6 pounds, per 2" strip (ASTM D 751).
   5. Wyzenbeek abrasion (double rubs): 300.

6. Tensile strength: 92 x 91 (w x f).
7. Tear strength: 36 x 38 (w x f).
8. Flame spread: 15 (ASTM E 84).
9. Smoke Developed: 20 (ASTM E 84).
10. Fire detection: "Early Warning Effect" (ASTM E 603)
11. Toxicity: Vinyl wallcovering shall be no more toxic than wood (NBS IR-82-2532 and NBS IR-82-2634).
12. Colorfastness: (200 hours) no change.
13. Cleanability: Meets or exceeds ASTM D 1308.
14. Alkalinity resistance: No fading, 24 hours in 1 percent sodium hydroxide.
15. Mildew resistance: Zone inhibition rating of "0" (ASTM G-21).
16. Staphylococcus resistance: 100% reduction within 24 hours.

B. Tackable Core: Fiberboard, 14-16 pcf (224-256 kg/cu m) density, flame retardant, 1/2 inch (12.7 mm) thickness.

C. Accessories: 1/2 inch aluminum "J" channel, 6063T5 aluminum alloy, clear satin anodized finish.

D. Fasteners and Adhesives: As recommended by manufacturer of tackable wall system for project conditions.

2.04 FABRICATION

A. General:
1. Fabricated individual panels accurately to size, with no joints in vinyl fabric or in fiberboard panels. Panels shall be fabricated in 4'-0" widths unless otherwise noted.
2. Fabricate individual panels by wrapping a single piece of vinyl fabric tightly over long vertical edges and around the back of a single piece of fiberboard panel and securely glue fabric to back of panel.
3. Apply vinyl fabric to fiberboard surfaces with skilled workmen, with adhesive in strict conformance with manufacturer's specifications. Number cuts from rolls and install consecutively on panels to minimize color variations.
4. After application, vinyl fabric shall be free from blisters, wrinkles or other defects due to faulty workmanship and shall be clean and in new condition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove wall plates and other obstacles, and prepare substrates to receive core material in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install tackable wall systems at locations indicated, complying with manufacturer's instructions.

B. Install prefinished tackwall panels prior to installation of ceiling and flooring.

C. Panels shall extend minimum of 6 inches above finish ceiling line.

D. Install panels direct to wall surface with construction grade adhesive and concealed fasteners.

E. Provide 1/2 inch aluminum "J" channel at doors, windows and where tackwall ends at other finishes. Miter and reinforce corner cuts

3.04 CLEANING

A. Clean exposed surfaces of tackable wall system, complying with manufacturer's instructions for cleaning and repair of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 10170

PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments, floor mounted overhead braced.

B. Urinal screens, wall hung.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry: Blocking and supports.

B. Section 09300 - Ceramic Tile.

C. Section 10800 - Toilet Accessories.

1.03 REFERENCES

A. ACI50 - Acceptance Criteria For Plastic Partitions Used in Public Restrooms.

B. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

C. ASTM B 221 - Specification for Aluminum Alloy Extruded Bars, Rods, Wire Shapes and Tubes.

D. ASTM D 2843 - Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

E. ASTM D 635 - Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

F. ASTM D 1929 - Test Method for Ignition Properties of Plastics.

G. California Accessibility Statutes/California Accessibility Regulations, Books 1 and 2.

H. California Building Code (CBC), California Code of Regulations, Title 24, Chapter 52.

I. Americans With Disabilities Act 1, ADA Title II.

1.04 PERFORMANCE REQUIREMENTS

A. Solid plastic components shall conform to the following ASTM Test Standard and ASTM Results:

Test	Standard	Results	ASTM Method
Self Ignition	650 F.	700 F.	D 1929
Rate of Burn	2.0 cm/min.	1.29 cm/min.	D 635
Smoke Density	<75	13.9	D 2843

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

C. Product Data: Provide data on panel construction, hardware, and accessories.

D. Samples: Submit two samples of partition panels, 4 x 4 inch (102 x 102 mm) in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.06 REGULATORY REQUIREMENTS

A. Comply with CAS/CAR and ADA for accessibility for the physically disabled.

B. Comply with CBC Section 1115B.7. Toilet stalls for disabled persons shall have slide bolt door latch, U-shape or wire pulls both sides of the door and self-closing hinges. Door hardware shall be mounted at 30 inches to 44 inches above finished floor. Doors at front entry stalls shall have 32 inches minimum clear width when the door is open 90 degrees. Doors at side entry stalls shall have 34 inches minimum clear width when the door is open 90 degrees. Maximum stile width shall be 4-inches.

1.07 WARRANTY

A. Provide manufacturer's standard 15 year warranty, to include breakage, corrosion or delamination of installed plastic components.

1.08 COORDINATION

A. Coordinate the work with placement of support framing and anchors in wall.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Toilet Compartments: Design is based on the use of products manufactured by Comtec Industries.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer listed below:
   1. Ampco Products, Inc: www.ampco.com.
   2. Substitutions: Section 01600 - Product Requirements.

2.02 MATERIALS

A. Solid Plastic: High density polyethylene (HDPE) containing a minimum of 10% recycled resin, manufactured under high pressure forming a single component section that is waterproof, non-absorbent, with a self-lubricating surface resistant to marking with writing utensils.

2.03 COMPONENTS

A. Toilet Compartments: Solid molded plastic panels, doors, and pilasters, floor-mounted headrail-braced, using 8" wrap around hinge and aluminum CWB features.
   1. Color: As selected.

B. Door and Panel Dimensions:
   1. Thickness: 1 inch (25 mm).
   2. Door Width: 24 inch (610 mm).
   3. Door Width for Accessible Use: 36 inch (915 mm).
   4. Height: 58 inch (1 473 mm).
   5. Thickness of Pilasters: 1 inch (25 mm).

C. Urinal Screens: Wall mounted with continuous wall brackets, minimum 18 inch depth.

2.04 ACCESSORIES

A. Pilaster Shoes: Formed plastic to match, 3 in (75 mm) high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
   2. Attachment of brackets to wall construction shall use No. 14 x 1 1/2 inch tamper proof stainless steel screws at 12 inch on center.

B. Head Rails: ASTM B221; aluminum extrusion, 6364-T5 alloy with clear anodized finish and anti-grip configuration, minimum 1.188 lbs. per lineal foot. Provide 18 gauge stainless steel wall brackets.

C. Wall and Pilaster Brackets: Natural anodized aluminum, continuous type.

D. Attachments, Screws, and Bolts: Type 304 stainless steel, tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts; tamper proof, Type 304 stainless steel.

E. Hardware: Natural anodized aluminum:
   1. Pivot hinges, self-closing, 8 inch wrap around type with through bolts, adjustable for door close positioning; two per door. Provide three hinges per door at accessible compartments.
   2. Nylon bearings.
   3. Door Latch: Slide type, surface mounted and fastened to door with tamper proof screws. Latch shall not require grasping or pinching of wrist.
   4. Each handicapped compartment door to include two (2) U-shape/looped handles to be located immediately below the latch on both sides.
   5. Door strike and keeper with rubber bumper; 6 inch long mounted on pilaster in alignment with door latch.
   6. Coat hook with rubber bumper; one per compartment, mounted on door at 48-inches maximum above finish floor.
   7. Wall stop: Provide at each handicap compartment.
   8. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 to 1/2 inch (9 to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 ERECTION TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in full closed position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

3.05 CLEANING

A. All surfaces shall be free of imperfections, scratch marks, blemishes or color variations. Remove and replace any components indicating evidence of imperfections at no cost to the District.

END OF SECTION

SECTION 10350

FLAGPOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 02316 - Filling and Backfilling.

B. Section 03300 - Cast-in-Place Concrete: Concrete base and foundation construction.

C. 07900 - Joint Sealants: Flash collar sealant.

1.03 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; American Association of State Highway and Transportation Officials; 2003.

B. ASTM B 241/B 241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2002.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

1.05 QUALITY ASSURANCE

A. Design flagpole foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State of California.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole; Product - ICC30D61-02: www.americanflagpole.com.
   2. Concord Industries, Inc; Product - Independence: www.concordindustries.com.
   3. Pole-Tech Co., Inc; Product - PT306C: www.poletech.com.
   4. Substitutions: See Section 01600 - Product Requirements.

2.02 FLAGPOLES

A. Flagpole: Aluminum.
   1. Design: Straight shaft.
   2. Mounting: Ground mounted type.
   3. Outside Butt Diameter: 6 inches (152 mm).
   4. Outside Tip Diameter: 3.5 inches (89 mm).
   5. Nominal Wall Thickness:.188 inches (4.8 mm).
   6. Nominal Height: 30 ft (9.14 m); measured from nominal ground elevation.

7. Mounting: Ground mounted type.
8. Design: Cone tapered.
9. Halyard: Interior type.

B. Performance Requirements:
1. Flagpole With Flag Flying: Resistant without permanent deformation to ____ miles/hr (____ km/hr) wind velocity; non-resonant, safety design factor of 2.5.
2. Flagpole Without Flag: Resistant without permanent deformation to ____ miles/hr (____ km/hr) wind velocity; non-resonant, safety design factor of 2.5.

C. Comply with CBC Section 1127A.9.5; flush access door for controls shall be mounted at 48-inches above finish surface, maximum.

2.03 POLE MATERIALS

A. Aluminum: ASTM B 241/B 241M, 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Stainless steel, 6 inch (150 mm) diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Flag: US design, 5 feet x 8 feet size, embroided nylon fabric, brass grommets, hemmed edges.

D. Halyard: 5/16 inch (8 mm) diameter nylon, braided, with steel or bronze core.

E. Connecting Sleeve For Multiple Section Poles: Same material as pole, precision fit for field assembly of pole, concealed fasteners.

2.05 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage (1.5 mm) steel, galvanized, depth of 36 inches (910 mm), as indicated.

B. Pole Base Attachment: Sleeve; aluminum base with base cover.

C. Lighting Ground Rod: 18 inch (455 mm) long steel rod, 3/4 inch (19 mm) diameter.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Satin Brush finish.

C. Finial: Spun finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Fill foundation tube sleeve with sand specified in Section 02316 and compact.

C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch (25 mm).

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 10400 3

IDENTIFICATION DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building identification signs.

1.02 RELATED SECTIONS

A. Section 04810 - Unit Masonry Assemblies.

B. Section 09220 - Portland Cement Plaster.

C. Section 10426 - Signage and Graphics.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum fifteen years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

1.06 WARRANTY

A. Provide manufacturer's standard warranty against material defects and installers one-year labor warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by A.R.K. Ramos Architectural Signage Systems, Oklahoma City, Oklahoma, 405-235-5505.
   1. Product: Standard Cast Letters.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer listed below:
   1. Gemini Incorporated, Taylor, TX.
   2. Mohawk Sign Systems, Inc., Schenectady, NY.

2.02 SIGNAGE TYPES

A. Building Identification Signs:
   1. Use individual metal letters and numbers.
   2. Mount on outside wall in location shown on drawings.

2.03 CAST LETTERS AND NUMBERS

A. Fabrication: Fabricate letters and numbers to comply with requirements indicated below and as indicated on the drawings:
   1. Cast Letters and Numbers: Form letters and numbers by sand casting. Produce

characters with smooth flat faces, sharp corners, precisely formed lines and profiles, free from pits, scale, sand holes and other defects. Cast anchoring devices into individual letters as required for anchorage.

B. Characteristics:
   1. Metal: Aluminum.
   2. Size:
      a. Building Letters: 8-inch.
   3. Letterstyle: As selected by the Architect from manufacturer's standard letterstyles.
   4. Mounting: Flush mount with threaded studs set in adhesive.
   5. Text: As indicated on the drawings.

C. Template: Provide full size paper mounting template showing hole placement and location of mounting holes.

D. Finishes: Colors and surface textures for exposed letters as selected by the architect from the manufacturer's standard metal letter finishes.

2.04 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install signs level, plumb and at height indicated with sign surfaces free from distortion or other defects in appearance.

C. Locate signs where indicated.

D. Protect from damage until Substantial Completion; repair or replace damage items.

END OF SECTION

SECTION 10405

DETECTABLE WARNING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface applied detectable warning tiles.

1.02 RELATED SECTIONS

A. Section Section 02751 - Portland Cement Concrete Paving: Concrete curb ramps and sidewalks.

B. Section 02765 - Pavement Markings. Painted warning stripes.

1.03 REFERENCES

A. Americans with Disabilities Act (ADA), CFR Transportation, Part 37.9, Standards for Accessible Transportation Facilities.

B. California Code of Regulations, Title 24, California Building Code (CBC), Section 1127B, Exterior Routes of Travel, and Section 1133B, Accessibility for Entrances, Exits, and Paths of Travel.

C. ASTM C 1028 - Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like surfaces by the Horizontal Dynamometer Pull Meter Method.

D. ASTM D 543 - Test Method for Resistance of Plastics to Chemical Reagents.

E. ASTM D 570 - Test Method for Water Absorption of Plastics.

F. ASTM D 638 - Test Method for Tensile Properties of Plastics.

G. ASTM D 695 - Test Method for Compressive Properties of Rigid Plastics.

H. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

I. ASTM D 2486 - Standard Test Method for Scrub Resistance of Wall Paint.

J. ASTM D 5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).

K. ASTM E 84 - Test Methods for Surface Burning Characteristics of Building Materials.

L. ASTM G 155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

M. Federal Specification Standards.

N. California Code of Regulations (CCR), Title 24, California Building Code (CBC), Chapter 11B, Accessibility to Public Buildings.

1.04 SYSTEM DESCRIPTION

A. Provide surface applied polyurethane detectable warning tiles where indicated using an exterior grade tactile warning surface described herein.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

C. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x 8" of the kind proposed for use.

D. Shop drawings are required for products specified showing fabrication details; composite structural system; plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

E. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet the properties indicated. All test reports shall be conducted on a Surface Applied tactile tile system as certified by a qualified independent testing laboratory.

F. Maintenance Instructions: Submit copies of manufacturer's specified maintenance practices for each type of tactile tile and accessory as required.

1.06 QUALITY ASSURANCE

A. Provide Surface Applied tactile tiles and accessories as produced by a single manufacturer.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by tactile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

1.07 REGULATORY REQUIREMENTS

A. California Code of Regulations (CCR): Provide only approved DSA-AC detectable warning products as provided in the California Code of Regulations (CCR), Title 24, Part 1, Articles 2, 3, and 4.Section 205 definition of "Detectable Warning". See CBC Section 1127B.5 for "Curb Ramps" and Section 1133B.8.5 for "Detectable Warnings at Hazardous Vehicle Areas".

B. Provide detectable warning systems at all curb ramps, passenger loading zones, and other locations where shown on the drawings, in accordance with CBC Sections 1127B.5.7, 1131B.2, and 1133B.8.5.

C. Color yellow for detectable warning surface shall conform to Color No. 33538 per Federal Standard No. 595B.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

B. Tiles shall be delivered to location at building site for storage prior to installation.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40°F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40°F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

C. Disposal of any liquids or other materials of possible contamination shall be made in accordance with federal, state, and local laws and ordinances.

D. Cleaning materials shall have code acceptable low VOC solvent content and low flammability if used on the site.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Surface Applied tactile tiles shall be guaranteed in writing for a period of five years from date of final completion. The guarantee includes defective work, breakage, deformation, and loosening of tiles.

1.11 EXTRA MATERIALS

A. See Section 01600 - Product Requirements, for additional provisions.

B. Deliver extra stock to storage area designated by District. Furnish new materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identification for Surface Applied tactile tiles. Furnish not less than two (2) % of the supplied materials for each type, color and pattern installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

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

B. The Vitrified Polymer Composite (VPC) Surface Applied Tactile Tile specified is based on Armor-Tile manufactured by Engineered Plastics Inc., Williamsville, New York, 800-682-2525.

C. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Vitrified Polymer Composite (VPC) Surface Applied tiles shall be an epoxy polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line dome pattern of truncated domes 0.2" in height, 0.9" diameter at the base, and 0.4" diameter at top of dome spaced 2.35" nominal as measured on a diagonal and 1.70" nominal as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch.
   1. Dimensions: Tiles shall be held within the following dimensions and tolerances:
      a. Length and Width: 12" x 12", 24" x 24", 24" x 36", 24" x 48", 36" x 48", 36" x 60".
      b. Depth: 0.1875 inches +- 5% max.
      c. Face Thickness: 0.1875 inches +- 5% max.
      d. Warpage of Edge: +-0.5% max.
   2. Water Absorption of Tile when tested by ASTM D 570 not to exceed 0.35%.
   3. Slip Resistance of Tile when tested by ASTM C 1028 the combined wet/dry static co-efficient of friction not to be less than 0.80 on top of domes and field area.
   4. Compressive Strength of tile when tested by ASTM D 695 not to be less than 18,000 psi.
   5. Tensile Strength of Tile when tested by ASTM D 638 not to be less than 10,000 psi.
   6. Flexural Strength of Tile when tested by ASTM D 790 not to be less than 24,000 psi.
   7. Chemical Stain Resistance of Tile when tested by ASTM D 543 to withstand without discoloration or staining - 1% hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
   8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM D 2486 with reciprocating linear motion of 37± cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block to be 3.2 lb. Average wear depth shall not exceed 0.030 after 1000 abrasion cycles measured on the top surface of the dome representing the average of three measurement locations per sample.
   9. Fire Resistance: When tested to ASTM E 84 flame spread be less than 25.
   10. Gardner Impact to geometry "GE" of the standard when tested by ASTM D 5420 to have a mean failure energy expressed as a function of specimen thickness of not less than 450 in. lbf/in. A failure is noted if a hairline fracture is visible in the specimen.

11. Accelerated Weathering of Tile when tested by ASTM G 155 for 2000 hours shall exhibit the following result - no deterioration, fading or chalking of surface of tile.

B. Color: Yellow conforming to Federal Color No. 33538. Color shall be homogeneous throughout the tile.

2.03 ACCESSORIES

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: ¼" diameter x 1 ¾" long. Armor-Drive by Engineered Plastics or equal.

B. Adhesive: Armor-Bond as supplied by Engineered Plastics Inc..

C. Sealants: Armor-Seal as supplied by Engineered Plastics Inc.

PART 3 EXECUTION

3.01 INSTALLATION

A. During all surface preparation and tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with applicable industry and government standards.

B. The application of all tile, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers.

C. Work with the Contractor or Engineer to ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review design drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer.

D. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. A thin permanent marker works well. Remove tile when done marking its location.

E. The surface to receive the detectable warning surface tile (not recommended for asphalt) is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a rag soaked in Acetone.

F. Immediately prior to installing the detectable warning surface tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured for a minimum of 30 days.

G. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.

H. Apply the adhesive on the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator. A 3 x 4 foot tile will typically require an entire tube of adhesive.

I. Set the tile true and square to the curb ramp area as detailed in the design drawings.

J. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3½" using the recommended diameter bit. Drill through the tile without hammer option until the tile has been successfully penetrated, and then with hammer option to drill into the concrete.

K. Immediately after drilling each hole, and while still applying foot pressure, vacuum, brush or

blow away dust and set the mechanical fastener as described below, before moving on to the next hole.

L. Mechanically fasten tiles to the concrete substrate using a hammer to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the hammer, taking care to avoid any inadvertent blows to the truncated dome or tile surface. A plastic deadblow or leather hammer is recommended.

M. Working in a sequence which will prevent buckles in the tile, proceed to drill and install all fasteners in the tiles molded recesses.

N. Following the installation of the tiles, the perimeter caulking sealant should be applied. Follow the perimeter caulking sealant manufacturer's recommendations when applying. Tape all perimeter edges of the tile and also tape the adjacent concrete back 1/2" from the tiles perimeter edge. Tool the perimeter caulking with a plastic applicator or spatula to create a straight edge in a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.

O. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking.

3.02 CLEANING AND PROTECTION

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

END OF SECTION

SECTION 10420

CAST BRONZE PLAQUES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dedication Plaque.

1.02 RELATED SECTIONS

A. Section 04810 - Unit Masonry Assemblies: CMU mounting surfaces.

B. Section 09220 - Portland Cement Plaster: Plaster mounting surfaces.

1.03 BIDDING

A. Exact verbiage and spelling of names shall be provided to contractor before the preparation of shop drawings. For bidding purposes, plaque will include the following:
   1. Name of Building
   2. Name of School District.
   3. Completion Date.
   4. Board of Trustees (include six names with an average of twelve letters each).
   5. Name of District Superintendent.
   6. Name of Architect.
   7. Name of Contractor.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's current product data.

C. Shop Drawing Template: Submit full scale template of plaque showing letter size, spacing, alignment, border, and spelling of all names and titles.

D. Samples: Submit two samples illustrating finish, texture, and color of plaque.

E. Certificates: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's Instructions: Indicate mounting method for intended substrate.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than fifteen years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Deliver plaque to project site in manufacturer's original wrapping materials.

1.07 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Submit manufacturer's standard warranty against material defects.

C. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is base on the use of products manufactured by The Southwell Company, San Antonio, TX (800) 950-8068.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer listed below:
   1. Southern California Bronze Company, Los Angeles, CA (213) 746-8046.
   2. A.R.K. Ramos Signage Systems, Oklahoma City, OK, (800) 725-7266.
   3. Metal Arts, Mandan, ND, (800) 237-8069.

C. Substitutions: See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Tablet shall be cast of virgin ingots (85-5-5-5 standard U.S. Bronze Alloy). Casting shall be free of pits and gas holes and all letters shall be sharp and hand tooled. Background shall be oxidized.

B. Size: 24 inch wide by 18 inch high.

C. Border: Border and face of letters shall be raised above field or plaque background. Provide Double Line (DL) border.

D. Background Texture: Texture shall be Leatherette Stipple.

E. Letter Style: As selected by the District.

F. Finish: Border and faces of raised letters shall be satin finish.

G. Mounting: Provide bosses and studs for concealed mounting.

H. Plaque shall be chemically cleaned and sprayed with two coats of manufacturer's standard clear lacquer.

2.03 ACCESSORIES

A. Adhesive: As recommended by manufacturer.

B. Mounting Hardware: As recommended by manufacturer for concealed mounting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean and ready for installation of plaque.

B. Verify mounting location with the District.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install plaque plumb, level, and true-to-line and rigidly attached to supporting structure.

C. Protect surrounding surfaces during installation and repair any damage created during installation.

3.03 CLEANING

A. Clean plaque in accordance with manufacturer's instructions.

END OF SECTION

SECTION 10426

SIGNAGE AND GRAPHICS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Room and door identification system.

B. Required informational signs.

C. Site directional and traffic signs.

1.02 RELATED SECTIONS

A. Section 02765 - Pavement Markings: Directional arrows and accessibility/disabled graphics.

B. Section 03300 - Cast-in-Place Concrete: Footings for signs.

1.03 REFERENCES

A. Federal Standards 595B, Colors, Volume 1.

B. California Building Code (CBC), California Code of Regulations, Title 24.
   1. Chapter 10, Means of Egress, Sections 1003.2.8.2 and 1003.2.8.6.1.
   2. Chapter 11B, Accessibility.

1.04 DESIGN REQUIREMENTS

A. All accessible signage shall conform to CBC Sections 1115B.5, 1117B.5 and 1103.2.4 Tactile exit signage shall be provided per CBC Section 1003.2.8.6.
   1. Character Type: Characters on signs shall be raised 1/32 inch minimum and shall be sans serif uppercase characters accompanied by California Grade 2 Braille.
   2. Character Size: Raised characters shall be a minimum of 5/8 inch and a maximum of 2 inches high.
   3. Finish and Contrast: Contrast between characters, symbols and their background must be 70% minimum and have a non-glare finish in accordance with CBC Section 1117B.5.2.
   4. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10 in accordance with CBC Section 1117B.5.3.
      a. All letters measured must be uppercase. After choosing a typestyle to test, begin by printing the letters I,X, and O at 1 inch height. Place the template's 1:1 square over the X or O, whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all tests are passed, the typestyle is compliant with the proportion code.
   5. Braille: California Contracted Grade 2 Braille shall be used whenever Braille is required on the signage and/or as shown on the Drawings. Dots shall be spaced 1/10 inch (2.54 mm) on center in each cell, with 2/10 inch(5.08 mm) space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above background in accordance with CBC Section 1117B.5.6.
      a. Provide rounded or domed California Braille dots, each distinct and separate and an integral part of the sign. Dots with straight sides and flat tops are not acceptable and heat or glue applied dots are not acceptable.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements for submittal procedures.

B. Product Data: Submit complete manufacturer's description literature and specifications.

1. Materials List: Submit complete lists of materials and equipment proposed for use, giving the manufacturer's name, catalog number, and catalog cut for each item where applicable.
2. Manufacturer's Recommendations: Submit the manufacturer's current recommended methods of installation.

C. Submit shop drawings listing sign size, letterform, letter heights, and format.

D. Samples: Submit one full size sample sign of type, style and color specified, including method of attachment.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation.

B. Replacements: In the event of damage, immediately make repairs and replacements necessary to the acceptance of the Architect and at no additional cost to the District.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Design of plastic laminate signs is based on the use of products manufactured by Mohawk Sign Systems, Inc., Schenectady, NY, 518- 370-3433.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted in advance by the Architect.
   1. Acceptable Manufacturer: Best Sign Systems, Montrose, Colorado, 800-235-2378.

2.02 MATERIALS

A. General: Signs shall comply with ADAAG, Title 24, and CABO/ANSI A117.1 requirements.

B. MP Plastic: For interior signs.
   1. Material thickness: 1/8 inch.
   2. Flexural strength flat: 25, 000 psi.
   3. Tensile strength: 22,000 psi.
   4. Compressive strength flat: 47,000 psi.
   5. Shear strength: 16,800 psi.
   6. NEMA rated "Self-extinguishing".

C. Fiberglass: For exterior signs.
   1. Material thickness: 1/4 inch.
   2. Flexural strength flat: 22,000 psi.
   3. Tensile strength: 14,000 psi.

2.03 GRAPHIC PROCESS

A. All signs shall be manufactured in accordance with Mohawk Graphic Process Series 200A - Sand Carved, using Format D.
   1. Plaque material for interior signs shall be melamine plastic (MP) laminate, approximately 1/8 inch thick, with contrasting core or sub-surface color. The melamine shall be non-static, non-glare, fire-retardant and self-extinguishing.
   2. Plaque material for exterior signs shall be 1/4 inch thick fiberglass.
   3. Letter or numbers shall be raised 1/32 inch (0.794 mm) minimum and shall be upper case characters accompanied by California Contracted Grade 2 braille. Braille dots shall be 1/10 inch (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background and shall have rounded or domed tops. Braille shall be separated 1/2 inch from the corresponding raised characters or symbols.
   4. Letterform or letterstyle shall be Helvetica Medium upper case characters with copy centered

on the sign. Helvetica Regular may be used where characters are less than 1 inch high. Sign shape shall have 5/16 inch radius corners.

5. All letters, numbers, and /or symbols shall contrast a minimum of 70% with their background, either light characters on a dark background or dark characters on a light background. Text and symbols height shall be a minimum of 5/8 inches and a maximum of 2 inches.
6. Colors will be selected by the Architect from the manufacturer's standard colors.

2.04 TEXT AND LOCATION

A. Room Names: All rooms shall have room name signs. Use Finish Schedule as a guide. Actual room names will be verified by the District after construction begins.

B. Door Numbers: All interior and exterior doors shall have door numbers. Use Opening Schedule as a guide. Actual door numbers will be verified by the District after construction begins. Assume an average of 4 numerals for each door. Provide fiberglass plaques at exterior doors.

C. Letters and number sizes shall be minimum of one inch unless otherwise noted.

D. All permanent identification shall be installed on the wall adjacent to the latch side of the door. Install signs 60 inches from finished floor to center line of sign.

E. All signs shall be anchored to the surface with four Torx head screws per sign.

F. Signs mounted on glass shall use Scotchmount, double-faced tape mounting. Provide blank MP plate on opposite side of glass to conceal mounting tape, color and size to match sign.

2.05 SPECIALTY SIGNS

A. International Symbol of Accessibility (ISA): Provide at all main building entrances that are accessible to and usable by persons with disabilities.
   1. Symbol proportions shall conform to CBC, Chapter 11B, Figure 11B-6.
   2. Symbol shall consist of a white figure on a blue background. The blue shall be equal to Color No. 15090 in Federal Standard 595B.
   3. Material: Plaque shall be 1/4 inch thick fiberglass with 5/16 inch radius corners.

B. Building Identification Sign: Provide at each main building.
   1. Material: 1/4 inch thick fiberglass.
   2. Letter height: 6 inches for building designation and 4 inches for building name. Provide 1-1/4 inch radius at plaque corners.
   3. Sign text: "Building __", "Administration", etc.

C. Toilet Room Identification Symbols and Accessibility Signs: Provide at all accessible toilet rooms.
   1. Identification symbols for toilet room doors per CBC, Section 1115B.5 requirements. Mount centered on door leaf, 60 inches above finish floor.
      a. Men: 12 inch equilateral triangle, 1/4 inch thick MP, with gender pictogram. Mohawk Design MCA-VM-4, CA T-24, Format D.
      b. Women: 12 inch diameter circle, 1/4 inch thick MP, with gender pictogram. Mohawk Design MCA-VM-3, CA T-24, Format D.
      c. Unisex: 12 inch equilateral triangle with gender pictograms, 1/4 inch thick MP, superimposed on a 12 inch diameter circle, 1/4 inch thick MP. Mohawk Design Unisex, CA T-24, Format D.
   2. Toilet Room Accessibility Sign: Provide at all accessible toilet rooms. Mount on latch side of door, 60 inches from finished floor to centerline of sign, 4 inches from door jamb.
      a. Material: 1/8 inch thick MP.
      b. Plaque to include International Symbol of Accessibility, gender pictogram(s), and raised text and Braille. Mohawk Design DS, Format D.

D. Fire Extinguisher Identification Signs: Provide at each fire extinguisher location.
   1. Material: 1/8 inch thick MP.
   2. Letter height: 1-1/2 inches.
   3. Sign text: "Fire Extinguisher", with California Grade 2 braille.

E. Occupancy Signs: Provide at all assembly areas and where noted on the plans.
   1. Material: 1/8 inch thick MP.
   2. Letter height: 2 inches.
   3. Sign text: "Occupancy #### Persons". Verify actual number with Architect.

F. Non-illuminated Exit/Exit Route signs: Comply with CBC, Sections 1003.2.8.2 and 1003.2.8.6.1.
   1. Material: 1/8 inch thick MP.
   2. Letter height: two inches.
   3. Sign Text: "Exit", "Exit Route", "Exit Stair Down", etc., with California Grade 2 braille.

G. Wheelchair Lift Sign: Provide sign at wheelchair lift door.
   1. Material: 1/8 inch thick MP.
   2. Letter height: 3/4 inch.
   3. Sign text: "Wheelchair lift keys are available at Administration Office".

H. Post Indicator Valve/Fire Department Connection (P.I.V./F.D.C.) Sign: Provide sign at P.I.V./F.D.C. complying with NFPA 24.
   1. Material: 1/4 inch thick fiberglass.
   2. Letter height: one inch.
   3. Sign text: "Serving Building "_" (Building Designation).

I. Fire Riser Sign: Provide where fire risers occur in buildings at a location on the exterior of the building acceptable to the local fire department.
   1. Material: 1/4 inch thick fiberglass.
   2. Letter height: one inch.
   3. Sign text: "Fire Riser Inside".

J. Miscellaneous Signs: Provide other signs as detailed on the drawings using 1/8 inch thick MP for interior signs and 1/4 inch thick fiberglass for exterior signs.

2.06 SITE SIGNS

A. Design is based on the use of products manufactured by SignWire, Inc., Dayton, Ohio, 800-922-6189.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted in advance by the Architect.
   1. Acceptable Manufacturers:
      a. AllState Sign & Plaque Corporation, Deer Park, New York, 800-240-6039.
      b. SA-SO Corporation, St. Paul, Minnesota, 800-752-4294.

C. Accessible Signs: Provide 0.080" aluminum with RA Engineer Grade Reflective Sheeting at all accessible signs. Signs shall be of white or blue background with blue or white symbols and characters respectively. Blue color shall conform to Color No. 15090 in Federal Standard 595B.

D. Traffic and Parking Signs: Provide non-reflective painted 18 gauge heavy duty steel sign with contrasting characters and background. Color shall be selected by the Architect.

E. All text shall be capitalized and signs shall have radius corners with eased edges.

F. Signs shall be mounted on 2 inch square galvanized steel post with 12 inch diameter by 24 inches deep concrete footing.

G. Tow Away Signs: Provide non-reflective 18 inch wide by 24 inch high tow away signs with 1 inch letters at all entrances to parking lots with accessible parking stalls. See site plan for location and details.
   1. Sign shall read:
      a. "UNAUTHORIZED VEHICLES PARKED IN DESIGNATED ACCESSIBLE SPACES NOT DISPLAYING DISTINGUISHING PLACARDS OR LICENSE PLATES ISSUED FOR PERSONS WITH DISABILITIES MAY BE TOWED AWAY AT OWNER'S EXPENSE. TOWED VEHICLES MAY BE RECLAIMED AT * (address) OR BY

TELEPHONING * (telephone no.) ." *(Verify information with Architect prior to fabrication).

H. Parking Traffic Signs: Provide non-reflective 12 inch wide by 18 inch high signs at locations noted on the site plan. Lettertype and letter size shall be manufacturer's standard.
   1. Signs shall read:
      a. Bus Only Entrance
      b. Bus Only Exit.
      c. Faculty Parking Lot.
      d. Visitor Parking.
      e. One Way Entrance.
      f. One Way Exit.
      g. No Parking Fire Access.
      h. Entrance Only.
      i. Exit Only.
      j. Passenger Loading Zone.

I. Accessible Parking Stall Sign: Provide reflective sign with ISA symbol. Sign shall be 12 inches wide by 18 inches high, mounted 80 inches above finished paved surface. Provide one sign for each accessible parking space or stall. Van accessible parking stalls shall include an additional sign, 12 inches wide by 6 inches high with the letters "Van Accessible". Where "Van Accessible" sign occurs, it shall be installed at 80 inches above the finished paved surface. See details on site plan.

J. Accessible Path of Travel Sign: Provide reflective 12 inch by 18 inch path of travel signs with 1-1/2 inch letters and ISA symbol at locations noted on the site plan. Text shall read "Accessible Path of Travel". Sign shall be mounted 80 inches above finished surface at paved path of travel areas. Sign may be mounted 60 inches above finished surface in landscaped areas. If mounted on a stucco or CMU wall, use #12 vandal proof lag screws set into expansion shields. See drawings for locations.

2.07 OTHER MATERIALS

A. Other materials, not specifically described but required for a complete and proper installation of the work of this section, shall be new, first quality of their respective kinds, and subject to approval of the Architect.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the substrates and conditions under the specialty signs which are to be installed and remedy any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sign units and components at the locations shown or scheduled, securely mounted with adhesive mounting system and screws, unless otherwise indicated. Attach signs to substrates in accordance with manufacturer's instructions.

B. Install level, plumb, and at the proper height. Cooperate with other trades for installation of sign units to finish surfaces. Repair or replace damaged units as directed by the Architect.

END OF SECTION

SECTION 10500

LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Locker units with hinged doors.

B. Metal tops and filler panels.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Concrete base construction.

1.03 REFERENCES

A. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2006a.

B. California Building Code (CBC), California Code of Regulations, Title 24, Section 1115B.6.4, Lockers.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on locker types, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples 3 x 6 inches (75 x 150 mm) in size, of each color scheduled; applied to specified base metal.

E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 QUALITY ASSURANCE

A. Provide a path of travel (POT) not less than 36 inches in clear width to all accessible lockers.

1.06 MOCK-UP

A. Provide mock-up of one full size locker, single tier with sloped top, in selected colors.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 MATERIALS

A. Design is based on the use of products manufactured by Republic Storage Systems Co. Canton, Ohio. Materials shall be the products of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer approved as listed, or equal.

B. Acceptable Manufacturers:
   1. Lyon Workspace Products, Aurora, Illinois.
   2. Penco Products, Oaks, Pennsylvania.
   3. List Industries, Inc., Deerfield Beach, Florida.

4. Substitutions: See Section 01600 - Product Requirements.

C. Lockers shall be Republic "Standard" locker. Provide minimum one (1) accessible locker at each locker room or location.

D. Sheet Steel: ASTM A 653/A 653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; to the following minimum thicknesses:
   1. Body and Shelf: 24 gage (.02 mm).
   2. Door Outer Face: 16 gage (.05 mm).
   3. Door Frame: 16 gage, 0.060 inch (1.5 mm).
   4. Hinges: 14 gage, 0.075 inch (1.9 mm).
   5. Base: 16 gage (.05 mm).
   6. Sloping Top: 20 gage, 0.036 inch (0.9 mm).
   7. Trim: 20 gage, 0.036 inch (0.9 mm).

E. Accessories For Each Locker: Two single prong wall hooks, one double prong wall hook, hat shelf and rubber bumpers.

2.03 LOCKER UNITS

A. Width: 12 inches (300 mm).

B. Depth: 12 inches (300 mm).

C. Height: 72 inches (1,830 m).

D. Configuration: single tier.

E. Mounting: Recessed.

F. Base: Metal base. 16 gauge zee base.
   1. Base Height: 4 inch (100 mm).

G. Top: Sloped metal with closures.

H. Locking: Equipped for built-in combination locks.

I. Ventilation Method: Door louvers.

J. Class: Conventional.

K. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

L. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

M. Doors: Hollow channel edge construction, 1-3/16 inch (30 mm) thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

N. Hinges: Two for doors under 42 inches (1 050 mm) high; three for doors over 42 inches (1 050 mm) high; weld securely to locker body and door. Hinges shall be 2 inches high, 5-knuckle, full loop, tight pin style.

O. Number Plates: Provide oval shaped brass plates. Form numbers 1/2 inch (13 mm) high of block font style with ADA designation, in contrasting color.

P. Provide ventilation openings at top and bottom of each locker.

Q. Form recess for operating handle and locking device.

R. Finish edges smooth without burrs.

S. Fabricate continuous sloped metal tops, ends and closure pieces.

T. Provide end panels and filler strips.

U. Accessible Lockers:
   1. Provide latch and locking hardware that does not require twisting, pinching or grasping to operate. Lock shall be one touch access by contacting a button key to the lock face. Product: Republic Digilock ADA.
   2. Provide shelf and pole at 48 inches maximum above finish floor and lower shelf at 9 inches minimum above finish floor.
   3. Provide minimum one accessible locker and 1% of total lockers per CBC Section 1115B.6.4 See Floor Plans.

2.04 FINISHING

A. Clean, degrease, and neutralize metal; prime and finish with one coat of baked enamel.

B. Paint locker bodies and doors in contrasting colors.

C. Paint locker units 1 color, as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10523

FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers and fire extinguisher cabinets.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Wood blocking and shims.

B. Section 09260 - Gypsum Board Assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2010.

B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 PERFORMANCE REQUIREMENTS

A. Conform to NFPA 10.

B. Provide extinguishers classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

C. Fire extinguishers shall be listed and approved by the California State Fire Marshal.

D. Fire extinguisher cabinets shall comply with the following:
   1. Latching and locking hardware to be operable with a single effort by lever-type hardware, panic bars, push-pull activating bars or other hardware designed so as not to require the ability to grasp the opening hardware and not require a force greater than 5 lbs. to open.
   2. Force required to activate controls shall not exceed 5 lbs.
   3. Cabinet shall be mounted between 15 to 48-inches above finish floor for forward accessibility approach.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate cabinet physical dimensions and rough-in measurements for recessed cabinets.

C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

F. Submit CSFM listing.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguisher Cabinets and Accessories:
   1. JL Industries, Inc: www.jlindustries.com.
   2. Larsen's Manufacturing Co: www.larsensmfg.com.

3. Potter-Roemer: www.potterroemer.com.
4. Substitutions: See Section 01600 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

B. Design is based on products manufactured by JL Industries.

C. Dry Chemical Type, Classrooms and Offices: Cast steel tank, with pressure gage.
   1. Class: A, B, C.
   2. Size: 5 lbs.
   3. Finish: Baked enamel, Red color.
   4. U/L Classification: 2A-10BC.
   5. Product: Cosmic 5E by JL Industries.

D. Wet Chemical Type, Kitchens and Snack Bars: Stainless steel tank, with pressure gage.
   1. Class: K.
   2. Size: 6 liters.
   3. Finish: Baked enamel, Red color.
   4. U/L Classification: K.
   5. Product: Saturn 15.

2.03 FIRE EXTINGUISHER CABINETS

A. Metal Door and Frame: Formed aluminum.

B. Cabinet Configuration: Semi-recessed type.
   1. Tub interior nominal dimensions of 10 1/2-inch wide x 24-inch high x 6-inch deep.
   2. Trim: Returned to wall surface, with 1 1/2" inch (38 mm) projection, 1 3/4" inch (45 mm) wide face.
   3. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim.

C. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.

D. Door Glazing: Plastic, clear, 1/8 inch (3 mm) thick acrylic. Set in resilient channel gasket glazing.

E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.

F. Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: #180 clear anodized aluminum.

H. Finish of Cabinet Interior: White enamel.

I. Product: Academy Model 1026W10 by JL Industries.
   1. Provide Ambassador Model 1026W10FX with Fire-FX Option at fire rated walls.

J. At surface mounted locations, provide Academy Model 1028W10.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Cabinet Signage: "Fire Extinguisher" - letters die cut, mounted vertical, red.

C. ADA Flush Pull.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings or surface mount, 15 to 48-inches from finished floor to midpoint of door pull.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

END OF SECTION

SECTION 10810 3

TOILET ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Toilet Room and Custodial Accessories.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 09260 - Gypsum Board Assemblies.

C. Section 09300 - Tile.

D. Section 10170 - Plastic Toilet Compartments.

E. Section 16050 - Basic Electrical Materials and Methods; Provisions for required power to hand dryers.

1.03 REFERENCES

A. ADAAG/ATBCB - Americans with Disabilities Act Accessibility Guidelines; US Architectural and Transportation Barriers Compliance Board; 2004.

B. ASTM A 240/A 240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2005.

C. ASTM A 554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2003.

D. ASTM C 1036 - Standard Specification for Flat Glass; 2001.

E. ASTM F 446 - Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area; 1985 (Reapproved 2004).

F. California Building Code (CBC), California Code of Regulations, Title 24, Section 1118B, Space Allowance and Reach Ranges.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data for products specified, indicating selected options and accessories.

C. Shop Drawings:
   1. Plans: Locate each specified unit in project.
   2. Elevations: Indicate mounting height of each specified unit in project.
   3. Details: Indicate anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for correct installation of specified products not supplied by manufacturer of products of this section.

D. Verification Samples: Two sample chips of each specified color and finish.

E. Quality Assurance Submittals:
   1. Manufacturer's printed installation instructions for each specified product.
   2. Documentation of manufacturer's qualifications, specified in QUALITY ASSURANCE Article of this section.

F. Closeout Submittals: Warranty documents, issued and executed by manufacturer of products of this section, and countersigned by Contractor.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum fifteen (15) years of documented experience producing products of the types specified in this section.

B. Regulatory Requirements:
   1. Comply with ADAAG/ATBCB requirements.
   2. Comply with CBC, Title 24 requirements.

C. Toilet accessories required to be accessible shall be mounted at heights according to CBC Section 1115B.8.
   1. The grab bar cannot project more than 3" into the 48" minimum clear space in front of the water closet per CBC Section 1115B.4.1.3.
   2. Toilet paper and feminine dispensers located on the grab bar side of an accessible toilet room or stall shall not be located closer than 1 1/2" clear of the tangent point of the grab bar. Accessories surface mounted above grab bar will restrict usability.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Factory-apply strippable protective vinyl coating to sight-exposed surfaces after finishing of products; ship products in manufacturer's standard protective packaging.

B. Storage and Protection: Store products in manufacturer's protective packaging until installation.

1.07 SEQUENCING

A. Supply locating and sizing templates, and other requirements, to fabricators and installers of products referenced in RELATED SECTIONS Article for building in products of this section.

B. Supply reinforcing and anchoring devices required for installation of products of this section to fabricators and installers of products referenced in RELATED SECTIONS Article.

1.08 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's standard warranty against defects in product workmanship and materials.

C. Manufacturer's 15-year warranty against silver spoilage of mirrors.

D. Manufacturer's 10-year warranty for hand dryers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by Bobrick Washroom Equipment, Inc.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer listed below:
   1. ASI-American Specialties, Inc., Yonkers, New York.
   2. Bradley Corporation, Washroom Accessories Division, El Toro, California
   3. Substitutions: Section 01600 - Product Requirements.

2.02 MATERIALS

A. Stainless Steel Sheet: ASTM A 240/A 240M, Type 304, 18-8 alloy.

B. Keyed (tumbler lock) accessories shall be keyed alike.

2.03 TOILET ACCESSORIES

A. Toilet accessories and equipment to be provided for this project are shown on the following schedule.

B. Paper Towel Dispenser: Bobrick Model B-262, 400 C-fold towels, 22 gauge stainless steel,

surface mounted.

C. Paper Towel Disposal: Bobrick Model B-367, recessed, 1.6 cu. ft. capacity, 22 gauge stainless steel.

D. Paper Towel Disposal: Bobrick Model B-525, recessed covered receptacle, 11.4 L capacity, 22 gauge stainless steel.

E. Toilet Seat Cover Dispenser: Waxie Model W851595, 15.75" x 11" x 2"d, stainless steel, surface mounted.

F. Toilet Paper Dispenser: Bobrick Model B-386, partition mounted multi-roll dispenser, 22 gauge stainless steel, theft-resistant spindles.

G. Toilet Paper Dispenser: Bobrick Model B-3888, recessed multi-roll dispenser, 22 gauge stainless steel, theft-resistant spindles. Provide Model B-3888 at all accessible toilets compartments.

H. Soap Dispenser: Waxie Model W380143, high-impact resistant ABS, vandal-resistant housing, surface mounted with concealed wall fasteners, complies with ADAAG barrier-free accessibility guidelines.

I. Soap Dispenser: Waxie Model W380910, Boraxo #36 powdered soap dispenser, 32 oz. capacity, white enamel base with chrome-plated vandal-proof cover.

J. Napkin Dispenser:

K. Utility Shelf: Model B-298 x 36, 18 gauge stainless steel with 16 gauge mounting brackets, 36 inches long by 8 inches deep, surface mounted.

L. Mop Holder: Model B-224 x 30, 30 inches long with 3 mop holders, 18 gauge stainless steel, utility shelf, surface mounted.

2.04 MIRRORS

A. Mirror: Bobrick Model B-290-1830.

1. Angle Frame: ¾" x ¾" angle, one piece, roll-formed construction, beveled edge, with galvanized steel back fastened to frame with concealed screws. Mounted to wall with concealed mounting brackets and tamper-proof fasteners.

2. Float Glass Mirror: 1/4 inch (6 mm) thick polished select float glass, quality Q1.

B. Mirror (Student toilets only): Bobrick Model B-1556-1830.

1. 22 gauge, type 430 stainless steel with bright polished finish, ¼" return.

2. ¼" thick tempered masonite backing.

2.05 GRAB BARS

A. Grab Bars - Basic Requirements: Fabricated to comply with ASTM F 446 and to withstand a 900 pound (4 000 N) force, from ASTM A 554 stainless steel tubing, 0.050 inch (1.27 mm), Type 304, 18-8 alloy; formed 1-1/2 inch (38 mm) radius return to wall at each end; each end heliarc-welded to minimum 11 gage stainless steel circular flange; welds finished to match tube finish.

B. Grab Bars: Series 6206.
1. Peened finish.
2. Sizes and configurations: As indicated on drawings.

C. Grab Bar Concealed Mounting Flanges: Stainless steel, 3 inch (76 mm) diameter by 1/2 inch (13 mm) deep, with 0.0897 inch (2.3 mm) steel tenon plate for concealed attachment, using four set screws.

2.06 ELECTRICAL ACCESSORIES

A. Electric hand dryer shall comply with CBC Section 1133B.8.6.1. Hand dryer shall not project more than 4 inches into path of travel or when mounted adjacent to lavatory, 3 inches into maneuvering space.

B. Design is based on the use of products manufactured by Pinnacle Dryer, Aberdeen, North Carolina.

C. Electric Hand Dryer: Model PDC-R10, 4 inch maximum projection from wall.
   1. Cover and drying chamber 18 gauge stainless steel.
   6. 115V, 11.5 Amp, 50/60 Hz. See electrical drawings for electrical requirements.
   7. Activated by means of an infra-red light.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Prepared openings are sized and located in accordance with shop drawings.
   2. Reinforcement and anchoring devices are correct type and are located in accordance with shop drawings.

B. Installer's Examination:
   1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
   2. Transmit two copies of installer's report to Architect within 24 hours of receipt.
   3. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.02 INSTALLATION

A. Install toilet accessories plumb and level in accordance with shop drawings and manufacturer's printed installation instructions.

B. Toilet accessories required to be accessible shall be mounted at heights according to CBC Section 1118B. Toilet paper and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the wall surface nor be located closer than 1 1/2 inch clear of the tangent point of the grab bar.

C. Toilet paper and feminine napkin dispensers located on the grab bar side of an accessible toilet room or stall shall not project more than 3 inches from the finished wall surface nor be located closer than 1-1/2 inches clear of the tangent point of the grab bar.

D. Use concealed fasteners wherever possible.

E. Provide anchors, bolts, and other necessary anchorages, and attach accessories securely to walls and partitions.

3.03 CLEANING

A. Remove manufacturer's protective vinyl coating from sight-exposed surfaces 24 hours before final inspection.

3.04 PROTECTION OF INSTALLED PRODUCTS

A. Protect products from damage caused by subsequent construction activities.

B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION

SECTION 11400

FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Food service equipment.

B. Connections to utilities.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers.

B. Section 16155 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

B. ASTM C1036 - Standard Specification for Flat Glass; 2006.

C. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.

D. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

E. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2009, Revision 1 - 2010.

F. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2011.

H. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001

I. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on appliances; indicate configuration, sizes, materials, finishes, locations, and utility service connection locations, service characteristics, and wiring diagrams.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Operation Data: Provide operating data for the specified equipment.

F. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of standard products of the type specified.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for utility requirements.

B. Products Requiring Electrical Connection: Listed and classified by UL (EAUED) as suitable for the purpose specified and indicated.

C. All “hardwire and gas” kitchen equipment shall be installed with seismic restraints per SMACNA Kitchen Ventilation Systems and Food Service Equipment - Fabrication and Installation Guidelines, Appendix A, and as approved by DSA.
   1. Where anchorage details are not shown on the drawings or in the guidelines, the field installation shall be subject to the approval of the Architect and the DSA Field Engineer.
   2. A copy of the "Guidelines” shall be provided by the Contractor and kept on the job site at all times.

D. Food service aisles shall be a minimum of 36" wide and tray slides shall be mounted at 34" maximum above the floor per CBC Section 1104B.r, Item 5.

E. Food service equipment required to be accessible shall conform to all reach requirements in CBC Figures 11B-16 and 11B-17 and in accordance with CBC Section 1104B.5, Items 6 and 8.

1.07 PRE-INSTALLATION MEETING

A. Convene one week before starting work of this section.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products clear of floor in a manner to prevent damage.

B. Coordinate size of access and route to place of installation.

1.09 PROJECT CONDITIONS

A. Coordinate the work with location and placement of utilities. Coordinate characteristics of utilities with requirements of food service equipment.

B. Schedule work of this section to follow immediately the installation of utilities.

C. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.10 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work of this section within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for replacement or repair of scheduled equipment, refrigerant and compressors, including disconnection and removal of defective unit, and connection of replacement unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Food Service Equipment:

   1. Design is based on the manufacturer's listed in the Equipment Schedule. Manufacturer's of equal products will be considered in accordance with Section 01600, Materials and Equipment.

2.02 EQUIPMENT

A. Equipment Schedule: Refer to schedule at end of this section.
   1. Cooler and Freezer Units: Listed by UL standards..
   2. Electrical Wiring and Components and Self-Contained Refrigeration Systems: Conform to UL standards.
   3. Exhaust Hoods: Comply with NFPA 96.
   4. Custom Fabricated Stainless Steel Equipment: See Section 11401.

B. Installation Accessories: Provide all rough-in hardware, supports and connections, attachment devices, closure trim, and accessories required for complete installation.

2.03 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

B. Stainless Steel Sheet: ASTM A666 Type 304 commercial grade, No. 4 finish.

C. Glass: ASTM C1036, annealed and laminated, 4 mm thick; exposed edges ground; cut or drilled to receive hardware.

D. Plastic Laminate: NEMA LD 3, HGS; acid-resistant; color as selected by Architect; textured, low gloss finish.

E. Finish Hardware: Manufacturer's standard.

F. Work Surfaces: Stainless steel.

G. Fittings: Sink drains with crumb cup and waste fittings and faucets.

H. Service Outlet Covers and Escutcheons: Stainless Steel.

I. Sealants: type, as specified in Section 07900.

2.04 FABRICATION

A. Install rubber button feet on bearing surface of any item positioned on a finished surface.

B. Isolate rotating or reciprocating machinery to prevent noise and vibration.

C. Provide indirect drain piping from equipment to terminate over nearest waste receptor.

D. Accommodate site installation of other services or equipment.

2.05 FINISHES

A. All Components: Shop finish.

B. Metal (Except Stainless Steel): Degrease and phosphate etch, prime and apply minimum two coats factory baked epoxy, color as selected.

C. Stainless Steel: No. 4 finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify ventilation outlets, service connections, and supports are correct and in required location.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Accurately lay out locations of equipment leg supports.

B. Pre-drill holes into concrete floor.

3.03 INSTALLATION

A. Install items in accordance with manufacturers' instructions.

B. Insulate to prevent electrolysis between dissimilar metals.

C. Weld and grind joints in steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.

D. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.

E. Install seismic anchorage in accordance with SMACNA Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines:
   1. Install anchorage at opposite legs of table or equipment in accordance with Figure A-22, Detail 'B' (Bullet Leg) Shear and Uplift, using 3/8-inch diameter Hilti Kwik Bolt TZ anchor, ICC ES ESR-1917, stainless steel, minimum embedment 2-inches. .

F. Provide sealant to achieve clean joint with adjacent building finishes and between abutting components.

3.04 ADJUSTING

A. Adjust equipment and apparatus to ensure proper working order and conditions.

B. Remove and replace equipment creating excessive noise or vibration.

3.05 CLEANING

A. Remove masking or protective covering from stainless steel and other finished surfaces.

B. Wash and clean equipment.

C. Polish glass, plastic, hardware, accessories, fixtures, and fittings.

3.06 CLOSEOUT ACTIVITIES

A. Test equipment prior to demonstration. Demonstrate operation of components scheduled.

B. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct District in operating procedures and maintenance.
   1. Test equipment prior to demonstration.
   2. Individual Performing Demonstration: Fully knowledgeable of all operating and service aspects of equipment.

3.07 PROTECTION

A. Remove protective coverings from prefinished work.

3.08 FOOD SERVICE EQUIPMENT SCHEDULE

A. See drawings for location of equipment:
   1. Air Curtain (B): 4'-0" wide, 1200 CFM, 56 dBA @ 10 feet, 115V, 1 Phase, 2.4 Amps. Mars Model No. 48C with air curtain door limit switch.
   2. Cold Storage Shelving, Mobile (E): MetroMax Q Storage System, four tier, 63 inches high post, 21 inches wide x lengths as shown on the drawings. Furnish with the following accessories:
      a. Steel shelf frames and posts with electroplated substrate and highly durable, abrasive-resistant epoxy finish.
      b. Injection molded polypropylene modular shelf mats.
      c. Stem type casters.
      d. Maximum shelf span of 48 inches.
      e. Shelves equally spaced with 6 inch clearance between floor and first shelf.
   3. Shelving, Dry Storage (G): InterMetro Super Adjustable Super Erecta Shelf, complete with five tier, 74 5/8 inches high, Brite plated wire in widths and arrangements as shown on the drawings. Furnish with the following accessories:
      a. Steel posts with top caps and adjustable bullet feet.

   b. Maximum shelf span of 48 inches.
   c. Shelves equally spaced with 6 inch clearance between floor and lowest portion of first shelf.
4. Bread Racks (J): Aluminum Revent C Bread Rack Double with C-style hanging device, ALDBLSL, 09 x 6.75", Model 2711 by Magna Industries.
5. Convection Oven (M): Garland/US Range SDG-2, Double Stack Convection Oven, gas-fired, 60"x40"x42". Furnish with the following accessories:
   a. Stainless steel right side.
   b. Stainless steel left side.
   c. Casters with brakes.
   d. Gas hose with quick-disconnect and restraining device.
   e. Gas manifold.
6. Pan Rack (N): Bevles Model RA64-UA13, universal type. Furnish with the following accessories:
   a. Perimeter bumpers.
7. Proofer/Hot Cabinet (P): Bevles Model PCH70-MP171NS-S, 5-20R, insulated. Furnish with the following accessories:
   a. Perimeter bumpers.
   b. Door hinged left (verify).
   c. Cord guide/protector.
   d. Lexan door.
8. Work Table, Mobile (Q):Duke Aerohot Catalog No. 9331, 30 inch wide x 48 inch long x 36 inch high. Furnish with the following accessories:
   a. One stainless steel drawer assembly.
   b. One stainless steel high shelf.
   c. One stainless steel undershelf.
   d. One Edlund Model S-11, manual can opener. Food Service Director to verify location.
9. Work Table, Mobile (R): Duke Model No. DUK418-3072, 30" x 72" x 36" high, 18 gauge Type 430 stainless steel top, bullnose front and rear edges, galvanized undershelf and legs, one 30" deep stainless steel drawer assembly. Provide with Powcaster-Kit manufactured by Powers Industrial Equipment Co.:
   a. One stainless steel drawer assembly.
10. Shelving, Mobile (S): InterMetro Super Adjustable Super Erecta Shelf, complete with four tier, 62 9/16 inch high, Brite plated wire in widths and arrangements as shown on the drawings. Furnish with the following accessories:
   a. Steel posts with top caps.
   b. Casters with brakes.
   c. Maximum shelf span of 48 inches.
   d. Shelves equally spaced with 6 inch clearance between floor and lowest portion of first shelf.
11. 3-Compartment Sink, Dishtable Assembly (T): See Section 11401.
12. Exhaust Ventilator/Condensate Hood (L)(U): Gaylord Model VH2, Type II, vapor series, wall-type, exhaust hood, 4'-6" length. Locate brow 6'-6" above finish floor. Furnish with the following accessories:
   a. Fan and light switch.
   b. 100 watt light fixtures.
   c. Balancing damper.

   As part of the installation provide the following accessories:
   d. 16 gauge steel, all-welded exhaust ducts(s) to ceiling connection(s).
   e. 20 gauge stainless steel removable enclosure panels between hood and ceiling.
   f. 3/8 inch steel hanger rods.
   g. Stainless steel wall flashing from top of floor base to bottom of hood.

   The light fixture shall be interconnected with concealed conduit and wiring to a single J-box for the final connection.
13. Dishwasher, Door-type (V): Hobart Model AM-14T, electric tank heat with built-in booster heater. Furnish with the following accessories:

   a. Five dish racks.
   b. Detergent connections kit.
14. Pre-rinse Assembly (W): Chicago Faucets 923-HCLCP, lever handle, adjustable dual wall mount control valve, and wall bracket. Mount control valve no more than 48-inches maximum above finish floor.
15. Disposer (X): In-Sink-Erator Model SS-200-18C, 2HP with 18" cone. Furnish with the following accessories:
   a. CC-202 Control Panel. Mount Control Panel no more than 48-inches maximum above finish floor.
   b. Short upper housing.
16. Soiled Dishtable Assembly (Z): Custom fabricate. See Section 11401. Furnish with the following:
   a. Slanted rack shelf.
   b. 20 inch x 20 inch x 7 inch deep pre-rinse sink and basket.
   c. Pass-thru ledge.
17. Pass-Thru Window (AA): Custom fabricate and install as required.
18. Sink, Food Prep. (BB): Custom fabricate. See Section 11401. Furnish with the following:
   a. One backsplash mounted mixing faucets.
   b. One rotary waste assembly.
   c. One wall shelf.
   d. Stainless steel wall flashing.
19. Hot Food Unit (CC): Duke Model E4CBSS, four well, stainless steel electric hot food server with casters with brakes.
20. Counter, Serving (DD): Custom fabricate and install as detailed on the drawings.
21. Sneeze Guard/Serving Table (EE): 6'-0" Acrylic Sneezeguard, double face, table mounted with brackets. Product No. CM-771 by Cal-Mil.
22. Milk Cooler (FF): Beverage-Air Model ST58N-SS, 1/4 HP, self-contained, mobile, double access milk cooler with 270-quart capacity. Furnish with the following accessories:
   a. Stainless steel exterior.
   b. Stainless steel interior.
23. Salad Bar (GG): Cambro Children's Food Bar Model 6FBRSL, mobile, 72 inches long. Furnish with the following accessories:
   a. Tray rail on one side.
   b. End tables.
24. Tray Dispenser (KK): Shelleymatic Model TT21014. Furnish with the following accessories:
   a. Two casters with brakes.
   b. 5 inch casters in lieu of 4 inch.
   c. Perimeter bumper.

END OF SECTION

SECTION 11401

CUSTOM FABRICATED FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Custom fabricated stainless steel units, including:
   1. Serving counters and casework.
   2. Food preparation tables, sinks, and shelving.
   3. Pot and pan washing sinks.
   4. Dish and tray washing tables, sinks, and shelving.

1.02 RELATED REQUIREMENTS

A. Section 07900 - Joint Sealers.

B. Section 11400 - Food Service Equipment: General requirements covering all food service equipment work; manufactured equipment items.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2001 (R2005).

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; 2001 (R2005).

C. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2006.

D. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2011a.

E. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2010.

F. ASTM A270 - Standard Specification for Seamless and Welded Austenitic and Ferritic/Austenitic Stainless Steel Sanitary Tubing; 2010.

G. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes; 2010.

H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2010.

I. ASTM B32 - Standard Specification for Solder Metal; 2008.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2009.

K. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding; 2004 and errata.

L. NSF 2 - Food Equipment; NSF International; 2009.

M. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for utility requirements.

B. Products Requiring Electrical Connection: Listed and classified by UL (EAUED) as suitable for the purpose specified and indicated.

C. All stationary kitchen equipment shall be installed with seismic restraints per SMACNA Kitchen Ventilation Systems and Food Service Equipment - Fabrication and Installation Guidelines, Appendix A, and as approved by DSA.

1. Where anchorage details are not shown on the drawings or in the guidelines, the field installation shall be subject to the approval of the Architect and the DSA Field Engineer.
2. A copy of the "Guidelines" shall be provided by the Contractor and kept on the job site at all times.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each manufactured product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Configuration, sizes, materials, finishes, locations, utility connections and locations.

C. Shop Drawings: Complete floor plans, elevations, cross-sections, and construction details for all fabricated units; include:
1. Layout and anchorage of equipment and accessories, including clearances for maintenance and operation and required electrical or plumbing connections.
2. Size, type, and location of equipment drain lines and floor drains.
3. Special conditions, including required slab depressions, cores, wall openings, blockouts, ceiling pockets, access panels, and above ceiling hanger assemblies.
4. Wiring, piping, and schematic diagrams.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Project Record Documents: Record actual locations of utility connections.

G. Operation and Maintenance Data: Provide maintenance manual listing routine maintenance procedures, possible breakdowns, repairs, and troubleshooting guides; include instructions for maintenance of stainless steel fabrications and components and simplified diagrams for equipment as installed.

H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of commercial food services equipment with minimum three years documented experience and NSF certified for the type of equipment specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver fixed equipment that is not to be integrated into structure until after completion of finished ceilings, floor and walls, painting, and lighting.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Tape fiberboard or plywood to surfaces as required by equipment shape and installation access requirements.

D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.09 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Stainless Steel: 18-8 composition; Type 302, 304, or 316; No. 4 finish on exposed surfaces.
   1. Sheets: ASTM A666 or A 240/A240M.
   2. Tubing: ASTM A269 or A 270; of true roundness with seams and welds ground smooth.
   3. Bars: ASTM A276.

B. Copper Tubing: ASTM B88; Type L, hard drawn.
   1. Fittings: ASME B16.18, B16.22, or B16.26.
   2. Solder: ASTM B32, lead-free.
   3. Brazing Alloy: AWS A5.8 silver solder.

C. Glass: Fully tempered float glass, 3/8 inch (4.5 mm) thick, minimum.

D. Sound Deadening Material: Bituminous paint or other water resistant mastic.

E. Sealants: As specified in Section 07900.

F. Manufactured Components:
   1. Finish Hardware: Manufacturer’s standard; stainless steel with polished finish.
   2. Feet for Legs: Bullet shaped stainless steel; screwed into tubular legs with concealed screw threads; minimum 1 inch (25 mm) vertical adjustment.

G. Bolts, Screws, and Rivets: Stainless steel; do not use on exposed surfaces unless specifically indicated or otherwise unavoidable.
   1. Bolt and Screw Caps: Provide lock washer and chromium-plated brass/bronze acorn nut to cap visible or exposed threads on inside of fixtures.

H. Anchoring Devices: Stainless steel, of type appropriate for use; provide seismic anchorage as specified in SMACNA "Kitchen Ventilation Systems and Food Service Equipment Guidelines."

2.02 CUSTOM FABRICATED UNITS - GENERAL REQUIREMENTS

A. See drawings for dimensions and configurations; ensure proper fit by taking field measurements prior to fabrication.

B. Provide fully shop assembled units complying with SMACNA "Kitchen Ventilation Systems and Food Service Equipment Guidelines" and NSF 2, unless specifically indicated otherwise; all components of stainless steel unless otherwise indicated.
   1. Where details are referenced as "SMACNA" details, refer to SMACNA "Kitchen Ventilation Systems and Food Service Equipment Guidelines."
   2. Stainless Steel Sheet: For surfaces up to 12 feet (1.52 m) in length provide one continuous sheet without joints or welds, including back and end splashes.
   3. Joints: All joints welded unless specifically indicated or impossible; do not solder or braze stainless steel; do not use bolts, screws, or other fasteners on work surfaces, food contact surfaces, or wet surfaces.
   4. Drainage of Surfaces: Provide distinct pitch of all tops toward waste or drain outlets while maintaining level tops of rolled and marine edges and back and end splashes.
   5. Drainage of Equipment: Provide drain piping as indicated; where compartments or pans are intended to hold liquids or catch drips and no drain piping is indicated, provide drain fitting and gravity draining piping terminating over nearest floor drain.
   6. Shop prepare openings for plumbing fixtures, fittings, and other service components.
   7. Sound Deadening: Apply sound deadening material to accessible internal surfaces of metal work and underside of metal counters and sinks.

C. Sinks: Stainless steel, 14 gage, 0.0747 inch (1.9 mm) thickness, minimum; provide integral sinks continuously welded to work surfaces, unless otherwise indicated.
   1. Slope to drain at 1 percent, unless otherwise indicated.
   2. Adjacent Sinks: Provide double wall partitions between sinks.
   3. Where sinks are set into countertops provide separate sink supports stud bolted to bottom of counter top; at minimum, provide painted galvanized steel angles, 1-1/2 inches (38 mm) by 1-1/2 inches (38 mm) by 1/8 inch (3 mm).
   4. Fittings: Provide waste and overflow fittings, faucets, baskets, and other plumbing fittings as specified in section 15410.
   5. Sink Faucet Spout Outlets: 5 inches (127 mm), minimum, above rim of sink.

D. Counter and Table Tops: Stainless steel, 14 gage, 0.0747 inch (1.9 mm) thick, minimum; with underbracing as recommended by SMACNA, and bullnose edges and 45-degree back and end splashes, unless otherwise indicated.

E. Counter, Table, and Sink Edges: Provide finished edge on all open sides; close open ends down to bottom edge of turn down; if not otherwise indicated provide bullnose edges.
   1. Bullnose Edges:; 2 inch (51 mm) turn down at 5/8 inch (16 mm) radius, returned at 60 degree angle to not closer than 3/4 inch (19 mm) to face of cabinet or case.
   2. Dish Tables and Counters: Make watertight joint into dishwashing machine.

F. Back and End Splashes: Provide wherever tops abut walls or other vertical surfaces; close open ends from top to bottom of turned down top edge.
   1. 45 Degree Back and End Splashes: 6 inches (152 mm) high, coved at 5/8 inch (16 mm) radius, turned back 2 inches (51 mm) at the top at 45 degree angle, turned down 1 inch (25 mm)
   2. Where indicated and where required for concealment of plumbing, make horizontal dimension of back and end splashes at least 2-1/2 inches (64 mm) from face of wall.
   3. Wall Clips: 4 inch (102 mm) long 14 gage, (0.0747 mm) stainless steel "zee" clips; anchored to wall at 36 inches (914 mm) on center.

G. Legs: stainless steel tubing, 1-5/8 inches (41 mm) outside diameter; fit legs with set-screw fastened sockets and adjustable feet as specified.
   1. Legs Over 12 inches (305 mm) Long: 14 gage, 0.065 inch (1.65 mm), minimum, wall thickness.
   2. Legs Up To 12 inches (305 mm) Long: 16 gage, 0.06 inch (1.5 mm), minimum, wall thickness.
   3. Weld leg sockets to continuous channel or angle or gusset plates; provide stainless steel triangular pad where leg gussets are welded to frame.
   4. Legs may be bolted to table tops using studs welded to bottom of top.
   5. Where vibration or oscillation is anticipated anchor in floor with 1/4 inch (6 mm) stainless steel pins.
   6. Unless otherwise indicated provide legs for all units.

H. Shelves: Stainless steel.
   1. Undercounter Shelves: 16 gage, 0.0598 inch (1.5 mm) thick.
   2. Overshelves: 16 gage, 0.0598 inch (1.5 mm) thick.
   3. Overshelf Supports: Stainless steel tubing extending through table top and shelving, 12 gage, 0.1046 inch (2.7 mm).
   4. Wall Mounted Shelf Supports: Stainless steel, 14 gage, 0.0747 inch (1.9 mm) thick.

I. Sneeze Guards: Acrylic plastic glazing sheet mounted in stainless steel channel frames; provide adjustable brackets allowing easy loading of food trays.

J. Tray Slides:
   1. Construction: Open, three bar type, of stainless steel tubes of 16 gage, 0.0598 inch (1.5 mm) wall thickness, 1 inch (25 mm) diameter, with ends capped.
   2. Support Brackets: Stainless steel.

2.03 DISH AND TRAY WASHING

A. Design all dish/ware washing units to accommodate trays and dish racks of standard dimensions:

B. Pre-Rinse: Input side of dishwasher; sink on legs for standard dishwasher racks.
   1. Depth: 30 inches (760 mm).
   2. Height to Top: 36 inches (905 mm).
   3. Rack Support Assembly: 16 gage, 0.0598 inch (1.5 mm) stainless steel; removable; angle rack guides on top of frame.
   4. Provide waste disposer and hopper as specified in section 11400.
   5. Provide spray rinse assembly as specified in section 15410.

2.04 FABRICATION

A. Joints, Bends, and Edges: Make all joints close fitting, especially butt and contact joints
   1. Make brake bends free of open-texture or orange peel appearance.
   2. Make sheared edges free of burrs, projections, and fins.
   3. Neatly finish mitered and bullnosed corners with under edge of material ground to uniform condition, without overlapping materials or cracks.

B. Welding: Make all welded joints smooth, ductile, and watertight, without gaps, holes, or discoloration or marring of surface adjacent to welds.
   1. Use welding processes and filler metal compatible with material being welded. Do not use carbon arc welding on surfaces that will be exposed to view in finished work.
   2. Grind exposed welds flush with adjacent material; finish and polish to match adjacent surface. Avoid excessive heating of metal and metal discoloration. In grinding, use iron-free abrasives, wheels, and belts that have not been used on carbon-steel. Remove pits, runs, sputter, cracks, low spots, voids, buckles, and all other imperfections. Remove grain of rough grinding by several successively finer polishing until specified finish is attained.
   3. When welding sheet, penetrate entire thickness for entire length of joint; make joints flat, continuous and homogeneous with sheet metal without reliance on straps under seams, filling with solder, or spot welding.
   4. When stainless steel is joined to dissimilar materials, use stainless steel for fastening devices and welding material.
   5. Protection Against Corrosion: Eliminate possibility of corrosion wherever welding occurs on stainless steel. Minimize possibility of carbide precipitation in welding bolts and screws.
   6. When welding galvanized steel, thoroughly clean and repair damaged galvanizing and coat welds with polyurethane coating welds.
   7. Where bolts or screws are welded to underside of tops or trim, finish and undepress the exposed side of welds.
   8. Coat welds and discolorations that are not exposed to view in finished work with metallic-based paint to prevent the possibility of progressive corrosion of joints, unless welds are ground and polished smooth.

C. Brazing of Copper Tubing to Brass and Bronze Fittings: Use silver solder. Do not braze stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify correct locations of utility connections, floor drains, ventilation connections, and supports.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with fabricator's instructions and recommendations, plumb and level and in proper locations, ready for utility connections.

B. Lay out work in advance to prevent damage to building, piping, wiring, or equipment; cut, fit, and patch where necessary; coordinate work with others.

C. Do not cut or fit units in the field; if adjustments are necessary due to inadequate field measurement prior to fabrication, take unit back to shop and perform modifications there.

D. Do not field weld unless absolutely necessary; weld and grind field joints in accordance with specified fabrication procedures.

E. Securely anchor and attach non-mobile or adjustable-leg equipment to walls, floors, or bases with stainless steel bolts.

F. Follow SMACNA seismic restraint recommendations for project location.

G. Make sanitary joints between equipment and flashings and adjacent walls, floor, and ceiling, in accordance with Section 07900.

3.04 ADJUSTING

A. Adjust new and existing equipment to ensure proper operation.

3.05 CLEANING AND PROTECTION

A. Protect installed products until completion of project.

B. Remove masking or protective covering from stainless steel and other finished surfaces.

C. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11405

FOOD SERVICE EQUIPMENT - WALK-IN

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Walk-in Refrigerator and Walk-in Freezer including but not limited to:
   1. Cutting of equipment holes for pipes, drains, electrical outlets, etc., as required for this installation.
   2. Installation of walk-in refrigerator and freezer insulated floors.
   3. Mechanical refrigeration equipment including refrigerant line runs.
      a. Plumbing and gas controls, valves, fittings, and waste as integral part of equipment, but not including rough-in connection or extensions.
      b. Electrical controls, devices, wiring, conduits, switches, fixtures, and cords as integral part of equipment, serving beyond cut-out switches and receptacles provided.
      c. All necessary wood or metal backing in walls and ceiling for wall and ceiling mounted equipment.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete: Depressed concrete floor slab.

B. Section 06100 - Rough Carpentry: Rough framing for walk-in areas.

C. Section 07212 - Batt Insulation: Insulating voids surrounding walk-ins.

D. Section 09260 - Gypsum Board Assemblies - Interior finish of walls surrounding walk-ins.

E. Section 09302 - Quarry Tile: Finish floor in walk-in refrigerator and freezer.

F. Division 15 Mechanical Work: Water supply piping and final connections to equipment, including all valves, etc., needed except as outlined in sub-paragraph above; floor drains, waste piping, indirect wastes, and final connections to equipment including all traps, valves, etc., as required; ventilating ductwork and final connections of same to equipment including ventilating fans not built-in to equipment.

G. Division 16 Electrical Work: Electrical wiring and final connections to equipment and remote controls, including disconnect switches, etc., but not including items outlined in sub-paragraph above.

1.03 REFERENCES

A. ASTM A 167 - Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

B. ASTM A 525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

C. ASTM C 177 - Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

D. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.

E. California Building Code (CBC), California Code of Regulations, Title 24:
   1. Section 1133B, General Accessibility for Entrances, Exits, and Paths of Travel.
   2. Section 2602, Foam Plastic Insulation.

F. National Sanitation Foundation (NSF) Standard No. 7.

G. Underwriters Laboratories (UL) Standards.

1.04 REGULATORY REQUIREMENTS

A. All work and materials shall be fully in accordance with the latest rules of the U.S. Public Health Service, the National Board of Fire Underwriters, the State Accident Commission's Safety Orders, and regulations of the State Fire Marshal.

B. All manufactured items shall conform to current standards and revisions established by the National Sanitation Foundation, Ann Arbor, Michigan.

C. All electrical operated and/or heated equipment, fabricated or otherwise shall conform to the latest standards of the National Electric Manufacturer's Association, National Electric Code, and Underwriter's Laboratories, Inc.

D. Walk-in refrigerators and freezers shall have entry and exit door hardware that complies with all of the requirements of CBC Section 1133B.2.5., and maneuvering clearances at the exterior side per CBC Section 1133B.2.5.2

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each manufactured product to be used, including:
   1. Configuration, sizes, materials, finishes, locations, utility connections and locations.
   2. Installation methods.

C. Shop Drawings: Complete floor plans, elevations, cross-sections, and construction details for all fabricated units including:
   1. Layout drawings showing exact location of anchor bolts.
   2. Layout and anchorage of equipment and accessories, including clearances for maintenance and operation and required electrical or plumbing connections.
   3. Size, type, and location of equipment drain lines.
   4. Special conditions, including required slab depressions, cores, wall openings, blockouts, access panels, etc.
   5. Wiring, piping, and schematic diagrams.

D. Certificates: Certify that products of this section meet or exceed specified requirements.

E. Operation and Maintenance Manual: Submit instructions containing complete description, wiring diagrams, operating data and other information pertaining to the proper operation and up-keep of the various items of mechanical equipment.
   1. Include names, addresses and telephone numbers of authorized service agencies, for items with mechanical equipment.

F. Service and maintenance contract signed by the manufacturer and installer or authorized service dealer.

1.06 QUALITY ASSURANCE

A. Installer's Qualifications:
   1. All work in this Section shall be installed by one qualified food service equipment contractor who is referred to hereafter as the "Food Service Equipment Contractor".
   2. Installer shall be approved in writing by the manufacturer.

B. Custom fabricated items and equipment shall comply with current standards established by the National Sanitation Foundation, Ann Arbor, Michigan.

C. The Food Service Equipment drawings indicate the general arrangement and location of kitchen equipment. Refer to Architectural and Structural drawings for building dimensions, and refer to Mechanical and Electrical drawings for general location of mechanical work.
   1. Take field measurements and verify conditions at the site as needed.
   2. Manufacturer's direction shall be followed in cases where the manufacturer of equipment used in this contract furnish directions of prints covering points not included or indicated on the drawings or specifications.

1.07 WARRANTY

A. All hardware, electrical components, and equipment shall be warranted against defects in material and workmanship for a period of one year from date of Substantial Completion.

B. Walk-in panels shall be warranted against defects in material and workmanship for a period of ten years from date of Substantial Completion.

C. Refrigeration equipment shall include manufacturer's five year extended warranty on sealed compressor/motor assemblies.

1.08 MAINTENANCE SERVICE

A. Provide service and maintenance contract for self-contained and remote refrigeration equipment, furnished under this section, for one (1) year after date of final acceptance by the District.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Design is based on the use of products manufactured by Kolpak, Parsons, Tennessee, 800-826-7036.

B. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer listed below:
   1. Refrigerator Manufacturers, Inc. (RMI), Commerce, California, 800-776-7178.

C. Substitutions See Section 01600 - Product Requirements.

2.02 MATERIALS

A. Walk-in Refrigerators and Walk-in Freezers (N.S.F. and U.L.):
   1. Urethane Foam Insulation: Rigid (accomplished by foaming in place), fluorocarbon filled, over 90% closed cell content, nominal density 2.2 pounds + 0.1 per cubic foot. Dimensional stability; no change from -20 degrees F to +160 degrees F.
      a. Flammability characteristics per ASTM E 84 shall be less than 25 flame-spread and less than 450 smoke density, in accordance with CBC, Section 2602.
   2. Classification: Class I, 0-25 flame spread in accordance with UBC Standard 42-1; and Class 'A' interior finish in accordance with NFPA 101, Section 6-2, and NFPA 255.
   3. Thermal conductivity: (K-Factor), shall not exceed (.12 BTU/hr./sq. ft/F) as tested on ASTM C 177, at 75 degree F mean temperature.
   4. Galvanized steel sheets used as fascia for wall and ceiling panels: prime finish, 26 gauge, complying with ASTM A 525, G90.
   5. Galvanized steel sheets used as floor panels: 16 gauge complying with ASTM A 525, G90.

2.03 FABRICATION - WALK-IN REFRIGERATOR AND WALK-IN FREEZER

A. Modular Panel :
   1. Modular Sandwich Panels - Refrigerator: 4" thick, 100% foamed in place urethane insulation core, without any wood or metal frame members.
   2. Modular Sandwich Panels - Freezer: 5" thick, 100% foamed in place urethane insulation core, without any wood or metal frame members.
   3. Interior and Exterior, Die Formed Sheet Metal Facings: shall be fully adhered to rigid urethane core.
   4. Perimeter of Sheet Metal Facings: Flanged 1/2" to 3/4".
   5. Corner panels shall be matching one piece construction, including 1/2" radius at all inside vertical corners.
   6. Partition panels shall be matching construction and facia. Intersection of wall and partition panels shall be accomplished with "T" shaped panels, matching corner panel construction.
   7. Panel joints shall be sealed with PVC gasket at interior and exterior panel edges, maintaining continuity.
   8. Lateral alignment of adjoining panels shall be provided for by continuous spline or urethane

tongue and groove mating edges.

9. Panels shall be rigidly coupled by steel cam action locks, foamed in place, maximum 4'-0" centers. Section lock ports shall be finished with PVC snap-in buttons. Where floor is depressed or floorless, wall panels shall be anchored to building floor with concealed galvanized steel floor track. Wall panels shall be sealed to building with continuous bead of sealant.
10. Maximum deflection of ceiling panels shall not exceed 1/240 of the span under uniform loading of 20 pounds per square foot. If ceiling spans require a support system, the contractor shall submit details and structural calculations to engineer for approval prior to fabrication.
    a. Indoor roof panel support system shall use hanger wire network attached to manufacturers furnished hanger brackets, designed to engage with female lock pins imbedded within roof panel foam core.

B. Panel Facia:
1. Interior face of wall panels shall be clad with 26 gauge stucco-embossed galvanized steel (galvalume).
2. Interior face of ceiling panels shall be clad with 26 gauge stucco-embossed galvanized steel (galvalume).
3. Exterior exposed face of wall panels shall be clad with 26 gauge stucco-embossed galvanized steel (galvalume).
4. Exterior unexposed face of wall and ceiling panels shall be clad with 26 gauge galvanized steel (galvalume).

C. Floor:
1. Depressed Subfloor:
    a. Subfloor Membrane: Asphalt emulsion shall be applied to clean, smooth concrete subfloor. Cover with foil coated Kraft waterproof paper (0.01 per, as determined by ASTM E 96) or Fortifier "Poly Foil Barrier," joints lapped 6" minimum and flashed up sides of recess.
    b. Floor panels shall be same construction as described under panel fabrication.
    c. Wearing floor shall be quarry tile and setting bed in accordance with Section 09302. Provide minimum 2 inch recess for tile and mortar bed. Finish floor shall be at same elevation as kitchen finish floor.
    d. Exterior face of flooring panels shall be clad with 16 gauge galvanized steel.
    e. Panels shall be rigidly coupled with cam action locks, maximum 4'-0" centers. Section lock ports, joints between floor panels and juncture at wall panels shall be filled with silicone sealant.

D. Cold Storage Doors:
1. Cold Storage Hinged Doors featuring Cam Lift and Spring Assisted Self-Closing Hinges, listed by U.L..
    a. Door sizes shall be 2'-10" or 3'-0" x 6'-6" or as called for in door schedule or indicated on drawings.
    b. Each door shall contain a full perimeter 11 gauge welded steel frame. Extend to protect exposed edge of magnetic gasket.
    c. Gaskets shall be extruded polyvinyl chloride with corners vulcanized and continuous magnetic core mounted at sides and head of door jamb.
    d. Sill wiper shall be extruded neoprene secured by removable stainless steel retainer strip and stainless steel fasteners.
    e. Freezer threshold shall be removable 1/8" thick stainless steel plate.
    f. Three hinges, each door, shall be Kason #1248, or equal, cam lift, spring assisted, self closing, zinc die cast, polished chrome finish.
    g. Latch shall be Kason #58CH with cylinder lock and Kason #59 roller strike, polished chrome finish. Comply with CBC Section 1133B.2.5.
    h. Inside safety release shall be Kason #481 Safety-Glow Push Handle.
    i. Door closer shall be International Model 1852AL, or equal, automatic hold open.

j. Hardware shall be mounted with reinforced steel tapping plates and machine screws.
k. Interior door cart bumper bar shall be 1/4" x 2" aluminum bar 36" A.F.F.
l. Doors shall be flush infitting type, insulated with 3" core same as specified under materials. The ambient side of each freezer door perimeter and door jambs shall each be provided with 115 volt, 240 watt electric resistance heating element, including thermostatic control, factory wired to "GS" splice box located above door at interior face of wall panel.
m. Front, back and edges of door shall be faced with stainless steel, 304, No. 4 finish, 20 gauge.

2. Cold Storage Door Kickplate, front and or back faces, shall be 16 gauge, type 304, No. 4 finish, stainless steel, 3'-0" high x full width of each door.

E. Light Fixtures and Switches:
1. Quantity of light fixtures shall be as indicated on electrical lighting plan or specified herein.
2. Fixtures: cast aluminum, fully enclosed and gasketed for vaportight, weathertight operation, with shatterproof diffuser.
   a. Sized for two 100 watt lamps each fixture, similar or equal to McPhilben 43-88 or Cole FS 7085SCNNL
3. Vapor tight cast junction box and galvanized steel nipple terminated at exterior face of roof panels.
4. Factory install and wire interior and exterior companion, 3-way AC presswitch switches mounted in "FS" boxes adjacent latch side of door opening.
5. Switch covers: gray hypalon, weatherproof presswitch plates.
6. Pilot lights: unbreakable red plastic lens, embedded at hypalon plates.
   a. Interior red light - constant burning.
   b. Exterior red light - indicating.
7. Rigid conduit and wiring shall be run within insulation wall panel. Conduit shall be terminated in vapor tight splice box mounted on inside wall of compartment near ceiling.
8. 1-1/4" diameter hole shall be provided in ceiling panel through which electrical contractor shall make power connections.
9. Only conduit and wiring within wall panels, including boxes, light fixtures, switches and cover plates, shall be furnished as a condition of this section.

F. Temperature Alarm System:
1. One temperature alarm system shall be provided for each cooler and freezer.
2. Each system shall include the following:
   a. One bell (96 decibels at 10') 120V., 60 cycle.
   b. One silencer relay with stainless steel cover.
   c. One indicating lamp.
   d. One thermostat.
3. Bell, relay and lamp mounted adjacent hinge side of door facing kitchen using recessed "FS" boxes, rigid conduit with factory wiring terminated in "GA" splice box.
4. Each thermostat shall be mounted in its respective room and connected to electrical service and alarm relay be the electrical section.

G. Freezer Door Fan Switch:
1. Each freezer door that opens to ambient condition shall be equipped with a door-operated switch designed to shut off freezer coil fan when door is open.
2. Switch shall be built into door jamb and factory wired to splice box.
3. Electrical connection between splice box and fan motor(s) shall be by the job site electrician as specified under the electrical section.

H. Digital Thermometer and Alarm:
1. Combined into one solid-state computer at each room with audio alarm, silencer button, trouble light and digital read out. Requires 110V-60HZ power. Capillaries at length needed up to 500 ft.

I. Finish Trim:

1. Tolerance gaps between face of cold room walls and building walls shall be finished with matching sheet metal angles furnished and installed by the Contractor.

J. Enclosure Panels:
1. Space between suspended ceiling and top of refrigerator shall be enclosed with matching sheet metal panels designed for easy removal to facilitate access to crawl space. (Dimensions permitting).

K. Strip Curtains:
1. Clear vinyl strip curtains shall be Kason ThermalFlex Strip Curtains, 4 inches wide, .06 gauge, NSF and USDA approved.

L. Corner Guards:
1. 4 inch x 4 inch x 4 feet, 16 gauge, stainless steel, Type 304.

M. Coil Supports:
1. Furnish to the Mechanical Refrigeration Contractor sufficient quantity of 1/2" diameter nylon threaded rods, plated steel nuts and washers to accommodate support of refrigeration coils.

N. Utility Penetrations:
1. Provide penetrations at cold storage room wall and ceiling panels required to accommodate electrical and refrigeration lines.

O. Escutcheon Plates:
1. Furnish sufficient quantity of 5" diameter stainless steel escutcheon plates as required by each trade to dress off utility penetrations including drain lines.
2. Each trade shall be responsible for cutting hole in blanks and sealing off respective penetrations.

P. Vacuum-Pressure Relief Vent:
1. Each freezer room shall be furnished with electrically heated screened aluminum vent, to automatically equalize room pressure with respect to ambient, also limit influx of ambient air during static periods.
2. Pre-wire unit to "GS" splicebox in conjunction with freezer perimeter door heater.

Q. Personnel Alarm Systems:
1. One alarm system shall be provided for each cold storage room.
2. Each system shall consist of:
   a. Bell, 4" (minimum 77 decibels @ 10'), 120V/60.
   b. Interior mounted, 120V switch, including constant burning pilot light, each room.
   c. Exterior mounted indicating lamp each room.
   d. Lamp and switch factory wired, terminated in wall panel splice box.
   e. Bell(s) shall be mounted in remote location as indicated on electrical drawings by Electrical Section. Interconnection conductors and conduit shall be furnished and installed per the Electrical Section.

2.04 REFRIGERATION SYSTEM

A. Installation:
1. Refrigeration System shall be installed as indicated on drawings or as specified, and shall be securely anchored. Furnish and install all compressor units, condensers, refrigerant piping, double stack compressor rack, all control valves, etc.
   a. Units to be located in mechanical room as shown on mechanical drawings, or on roof with weather protection.
2. Units and refrigerant piping shall be installed to eliminate noise and vibration being transmitted to any part of the building. Machines to be fitted with sound-absorbing isolation bases, and with vibration eliminators in suction lines, as manufactured by American Vibration Eliminator Company, or equal.

B. Refrigeration Rack:

1. ColdZone Model MPL2CZ, shall be housed in a single, compact rust-proof cabinet. The unit shall utilize multi-circuited air-cooled condensers for cooler and freezer applications. The frame and base shall be comprised of 14 and 10 gauge all welded structural steel, respectively. Hot-air discharge from condenser fans shall be vertical. A Venturi-contoured air scoop shall be provided for each fan to reduce air turbulence and fan loading. Fan blades shall be covered with a plastic coated fan guard.
2. Each Condensing System shall be equipped with a Copeland semi-hermetic compressor, dual pressure control, sight glass, liquid-line drier, suction and discharge vibration eliminators, flood back head pressure control and oversized receiver. A crankcase heater shall be provided for each compressor. All compressor units shall be new and factory assembled to operate with the refrigerant specified in Refrigeration Engineering Summary R1 sheet. Refrigerant R-22 shall be used on all medium temperature units and low temperature freezer bases, and R-404A/507A shall be used on all low temperature walk-ins.
3. Multi-circuited condensers to be sized to operate at 15 degree F T.D. The condenser surface shall be vertically mounted to maximize heat transfer.
4. Each condensing unit shall be equipped with a receiver with a pump down capacity to accept the total liquid volume of refrigerant for all systems without exceeding 90 percent of its volumetric capacity at its designated operating pressures and temperatures. Each receiver shall be equipped individually with a fusible plug, as well as installed "King" and "Queen" valves with service ports.
5. All refrigerant lines shall be extended to one side of the package in a neat and orderly manner, easily identified by system. All tubing shall be securely supported and anchored with clamps. All copper tubing to be refrigerant grade A.C.R. or type "L". Silver solder and/or sil-fos shall be used for all refrigerant piping. Soft solder is not acceptable.
6. All piping to be pressure tested with nitrogen at 300 psi. After the condensing unit and coil have been connected, the balance of the system shall be leak tested with all valves open.
7. The package shall have factory mounted and pre-wired NEMA3R weather-proof rating control panel complete with interlocked main-fused disconnect, compressor circuit breakers remote fan motor capacitors, contactors, thermal sensing fan cycle control as necessary, and time clocks wired for single-point power connection. A remote power/fan failure alarm shall be provided. A photo-etched wiring diagram shall be permanently affixed inside panel.
8. Electrical contractor shall provide and install main power lines to panel, and use wire harness for control and defrost heater between the defrost clock and the refrigeration fixtures, all in accordance with wiring diagram and local codes.

C. Evaporator System:
1. Russell coils or equal, to hold -10 degree F or 35-40 degree F.
2. Supply drier, sight glass, solenoid, thermostat, crankcase heater, pressure control, oil separator, time clock, drain line heater, expansion valve, suction line accumulator.
3. Provide inter-connecting piping as required.
4. Evaporators shall be supported by means of 1/2" nylon rods supplied by this contractor.
5. Evaporators shall be furnished with built-in electric defrost heater, drainpan heat and thermostat and heat exchangers. These heaters are for the freezer only.
6. Drain lines for evaporators in freezer run shall be provided with defrost heater.
   a. Units in systems shall be factory mounted and packaged refrigeration systems as manufactured by MRC, or Taylor, or equal. The condensing unit package shall have a factory mounted and pre-wired weatherproof control complete with circuit breakers, time clock controls, wired for single point power connection to main disconnect breakers. Electrical contractor shall provide and install main power lines to panel, defrost control wiring between condensing unit panel and remote refrigeration equipment and evaporator coils as per factory recommended wiring circuits by Electrical Contractor. Minor modification, if required to meet codes shall be done by the Electrical Contractor.

D. Temperature and Defrost Control:
1. Temperature control shall be compartment thermostat for prefabricated refrigerator compartments and otherwise by pressure switch for each individual system. Thermostat

shall be line voltage to operate line voltage liquid line solenoid.

2. Each prefabricated refrigerator, above or below freezing, shall be controlled by a Penn Type 219, or equal, electric thermostat, without external range adjustment.
3. A defrost timer shall be furnished for prefabricated freezer, with defrost cycle set to maintain frost free evaporator.

E. Valves and Accessories:

1. All valves shall be of standard weight and manufactured suitable for the service and purpose intended and shall be subject to approval.
2. Refrigerant shut-off valves in the refrigerant piping shall be Henry, or equal, seal cap globe valves for lines size 7/8" outside diameter and larger, and packless diaphragm for smaller sizes. All valves shall be placed at each inlet and each outlet of a condensing unit, and in each liquid line and each suction branch to each evaporator or evaporators with a compartment.
3. Expansion valves shall be Sporlan, Alco, or equal, and shall be provided by this contractor and placed in the refrigerant liquid at the point where the line enters the evaporator, except when valve is so furnished with evaporator by others.
4. A filter drier shall be provided in the liquid lines located in machine area. Filter driers shall be as manufactured by Sporlan Valve Company, or equal.
5. Systems with compressor horsepower up to and including three horsepower shall have replaceable core suction filter-driers.
6. Solenoid valves shall be Sporlan, or equal, sizes to operate at maximum of two pounds pressure drop across the valves for the capacity required. Solenoids shall be full refrigerant line size, using silver solder connections where possible. A liquid line solenoid shall be used with temperature controller for each walk-in box or field-assembled equipment.
7. Each liquid line sight glass shall be Sporlan See-All Moisture and Liquid Indicator.
8. Each suction pressure regulator, if required, shall be Sporlan, Alco, or equal, and shall match the capacity of the equipment it controls.
9. Heat exchanger, if used, shall be designed with a capacity to match the condensing units.
10. Where required by line runs, include oil separators, with heaters, at condensing units.

F. Refrigeration Piping:

1. Copper tubing for use in refrigerant piping shall conform to ASTM standard specification of copper refrigerant tubing serial designation B-88. All pipe shall be Type "L" arc hard or soft copper tubing as specified. Refrigerant piping shall be exposed to view as required by the American Standard Safety Code for mechanical refrigeration.
2. For exposed areas or accessible furred ceiling spaces, hard copper tubing shall be used. Exposed tubing shall be installed to avoid damage to activities in this area; otherwise tubing shall be run in pipe or conduit, furnished and installed by the electrical contractor.
3. Suction lines shall be sized to give minimum pressure drop from evaporator to machine of 2 lbs. for high temperature system, and of 1 lb. for freezer systems, and shall allow gas velocities of not less than 750 FPM in horizontal runs and 1,500 FPM in vertical risers. Liquid lines shall be sized to give maximum pressure drop of 3 lbs. from receiver to evaporator.
4. Tubing run shall be graded to prevent trapping of oil.
5. All refrigerant piping shall be properly secured with "Unistrut" clamps located to conform to proper refrigerant piping practice.

G. Insulation of Refrigeration Lines:

1. Insulation: Refrigerant suction lines outside of refrigerated compartment, not run in conduit, shall be insulated back to compressors with Armstrong Arma-Flex #AP-25/50 foamed plastic insulation, or equal, applied in accordance with direction of the Manufacturer. Minimum thickness shall be 1/2" for commercial temperature and 3/4" for low temperature.

H. Joints and Connections:

1. Copper tubing joints in piping lines shall be made with Handy & Harmon "Sil-Fos" brazing alloy "Phozon 15", "Silvaloy 15", or equal. Melting point shall be between 1185 -1300 degree F. Silver content not less than 45%.
2. Copper to brass joints for piping and fittings shall be made with Handy & Harmon "Easy-Flow

45" brazing alloy, "Silvaloy 45", "Mueller 122", or equal. Melting point shall be between 1125 -1145 degree F. Silver content not less than 45%.

3. All surfaces to be joined must be thoroughly cleaned. When soldering stop valves or solenoid valves, wrap valves with moist fabric to absorb excessive heat. Stop valves shall be partly open. When soldering expansion valves or suction pressure regulating valves, remove power assembly if necessary to prevent damage due to excessive heat.

I. Charging the System:
   1. Provide specified refrigerant and oil, charge the system and run an operational check of three days duration.

J. Testing and Dehydrating:
   1. All systems shall be subjected to a 25-inch vacuum for a period of twenty-four hours with a maximum decrease of 3 inch vacuum. All liquid lines shall be subjected to 100 PSI for a period of twenty-four hours with a maximum pressure decrease of 3 PSI. For insulated lines, testing shall be done before insulation is installed.

K. Instructions and Diagrams:
   1. Provide any required instruction to the Plumbing and Electrical Contractors for hook-up of machines or other items.

2.05 SWITCHES, CONTROLS, AND ELECTRICAL WORK

A. The Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch or starter of proper type in accordance with the Underwriter's Code. All other line switches, safety cut-outs, control panels, fuse boxes, other controls, fittings, and connections shall be furnished and installed by the Electrical Contractor except where specific instances are specified contrary.
   1. The Food Service Equipment Contractor shall provide all equipment, internally wired to a junction box including push button switches, starters, etc., built into or forming an integral part of these items shall be furnished and installed by the Food Service Contractor, in his factory, or at the building site with all items completed to a junction box. Final connection to the lines shall be made by the Electrical Contractor from junction box.
   2. Provide automatic door switches for walk-in doors and refrigerators or freezers. Doors complete with lights.
   3. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles for all equipment items powered by plugging into 110-12- volt single phase, A.C. Also provide suitable length 3-wire cord.

2.06 CONVENIENCE OUTLETS

A. Where receptacles are shown in fabricated equipment, the Food Service Contractor shall supply cut-out and mount box integrally in place at location as shown on the drawings.

2.07 ELECTRICAL MOTORS AND STARTERS

A. Quietness of operation of all equipment with motors is a requirement, and the Contractor will be required to remove or repair any equipment producing objectionable noise.

B. Every motor larger than 1/4 H.P. shall be equipped with a motor starter which shall have overload protection. If starters are not a standard part of said equipment, deliver starters to the job site separately for installation by the Electrical Contractor. For motors requiring automatic operation, the starters shall be automatic across the line type. Push button stations shall be included.

C. For motors over 1/2 H.P. and larger, not having automatic operation starters shall be General Electric CR 062 or equal. Motors under 1/2 H.P. and not having automatic operation shall have General Electric CR 1061 starters or equal, enclosed type, for surface mounting. 120V motors shall have single pole starters. 208V-3 phase motors shall have three pole starters.

D. Unless otherwise stated, all 1/2 H.P. or larger electric motors shall be for 208 Volt, 60 Cycle, three phase and all motors smaller than 1/2 H.P. shall be 120 Volt, 60 Cycle, single phase.

2.08 CONNECTION TERMINALS

A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified contrary, for other contractors to make Mechanical, Electrical, Ventilation and Refrigeration connections, as required.

2.09 VENTILATION OF REFRIGERATED EQUIPMENT

A. Adequate air supply and exhaust shall be provided for all self contained refrigeration condensing units, both fabricated and standard, as required for proper operation. If in the opinion of Contractor additional ventilation is required to insure correct operation temperatures, he shall so state in a letter to the Architect or Consultant, for evaluation and decision before installation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Anchor bolts, sleeves and other items required to be built into masonry and concrete shall be set by the masonry and concrete contractors and shall be furnished promptly by the Food Service Equipment Contractor so they may be built in as the work progresses.

3.02 INSTALLATION

A. Food Service Equipment shall be installed strictly in accordance with accepted shop drawings and manufacturer's instructions.

B. All items shall be installed plumb, square, level and in proper elevation, plane, location and in alignment with other work.

C. Space between all units and walls, ceilings, floors, and adjoining units not portable and with enclosed bodies shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material as suited to the nature of the equipment. Fill voids with batt insulations. Ends of hollow sections shall be closed.

3.03 EQUIPMENT SCHEDULE

A. Walk-in Refrigerator/Walk-in Freezer - One Each Required.
   1. Walk-ins shall be size and shape as shown on plans as manufactured by Kolpak, Parsons, Tennessee, 731-847-5620. Units to be approximately 8'-6" high clear from finished floor to finished inside of ceiling. Units shall be completely NSF approved.

B. Refrigeration Package (Refrigerator) - One Required.
   1. Refrigeration Package to be Model No. MPL2CZ as manufactured by ColdZone, Brea California, 714-529-4461. Unit to be completely weather protected by means of crank case heaters and fan cycling switches. Cooling to be accomplished by condensers and proper air movement. Unit to have a one point electrical connection completely pre-wired.

C. Refrigeration Package (Freezer) - One Required.
   1. Same as Refrigerator Unit.

D. Evaporator Coil (Refrigerator) - One Required.
   1. Provide as part of Refrigeration System.

E. Evaporator Coil (Freezer) - One Required.
   1. Provide as part of Refrigeration System.

F. Cold Storage Shelving, Mobile. - Two Required.
   1. Model No.PA548P lektro-coat as manufactured by Hodges, or Intermetro. Units to consist of five tiers high with 72" high posts and 5" diameter swivel non-marking NSF polyurethane casters, all with brakes, Model No. PP5B.

END OF SECTION

SECTION 11425

HOOD AND VENTILATION EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cooking hoods.

B. Condensate (dishwashing) hoods.

1.02 RELATED REQUIREMENTS

A. Section 10523 - Fire Extinguishers, Cabinets, and Accessories: Hand held fire extinguishers.

B. Section 11400 - Food Service Equipment: General provisions for hoods.

1.03 REFERENCE STANDARDS

A. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.

B. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2011.

C. NSF 2 - Food Equipment; 2009.

D. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

E. UL 710 - Standard for Safety for Exhaust Hoods for Commercial Cooking Equipment; Current Edition, Including All Revisions.

F. UL 1046 - Standard for Grease Filters for Exhaust Ducts; Current Edition, Including All Revisions.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for utility requirements.

B. Products Requiring Electrical Connection: Listed and classified by UL (EAUED) as suitable for the purpose specified and indicated.

C. All hood and ventilation equipment shall be installed with seismic restraints per SMACNA Kitchen Ventilation Systems and Food Service Equipment - Fabrication and Installation Guidelines, Appendix A, and as approved by DSA.
   1. Where anchorage details are not shown on the drawings or in the guidelines, the field installation shall be subject to the approval of the Architect and the DSA Field Engineer.
   2. A copy of the "Guidelines" shall be provided by the Contractor and kept on the job site at all times.

1.05 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions, adjusting and balancing methods.

C. Shop Drawings: For each custom fabricated unit, provide drawings showing details of construction, dimensions, and interfaces with adjacent construction.

D. Test Reports for Grease Extracting Hoods: Provide test reports substantiating exhaust volume

ratings and grease extraction performance.

E. Operation and Maintenance Data.

F. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. At least fifteen years experience in the design and manufacture of products of similar type to those specified.
   2. For grease extracting hoods, able to provide test data showing performance of hoods to be provided.
   3. Having at least one factory-authorized service agency located within 50 miles (80 km) of project site.
   4. Able to provide service to project site within 24 hours after receiving a service call.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Grease Extracting Hoods:
   1. Substitutions: See Section 01600 - Product Requirements.

B. Other Hoods:
   1. Same manufacturer as for grease extracting hoods.
   2. Substitutions: See Section 01600 - Product Requirements.

2.02 HOOD APPLICATIONS

A. Canopy-Style Cooking Hoods:
   1. Style: Wall-attached canopy.
   2. Type: Grease filter type.
   3. Mounting Height: Bottom rim at 6 feet 6 inches (1.8 m 152 mm) above finished floor.

B. Condensate Hoods:
   1. Style: Wall-attached canopy.
   2. Mounting Height: Bottom rim at 6 feet 6 inches (1.8m 152 mm) above finished floor.

2.03 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, and the requirements of the authorities having jurisdiction.

B. Cooking Hoods: Provide Type I hoods, with all external joints and seams continuously welded, liquid-tight, and all internal joints, seams, and attachments sealed liquid-tight and grease-tight.
   1. Provide fire extinguishing system for all cooking hoods.
   2. Provide complete assemblies listed and labeled by UL under UL 710 for its intended use.
   3. Provide hoods and exhaust ducts rated for zero clearance to combustible construction.
   4. Provide complete assemblies certified and labeled by NSF under NSF 2.

C. Condensate Hoods: Provide Type II hoods with all joints and seams liquid-tight.
   1. Inside the bottom perimeter provide an integral formed condensate gutter:
   2. Gutter Dimensions: 3 inches (75 mm) wide with one inch (25 mm) flange turned up at 45 degree angle.
   3. Drain: Stainless steel, one inch (25 mm) diameter, located in back corner of gutter.
   4. Pipe drain to nearest sink drainboard or floor drain.

5. Provide complete assemblies certified and labeled by NSF under NSF 2.

D. Construction: All materials, inside and out, stainless steel complying with ASTM A 666, Type 304, stretcher leveled; unless otherwise indicated.
1. Sheet Thickness: 18 gage, 0.048 inch (1.22 mm), minimum.
2. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.
3. Finish on Surfaces Exposed to View: No.4 (brushed directional); provide stainless steel faces on all sides exposed to view.
4. Finish on Concealed Surfaces: No.4 or No.2B (dull, matte).
5. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8 inches (200 mm) extension from top or back face of unit, with minimum one inch (25 mm) 90 degree flange, unless otherwise indicated.
6. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit; maximum width of 40 inches (1000 mm).
7. Electrical: Run electrical wiring in conduit or raceways, factory pre-wired, with single connection point per hood.
8. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
   a. Hanger Rods: 1/2 inch (12 mm) diameter, minimum.
   b. Hanger Spacing: 48 inches (1220 mm) on center, maximum.
   c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.
9. Accessory Panels: Where indicated, provide filler and closure panels of same construction as hoods, to close spaces between hoods and adjacent construction; mount with panel face flush with face of hood.
   a. Where top of ceiling hung hood is lower than the finished ceiling, provide panels to close space between top of hood and ceiling.
   b. Where back of hood must be set away from wall, provide filler panels to close space between hood and wall.

E. Exhaust Air Volume Control: For balancing; provide either built-in volume control damper or separate damper in exhaust duct.

F. Make-Up Air System: Provide volume damper at inlet, accessible for balancing.
1. Diffusers: Louvered register with opposed blade dampers.
2. Plenum: Insulated with one inch (25 mm) thick foil-face fiberglass insulation, on inside of plenum.

2.04 GREASE EXTRACTING HOODS

A. Grease Extracting Hoods: Pre-engineered, factory-fabricated standard products; high-velocity centrifugal grease extraction without requiring filters, cartridges, moving parts, removable parts, or constantly running water, with grease collected in gutter piped to drain, and as specified above.
1. Performance: Remove 95 percent of extraneous matter in air stream at rated air velocity; provide substantiation.
2. Grease Extracting Baffles: Non-removable, adjustable for balancing.
3. Access Panels: Provide removable panels, with handles, for access to exhaust plenum for cleaning.
4. Label: Provide permanent label indicating rated exhaust performance.

2.05 HOOD ACCESSORIES

A. Fire Extinguishing System: Comply with NFPA 96.
1. Exposed Piping Under Hood: Stainless steel or chrome plated.
2. Exposed Piping Outside Hood: Not permitted.
3. Nozzles: Stainless steel or chrome plated brass.
4. Electrical Components: Provide all components required for properly operating system,

including but not limited to wiring, raceways, contactors, circuit breakers, switches and solenoids.
5. Fire Alarm System: Provide connection point for building fire alarm system capable of signaling system readiness and to generate signal when system is actuated.
6. Manual Actuators: Wall-mounted pull stations; provide one near each hood and one near exit door.

B. Controls:
1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.
2. Fans: Provide controls for fan operation by time clock, programmable by the week, capable of maintaining time cycle after operation of manual push buttons.
3. Cooking Equipment: Provide manual shutoff and reset button located where indicated; combine with fire extinguishing actuation.
4. Fire Extinguishing System: Provide automatic actuation complying with NFPA 96; provide local and remote manual actuating stations clearly labeled "Hood Fire Protection"; upon actuation of fire extinguishing system, automatically:
   a. Shut off fans serving that hood.
   b. Shut off fuel source to equipment under hood; actuate solenoid gas valves provided as part of gas piping work.
   c. Shut off electric power to equipment under hood; actuate contactors or switches provided as part of electrical work.
   d. Signal building fire alarm system; normally-open contacts.

C. Control Panels: Factory assembled and pre-wired, ready for utility connections.
1. UL listed for use with specific hood.
2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
3. Provide a single control panel for each group of hoods served by a single exhaust fan.
4. Enclosures: Flush-mounted; stainless steel, to match hood.
5. Provide indicator lights on control panel door showing status of fans and power supply.

D. Lights Inside Hoods: Fluorescent and incandescent in quantity and locations indicated, in UL listed vapor-proof fixtures, pre-wired to junction box on top of hood.
1. Incandescent: Surface mounted, thermal shock proof glass globe with chrome plated steel wire guard; 100 watt bulb.
2. Locate switch for operating lights in locations indicated.

E. Grease Filters: Stainless steel, washable, complying with UL 1046, UL listed and labeled;

F. Exhaust Ducts: 18 gage, 0.048 inch (1.22 mm) stainless steel sheet, ASTM A 666; with external seams welded continuously, liquid-tight; see drawings for extent, location, and size of exhaust ducts.
1. Where ducts penetrate ceilings or walls, provide stainless steel angle flange trim with welded corners, 16 gage, 0.06 inch (1.5 mm) minimum thickness.
2. Where ducts penetrate hood body, provide stainless steel angle flange trim with welded corners and seal joints liquid-tight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that overhead supports are installed in correct locations.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and NFPA 96.

B. Install hoods level and plumb, securely fastened, with seismic restraints as specified, and free of vibration during normal operation.

C. Weld hood duct collars to ductwork, liquid-tight.

D. Connect to utilities.

3.04 SYSTEM STARTUP

A. Obtain the services of the manufacturer's representative experienced in the installation, adjustment, and operation of the equipment to supervise the starting and adjusting of equipment.

B. Prepare equipment for startup, start and operate equipment for sufficient period to verify proper operation; correct equipment not operating correctly.

C. Test liquid carrying components for leaks.

D. Adjust volume dampers as required for proper air flow after building air handling systems have been balanced and adjusted.

E. Demonstrate operation to District's designated personnel.

F. Report deficiencies in writing to Architect.

3.05 CLOSEOUT ACTIVITIES

A. Conduct training of District's designated personnel in the operation and maintenance of equipment.

B. Perform at least 2 hours of training, for minimum of 2 people, at project site.

C. Arrange training sessions with District at least 2 weeks in advance.

D. Have operation and maintenance data on hand for training sessions.

3.06 PROTECTION

A. Clean surfaces of equipment.

B. Protect installed products until completion of project.

C. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11450

APPLIANCE EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Staff Room appliances.

1.02 RELATED REQUIREMENTS

A. Section 06410 - Custom Cabinets.

1.03 REFERENCE STANDARDS

A. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data indicating dimensions, capacity, and operating features of each piece of residential equipment specified.

C. Copies of Warranties: Submit manufacturer warranty and ensure that forms have been completed in District's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 15 years of documented experience.

B. Electric Appliances: Listed and labeled by UL and complying with NEMA standards.

1.06 WARRANTY

A. See Section 01780 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard warranty.

C. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

D. Provide ten (10) year manufacturer warranty on magnetron tube of microwave ovens.

PART 2 PRODUCTS

2.01 APPLIANCES

A. Garbage Disposer:
   1. Type of Feed: Continuous.
   2. On/Off Control: Wall Switch.
   3. Motor: Single Phase.
   4. HP: 3/4.
   5. Volts: 120.
   6. HZ: 60.
   7. RPM: 1725.
   8. Amp. (Avg. Load): 8.1.
   9. Time Rating: Intermittent.
   10. Lubrication: Permanently Lubricated Upper & Lower Bearings.
   11. Overall Height: 12-5/8".
   12. Grind Chamber Capacity: 26 oz.
   13. Motor Protection: Manual reset Overload.
   14. Drain Connection: 1-1/2" Cushioned Slip Joint.

15. Accessories: Standard Mounting Gasket, Stainless Steel Stopper and Flange.
16. Manufacturer:
17. In-Sink-Erator, a division of Emerson, Racine, Wisconsin, 800-558-5700. Product: Model 444.

B. Refrigerator: Free-standing, side-by-side, frost-free.
1. Capacity: Total minimum storage of 23 cubic ft.; minimum 8.5 cubic ft. freezer capacity.
2. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by DOE. Energy Star Qualified.
3. Features: Include Upfront temperature controls, gallon door storage, vegetable/fruit crispers, can storage shelf, adjustable wire or glass shelves.
4. Control Type: Color LCD.
5. Finish: White-on-White.
6. Manufacturers:
   a. GE Appliances; Product PCF23RGWWW: www.geappliances.com.
   b. Whirlpool Corp; Product GC3SHEXNQ: www.whirlpool.com.
   c. Substitutions: See Section 01600 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify utility rough-ins are present and correctly located.

B. Verify that casework installation is complete.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor built-in equipment in place.

3.03 ADJUSTING

A. Adjust operating equipment to efficient operation.

3.04 CLEANING

A. Remove packing materials from equipment.

B. Wash and clean equipment.

END OF SECTION

SECTION 12492

HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 06100 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

D. Samples: Submit six samples, six inch (152 mm) long illustrating slat materials and finish, color, cord type and color.

E. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 PROJECT CONDITIONS

A. Coordinate the work with window installation and placement of concealed blocking to support blinds.

B. Take field measurements to determine sizes required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Horizontal Louver Blinds:
   1. Levolor Contract; Product Riviera: www.levolorcontract.com.
   2. Graber, division of Springs Window Fashions: www.graberblinds.com.
   3. Substitutions: See Section 01600 - Product Requirements.

2.02 BLINDS AND BLIND COMPONENTS

A. Blinds: Horizontal slat louvers hung from full-width headrail with full-width bottom rail; manual control of raising and lowering by cord with full range locking; blade angle adjustable by control wand; complying with WCMA A100.1.

B. Metal Slats: Spring tempered pre-finished aluminum; radiused slat corners, with manufacturing burrs removed.
   1. Width: 1 inch (25 mm).
   2. Thickness: 8 gauge, 0.12 inch (3 mm).
   3. Color: As selected.

C. Slat Support: Woven polypropylene cord, ladder configuration.

D. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats
   1. Color: Same as slats .

E. Bottom Rail: Pre-finished, formed aluminum with top side shaped to match slat curvature; with end caps. Color: Same as headrail.

F. Lift Cord: Braided nylon; continuous loop.
   1. Free end weighted.

G. Control Wand: Extruded hollow plastic; square shape.
   1. Non-removable type.
   2. Length of window opening height less 3 inches (75 mm).

H. Headrail Attachment: Ceiling brackets.

I. Accessory Hardware: Type recommended by blind manufacturer.

2.03 FABRICATION

A. Fabricate blinds to cover window frames completely.

B. At openings requiring multiple blind units, provide separate blind assemblies with space of 1/2 inch (13 mm) between blinds, located at window mullion centers.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that openings are ready to receive the work.

B. Ensure structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

C. Place intermediate head supports at 18 inch (457 mm) on center.

3.03 ADJUSTING

A. Adjust blinds for smooth operation.

3.04 CLEANING

A. Clean blind surfaces just prior to occupancy.

END OF SECTION

SECTION 12494 3

CURTAIN AND TRACK - CUBICLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Curtains, tracks, and installation.

B. Accessories.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 09260 - Gypsum Board Assemblies.

C. Section 09511 - Suspended Acoustical Panel Ceilings.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data for products specified.

C. Shop Drawings: Plans and details indicating anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for correct installation.

D. Samples: Submit curtain track section, 12 inches long, and six fabric samples, 8 inches x 12 inches, indicating fabric content.

E. Certificate showing compliance with this section.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of five years of documented experience producing products of the types specified in this section.

B. Installer's Qualifications: Regularly engaged and specializing for the preceding three years in the installation of drapery and track systems of equivalent type and approved by the manufacturer for this installation.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials protectively wrapped and store in a dry location.

1.06 WARRANTY

A. Furnish to the District, a written guarantee against defects in the material or workmanship for a period of one (1) year from the date of building acceptance. Furnish to District documentation of flame resistance of curtain fabrics.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted by the Architect prior to bid date.

2.02 MATERIALS

A. Curtains: Curtains are to be fabricated of permanently flame resistant hospital cubicle curtains, 61% SARAN, 31% VERAL, 8% RAYON, and 76 inches wide. Curtains shall be flame retardant treated per Section 3.08, T-19 C.C.R., with certification and labeling requirements of Section 1321.1 and B24 of Title 19, California Code of Regulations.

B. Nurse's Curtain: Manufacturer to be "Covel 75" by Covoc Corporation, Fullerton, California (800) 725-3266, or equal.

C. Curtain Track: Marshall McMurray No. 8870 aluminum roller track with No. 8780 two-wheel carrier with swivel eyelets, or equal. (This curtain track is to be used in Nurse's Room and to support valances hanging from the platform ceiling.)

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Curtain and track shall be clean prior to and after installation. If there are any defects in material, they shall be immediately reported to the general contractor and in writing to the Architect. Defective material shall not be installed.

B. Install curtain and track in accordance with manufacturer's written instructions.

C. Nurse's Curtains: Cubicle curtains are to be fabricated with 1-1/2 inches crinoline reinforced single heads, 1 inches single side hems, 1-1/4 inch single bottom hems and aluminum grommets at the head 6 inches on center.
   1. Curtain is to be fabricated 10% wider than the track length. Curtain shall hang to within 8 inches above floor.

D. Nurse's Curtain Track: Attach track to ceiling at framing members or blocking; all attaching screws shall be firmly imbedded in wood.

3.02 CLEANING

A. Upon completion of installation of the curtains and tracks, clean up and remove all debris resulting from this work from the site; leave the areas broom clean.

END OF SECTION

SECTION 12495

CURTAIN AND TRACK - CUBICLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Curtains, tracks, and installation.

B. Accessories.

1.02 RELATED SECTIONS

A. Section 06100 - Rough Carpentry.

B. Section 09260 - Gypsum Board Assemblies.

C. Section 09511 - Suspended Acoustical Panel Ceilings.

1.03 SUBMITTALS

A. See Section 01300 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's product data for products specified.

C. Shop Drawings: Plans and details indicating anchoring and fastening details, required locations and types of anchors and reinforcement, and materials required for correct installation.

D. Samples: Submit curtain track section, 12 inches long, and six fabric samples, 8 inches x 12 inches, indicating fabric content.

E. Certificate showing compliance with this section.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum of five years of documented experience producing products of the types specified in this section.

B. Installer's Qualifications: Regularly engaged and specializing for the preceding three years in the installation of drapery and track systems of equivalent type and approved by the manufacturer for this installation.

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A. Deliver materials protectively wrapped and store in a dry location.

1.06 WARRANTY

A. Furnish to the District, a written guarantee against defects in the material or workmanship for a period of one (1) year from the date of building acceptance. Furnish to District documentation of flame resistance of curtain fabrics.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Materials shall be the product of one manufacturer and shall be either the ones upon which the design is based or the products of a manufacturer accepted by the Architect prior to bid date.

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A. Curtains: Curtains are to be fabricated of permanently flame resistant hospital cubicle curtains, 61% SARAN, 31% VERAL, 8% RAYON, and 76 inches wide. Curtains shall be flame retardant treated per Section 3.08, T-19 C.C.R., with certification and labeling requirements of Section 1321.1 and B24 of Title 19, California Code of Regulations.

B. Nurse's Curtain: Manufacturer to be "Covel 75" by Covoc Corporation, Fullerton, California (800) 725-3266, or equal.

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PART 3 - EXECUTION

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B. Install curtain and track in accordance with manufacturer's written instructions.

C. Nurse's Curtains: Cubicle curtains are to be fabricated with 1-1/2 inches crinoline reinforced single heads, 1 inches single side hems, 1-1/4 inch single bottom hems and aluminum grommets at the head 6 inches on center.

1. Curtain is to be fabricated 10% wider than the track length. Curtain shall hang to within 8 inches above floor.

D. Nurse's Curtain Track: Attach track to ceiling at framing members or blocking; all attaching screws shall be firmly imbedded in wood.

3.02 CLEANING

A. Upon completion of installation of the curtains and tracks, clean up and remove all debris resulting from this work from the site; leave the areas broom clean.

END OF SECTION

SECTION 13915

FIRE-SUPPRESSION PIPING

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 fire-suppression piping inside the building:

1. Wet-pipe sprinkler systems.

B. Related Sections include the following:

1. Division 2 Section "Water Distribution" for piping outside the building.
2. Division 10 Section "Fire-Protection Specialties" for cabinets and fire extinguishers.
3. Division 13 Section "Fire Alarm" for alarm devices not specified in this Section.

1.3 DEFINITIONS

A. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.

B. Fire-suppression sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

a. Building Service Areas: Ordinary Hazard, Group 1.
b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
c. General Storage Areas: Ordinary Hazard, Group 1.
d. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
e. Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:

a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler:

a. Office Spaces: 225 sq. ft..
b. Storage Areas: 130 sq. ft..
c. Mechanical Equipment Rooms: 130 sq. ft..
d. Electrical Equipment Rooms: 130 sq. ft..
e. Other Areas: According to NFPA 13 recommendations, unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:

a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

C. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and the California Building Code.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
5. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
6. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable.

E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

F. Welding certificates.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

   a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

C. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
3. NFPA 230, "Fire Protection of Storage."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

C. Grooved-End, Ductile-Iron Pipe: AWWA C151, with factory- or field-formed, radius-cut-grooved ends according to AWWA C606.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Victaulic Co. of America.

b. Grooved-End Fittings: ASTM A 536, ductile-iron casting with OD matching ductile-iron-pipe OD and cement lining.
c. Grooved-End-Pipe Couplings: AWWA C606, gasketed fitting matching ductile-iron-pipe OD. Include ductile-iron housing with keys matching ductile-iron-pipe and fitting grooves, prelubricated rubber gasket with center leg, and steel bolts and nuts.

d. Grooved-End-Pipe Transition Coupling: UL 213 and AWWA C606, gasketed fitting with end matching ductile-iron-pipe OD and end matching steel-pipe OD. Include ductile-iron housing with key matching ductile-iron-pipe groove and key matching steel-pipe groove, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
e. Grooved-End Transition Flange: UL 213, gasketed fitting with key for ductile-iron-pipe dimensions. Include flange-type, ductile-iron housing with rubber gasket listed for use with housing and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed threaded ends.

1. Cast-Iron Threaded Flanges: ASME B16.1.
2. Malleable-Iron Threaded Fittings: ASME B16.3.
3. Gray-Iron Threaded Fittings: ASME B16.4.
4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe. Include ends matching joining method.
5. Steel Threaded Couplings: ASTM A 865.

B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

C. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, with factory- or field-formed, square-cut- or roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Central Sprinkler Corp.
2) Star Pipe Products; Star Fittings Div.
3) Victaulic Co. of America.
4) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

D. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13 specified wall thickness in NPS 6 to NPS 10.

1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
2. Steel Flanges and Flanged Fittings: ASME B16.5.

E. Grooved-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10; with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

1) Central Sprinkler Corp.
2) Star Pipe Products; Star Fittings Div.
3) Victaulic Co. of America.
4) Ward Manufacturing.

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

2.4 DIELECTRIC FITTINGS

A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.

B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.
d. Zurn Industries, Inc.; Wilkins Div.

C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Epco Sales, Inc.
c. Watts Industries, Inc.; Water Products Div.

D. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.

1. Manufacturers:

a. Perfection Corporation.
b. Precision Plumbing Products, Inc.
c. Victaulic Co. of America.

2.5 FLEXIBLE CONNECTORS

A. Flexible connectors shall have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:

1. NPS 2 and Smaller: Threaded.
2. NPS 2-1/2 and Larger: Flanged.
3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.

B. Manufacturers:

1. Flex-Hose Co., Inc.
2. Hyspan Precision Products, Inc.
3. Metraflex, Inc.

C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.

D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.6 SPRINKLER SPECIALTY FITTINGS

A. Sprinkler specialty fittings shall be UL listed or FMG approved, with 175-psig minimum working-pressure rating, and made of materials compatible with piping.

B. Outlet Specialty Fittings:

1. Manufacturers:

a. Central Sprinkler Corp.
b. Star Pipe Products; Star Fittings Div.
c. Victaulic Co. of America.

d. Ward Manufacturing.

2. Mechanical-T and -Cross Fittings: UL 213, ductile-iron housing with gaskets, bolts and nuts, and threaded, locking-lug, or grooved outlets.

C. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body; with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Fire-End and Croker Corp.
c. Viking Corp.
d. Victaulic Co. of America.

D. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.

1. Manufacturers:

a. Elkhart Brass Mfg. Co., Inc.
b. Fire-End and Croker Corp.
c. Potter-Roemer; Fire-Protection Div.

E. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.

1. Manufacturers:

a. AGF Manufacturing Co.
b. Central Sprinkler Corp.
c. G/J Innovations, Inc.
d. Triple R Specialty of Ajax, Inc.

2.7 LISTED FIRE-PROTECTION VALVES

A. Valves shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Gate Valves with Wall Indicator Posts:

1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.
3. Manufacturers:

a. Grinnell Fire Protection.
b. McWane, Inc.; Kennedy Valve Div.
c. NIBCO.
d. Stockham.

C. Ball Valves: Comply with UL 1091, except with ball instead of disc.

1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. NPS 3: Ductile-iron body with grooved ends.
4. Manufacturers:

a. NIBCO.
b. Victaulic Co. of America.

D. Butterfly Valves: UL 1091.

1. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.

a. Available Manufacturers:

1) Central Sprinkler Corp.
2) McWane, Inc.; Kennedy Valve Div.
3) Mueller Company.
4) NIBCO.
5) Victaulic Co. of America.

E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Clow Valve Co.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Globe Fire Sprinkler Corporation.
e. Grinnell Fire Protection.
f. Hammond Valve.
g. McWane, Inc.; Kennedy Valve Div.
h. Mueller Company.
i. NIBCO.
j. Potter-Roemer; Fire Protection Div.
k. Reliable Automatic Sprinkler Co., Inc.
l. Star Sprinkler Inc.
m. Stockham.
n. Victaulic Co. of America.
o. Watts Industries, Inc.; Water Products Div.

F. Gate Valves: UL 262, OS&Y type.

1. NPS 2 and Smaller: Bronze body with threaded ends.

a. Manufacturers:

1) Crane Co.; Crane Valve Group; Crane Valves.
2) Hammond Valve.
3) NIBCO.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

1) Clow Valve Co.
2) Crane Co.; Crane Valve Group; Crane Valves.
3) Hammond Valve.
4) Milwaukee Valve Company.
5) Mueller Company.
6) NIBCO.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

1) Milwaukee Valve Company.
2) NIBCO.
3) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

1) Central Sprinkler Corp.
2) Grinnell Fire Protection.
3) McWane, Inc.; Kennedy Valve Div.
4) Milwaukee Valve Company.
5) NIBCO.
6) Victaulic Co. of America.

2.8 SPECIALTY VALVES

A. Sprinkler System Control Valves: UL listed or FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Globe Fire Sprinkler Corporation.
c. Grinnell Fire Protection.
d. Reliable Automatic Sprinkler Co., Inc.

e. Star Sprinkler Inc.
f. Victaulic Co. of America.
g. Viking Corp.

2. Alarm Check Valves: UL 193, designed for horizontal or vertical installation, with bronze grooved seat with O-ring seals, single-hinge pin, and latch design. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.

   a. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.

2.9 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating.

B. Manufacturers:

1. Central Sprinkler Corp.
2. Globe Fire Sprinkler Corporation.
3. Grinnell Fire Protection.
4. Reliable Automatic Sprinkler Co., Inc.
5. Star Sprinkler Inc.
6. Victaulic Co. of America.
7. Viking Corp.

C. Automatic Sprinklers: With heat-responsive element complying with the following:

1. UL 199, for nonresidential applications.
2. UL 1767, for early-suppression, fast-response applications.

D. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.

E. Sprinkler types, features, and options as follows:

1. Concealed ceiling sprinklers, including cover plate.
2. Extended-coverage sprinklers.
3. Flush ceiling sprinklers, including escutcheon.
4. Pendent sprinklers.
5. Pendent, dry-type sprinklers.
6. Quick-response sprinklers.
7. Recessed sprinklers, including escutcheon.
8. Sidewall sprinklers.
9. Upright sprinklers.

F. Sprinkler Finishes: Chrome plated, bronze, and painted.

G. Special Coatings: Wax, lead, and corrosion-resistant paint.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, 2 piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.10 FIRE DEPARTMENT CONNECTIONS

A. Manufacturers:

1. Central Sprinkler Corp.
2. Elkhart Brass Mfg. Co., Inc.
3. Potter-Roemer; Fire-Protection Div.
4. Reliable Automatic Sprinkler Co., Inc.

B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPRINKLER."

1. Type: Flush, with two or more inlets and square or rectangular escutcheon plate.
2. Finish: Polished brass.

C. Exposed, Freestanding-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body, brass inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, and bottom outlet with pipe threads. Include brass lugged caps, gaskets, and brass chains; brass lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- high, brass sleeve; and round, floor, brass escutcheon plate with marking "AUTO SPRINKLER."

1. Finish Including Sleeve: Polished brass.

2.11 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings, and sleeve to suit wall construction and 10-inch-diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS 3/4 inlet and NPS 1 drain connections.

1. Manufacturers:

a. Central Sprinkler Corp.
b. Globe Fire Sprinkler Corporation.
c. Grinnell Fire Protection.
d. Reliable Automatic Sprinkler Co., Inc.
e. Star Sprinkler Inc.
f. Viking Corp.

C. Electrically Operated Alarm: UL 464, with 8-inch- minimum- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.

1. Available Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

D. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.

1. Available Manufacturers:

a. Grinnell Fire Protection.
b. ITT McDonnell & Miller.
c. Potter Electric Signal Company.
d. System Sensor.
e. Viking Corp.
f. Watts Industries, Inc.; Water Products Div.

E. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers:

a. McWane, Inc.; Kennedy Valve Div.
b. Potter Electric Signal Company.
c. System Sensor.

F. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

1. Manufacturers:

a. Potter Electric Signal Company.
b. System Sensor.

2.12 PRESSURE GAGES

A. Manufacturers:

1. AGF Manufacturing Co.
2. AMETEK, Inc.; U.S. Gauge.
3. Dresser Equipment Group; Instrument Div.

B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in Part 1 "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EARTHWORK

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.3 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast- or malleable-iron threaded fittings; and threaded joints.

E. Underground Service-Entrance Piping: Ductile-iron, grooved-end pipe and fittings; grooved-end-pipe couplings; and grooved joints. Include corrosion-protective encasement.

3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:

1. Sprinkler-Piping Fitting Option: Specialty sprinkler fittings, NPS 2-1/2 and smaller, including mechanical-T and -cross fittings, may be used downstream from sprinkler zone valves.
2. NPS 2 and Smaller: Threaded-end, black, standard-weight steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.
3. NPS 2-1/2 to NPS 6: Plain-end, black, standard-weight steel pipe; steel welding fittings; and welded joints.
4. NPS 2-1/2 to NPS 6: Grooved-end, black, standard-weight steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
5. NPS 2-1/2 to NPS 6: Plain-end, Schedule 10 steel pipe; steel welding fittings; and welded joints.
6. NPS 2-1/2 to NPS 6: Grooved-end, Schedule 10 steel pipe; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

3.5 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.

   a. Shutoff Duty: Use ball, butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.

   a. Shutoff Duty: Use ball, butterfly, or gate valves.
   b. Throttling Duty: Use ball or globe valves.

3.6 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Threaded Joints: Comply with NFPA 13 for pipe thickness and threads. Do not thread pipe smaller than NPS 8 (DN 200) with wall thickness less than Schedule 40 unless approved by authorities having jurisdiction and threads are checked by a ring gage and comply with ASME B1.20.1.

C. Grooved Joints: Assemble joints with listed coupling and gasket, lubricant, and bolts.

1. Ductile-Iron Pipe: Radius-cut-groove ends of piping. Use grooved-end fittings and grooved-end-pipe couplings.
2. Steel Pipe: Square-cut or roll-groove piping as indicated. Use grooved-end fittings and rigid, grooved-end-pipe couplings, unless otherwise indicated.
3. Copper Tube: Roll-groove tubing. Use grooved-end fittings and grooved-end-tube couplings.
4. Dry-Pipe Systems: Use fittings and gaskets listed for dry-pipe service.

D. Dissimilar-Metal Piping Joints: Construct joints using dielectric fittings compatible with both piping materials.

1. NPS 2 and Smaller: Use dielectric unions, couplings, or nipples.
2. NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 2 Section "Water Distribution" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Refer to Division 2 Section "Water Distribution" for backflow preventers.

3.8 PIPING INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

C. Install underground ductile-iron service-entrance piping according to NFPA 24 and with restrained joints. Encase piping in corrosion-protective encasement.

D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler zone control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install drain valves on standpipes.

K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.

L. Install alarm devices in piping systems.

M. Hangers and Supports: Comply with NFPA 13 for hanger materials.

1. Install sprinkler system piping according to NFPA 13.

N. Earthquake Protection: Install piping according to NFPA 13 to protect from earthquake damage.

O. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

P. Fill wet-pipe sprinkler system piping with water.

Q. Install flexible connectors in fire-suppression piping where indicated.

3.9 VALVE INSTALLATION

A. Install listed fire-protection valves, unlisted general-duty valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Valves for Wall-Type Fire Hydrants: Install nonrising-stem gate valve in water-supply pipe.

D. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water supply sources.

E. Specialty Valves:

1. Alarm Check Valves: Install in vertical position for proper direction of flow, including bypass check valve and retarding chamber drain-line connection.

3.10 SPRINKLER APPLICATIONS

A. Drawings indicate sprinkler types to be used. Where specific types are not indicated, use the following sprinkler types:

1. Rooms without Ceilings: Upright sprinklers.

2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.
3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Pendent, dry sprinklers.
5. Special Applications: Extended-coverage and quick-response sprinklers where indicated.
6. Sprinkler Finishes:

    a. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.
    b. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
    c. Flush Sprinklers: Bright chrome, with painted white escutcheon.
    d. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.11 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels and tiles and center or quarter-point of wide dimension of acoustical ceiling panels and tiles.

B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.

3.12 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type, fire department connections in vertical wall.

B. Install freestanding-type, fire department connections in level surface.

    1. Install protective pipe bollards on up to three sides of each fire department connection. Refer to Division 5 Section "Metal Fabrications" for pipe bollards.

C. Install ball drip valve at each check valve for fire department connection.

3.13 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Include backflow preventer between potable-water piping and fire-suppression piping. Refer to Division 15 Section "Plumbing Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 16.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 16 Section "Grounding and Bonding."

I. Connect wiring according to Division 16 Section "Conductors and Cables."

J. 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.

3.14 LABELING AND IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 15 Section "Mechanical Identification."

3.15 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Energize circuits to electrical equipment and devices.
4. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
5. Coordinate with fire alarm tests. Operate as required.
6. Verify that equipment hose threads are same as local fire department equipment.

B. Report test results promptly and in writing to Architect and authorities having jurisdiction.

3.16 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until Substantial Completion.

END OF SECTION 13915

SECTION 15050 - BASIC MECHANICAL MATERIALS AND METHODS

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. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Mechanical demolition.
9. Equipment installation requirements common to equipment sections.
10. Painting and finishing.
11. Concrete bases.
12. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.
b. Precision Plumbing Products, Inc.
c. Sioux Chief Manufacturing Co., Inc.
d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated and rough brass.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated and rough brass.

E. One-Piece, Floor-Plate Type: Cast-iron floor plate.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

A. Refer to Division 1 Sections "Cutting and Patching" and "Selective Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
   g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

2. Existing Piping: Use the following:

   a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
   b. Insulated Piping: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and spring clips.
   c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
g. Bare Piping in Unfinished Service Spaces: Split-casting, cast-brass type with polished chrome-plated finish.
h. Bare Piping in Unfinished Service Spaces: Split-plate, stamped-steel type with concealed or exposed-rivet hinge and set screw or spring clips.
i. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
j. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
k. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

A. Painting of mechanical systems, equipment, and components is specified in Division 9 Section " Painting (Professional Line Products)."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.8 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.9 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 15050

SECTION 15060 - HANGERS AND SUPPORTS

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 hangers and supports for mechanical system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Fire-Suppression Piping" for pipe hangers for fire-protection piping.
3. Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
4. Division 15 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
5. Division 15 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

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

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
5. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

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

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Tolco Inc.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. ERICO/Michigan Hanger Co.
2. PHS Industries, Inc.
3. Rilco Manufacturing Company, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.
3. Samco Stamping, Inc.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. 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.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

   b. NPS 4: 12 inches long and 0.06 inch thick.

   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15075 - MECHANICAL IDENTIFICATION

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 mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Duct markers.
7. Valve tags.
8. Valve schedules.
9. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.5 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.

1. Terminology: Match schedules as closely as possible.
2. Data:

a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Thickness: 1/8 inch, unless otherwise indicated.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.2 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

2.3 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

1. Material: 0.032-inch- thick brass.
2. Material: 0.0375-inch- thick stainless steel.
3. Material: 3/32-inch- thick laminated plastic with 2 black surfaces and white inner layer.
4. Valve-Tag Fasteners: Brass wire-link or S-hook.

2.5 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.2 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fire department hose valves and hose stations.
    c. Meters, gages, thermometers, and similar units.
    d. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    e. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    f. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    g. Fans, blowers, primary balancing dampers, and mixing boxes.
    h. Packaged HVAC central-station and zone-type units.
    i. Tanks and pressure vessels.
    j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.

1. Identify mechanical equipment with equipment markers in the following color codes:

    a. Green: For cooling equipment and components.
    b. Yellow: For heating equipment and components.
    c. Black: For combination cooling and heating equipment and components.
    d. Blue: For energy-reclamation equipment and components.
    e. White: For compresses air equipment and components

2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
4. Include signs for the following general categories of equipment:

    a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    c. Pumps, compressors, chillers, condensers, and similar motor-driven units.

d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
e. Fans, blowers, primary balancing dampers, and mixing boxes.
f. Packaged HVAC central-station and zone-type units.
g. Tanks and pressure vessels.
h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.

D. Install access panel markers with screws on equipment access panels.

3.3 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.4 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For cold-air supply ducts.
2. Yellow: For hot-air supply ducts.
3. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
5. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Provide 1-1/2" diameter natural brass tags with captions similar to those indicated in the following:

1. Valve-Tag:

   a. Cold Water
   b. Hot Water
   c. Fire Protection
   d. Gas
   e. Steam
   f. Compressed Air

3.6 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.8 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.9 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 15075

SECTION 15080 - MECHANICAL INSULATION

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 mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:

1. Insulation Materials:

   a. Mineral fiber.

2. Fire-rated insulation systems.
3. Adhesives.
4. Mastics.
5. Sealants.
6. Factory-applied jackets.
7. Securements.
8. Corner angles.

B. Related Sections include the following:

1. Division 15 Section "Metal Ducts" for duct liners.

1.3 DEFINITIONS

A. FSK: Foil, scrim, kraft paper.

B. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing inside insulation.

3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties, equipment connections, and access panels.
6. Application of field-applied jackets.
7. Application at linkages of control devices.
8. Field application for each equipment type.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Available Products:

a. CertainTeed Corp.; Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Duct Wrap.
d. Owens Corning; All-Service Duct Wrap.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

a. CertainTeed Corp.; Commercial Board.
b. Johns Manville; 800 Series Spin-Glas.
c. Knauf Insulation; Insulation Board.
d. Owens Corning; Fiberglas 700 Series.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.
d. Mon-Eco Industries, Inc.; 22-25.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Available Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.
d. Mon-Eco Industries, Inc.; 22-25.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-35.
b. Foster Products Corporation, H. B. Fuller Company; 30-90.
c. Marathon Industries, Inc.; 590.
d. Mon-Eco Industries, Inc.; 55-40.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-10.
b. Foster Products Corporation, H. B. Fuller Company; 35-00.
c. Marathon Industries, Inc.; 550.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 200 deg F.
4. Solids Content: 63 percent by volume and 73 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76-8.
b. Foster Products Corporation, H. B. Fuller Company; 95-44.
c. Marathon Industries, Inc.; 405.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS.

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 SECUREMENTS

A. Bands:

1. Available Products:

a. Childers Products; Bands.
b. PABCO Metals Corporation; Bands.
c. RPR Products, Inc.; Bands.

2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.

a. Products:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; CD.
3) Midwest Fasteners, Inc.; CD.
4) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

a. Products:

1) AGM Industries, Inc.; CWP-1.
2) GEMCO; Cupped Head Weld Pin.
3) Midwest Fasteners, Inc.; Cupped Head.
4) Nelson Stud Welding; CHP.

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

a. Products:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers:

   a. ACS Industries, Inc.
   b. C & F Wire.
   c. Childers Products.
   d. PABCO Metals Corporation.
   e. RPR Products, Inc.

2.8 CORNER ANGLES

A. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

   1. Verify that systems and equipment to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.5 DUCT AND PLENUM INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
6. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous UL-listed fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Division 7 Section "Through-Penetration Firestop Systems."

3.9 FINISHES

A. All Ducts, Equipment, and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material, and where indicated on the plans for exposed ductwork to be painted. Paint jacket with paint system identified below and as specified in Division 9 painting Sections

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.10 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in nonconditioned space.
4. Indoor, exposed return located in nonconditioned space.
5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
7. Outdoor, concealed supply and return.
8. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Round and flat-oval, supply and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.5-lb/cu. ft. nominal density.

B. Round and flat-oval, return and exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

C. Rectangular, supply and outdoor-air duct insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

D. Rectangular, return and exhaust-air duct insulation shall be the following:

1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.

E. Supply-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 6-lb/cu. ft. nominal density.

F. Return-air plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

G. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

END OF SECTION 15080

SECTION 15085 - PLUMBING INSULATION

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 mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:

1. Insulation Materials:

   a. Mineral fiber.

2. Adhesives.
3. Sealants.
4. Tapes.

1.3 DEFINITIONS

A. ASJ: All-service jacket.

B. SSL: Self-sealing lap.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated, identify thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings: Show details for the following:

1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Attachment and covering of heat tracing inside insulation.
3. Insulation application at pipe expansion joints for each type of insulation.
4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Removable insulation at piping specialties, equipment connections, and access panels.
6. Application of field-applied jackets.
7. Application at linkages of control devices.
8. Field application for each equipment type.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation.

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 INSULATION MATERIALS

A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

a. Johns Manville; Micro-Lok.
b. Knauf Insulation; 1000(Pipe Insulation.
c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

F. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.

1. Products:

a. Johns Manville; MicroFlex.
b. Knauf Insulation; Pipe and Tank Insulation.
c. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

a. Childers Products, Division of ITW; CP-82.
b. Foster Products Corporation, H. B. Fuller Company; 85-20.
c. Marathon Industries, Inc.; 225.

2.4 SEALANTS

A. ASJ Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.5 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
c. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 COMMON INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [**2 inches**] [**4 inches**] o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

A. Secure insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
3. Protect exposed corners with secured corner angles.
4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

a. Do not weld anchor pins to ASME-labeled pressure vessels.
b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
d. Do not overcompress insulation during installation.
e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

f. Impale insulation over anchor pins and attach speed washers.
g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
7. Stagger joints between insulation layers at least 3 inches.
8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

3.6 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Install firestopping at penetrations through fire-rated assemblies. Install fire-stop systems according to manufacturer’s installation instructions.

3.9 EQUIPMENT INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.

B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.

C. Domestic hot-water storage tank insulation shall be the following:

1. Mineral-Fiber Pipe and Tank: 4 inches thick.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Fire-suppression piping.
2. Drainage piping located in crawl spaces.
3. Below-grade piping.
4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

1. NPS 2 and Smaller: Insulation shall be the following:

a. Mineral-Fiber Pipe Insulation, Type I: 1 inch thick.

2. NPS 2-1/2 and Larger: Insulation shall be the following:

a. Mineral-Fiber Pipe Insulation, Type I: 1-1/2 inch thick.

END OF SECTION 15080

SECTION 15110 - VALVES

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 general-duty valves:

1. Bronze angle valves.
2. Cast-iron angle valves.
3. Copper-alloy ball valves.
4. Ferrous-alloy ball valves.
5. Bronze check valves.
6. Gray-iron swing check valves.
7. Ferrous-alloy wafer check valves.
8. Bronze gate valves.
9. Cast-iron gate valves.
10. Bronze globe valves.
11. Cast-iron globe valves.
12. Chainwheel actuators.

B. Related Sections include the following:

1. Division 2 piping Sections for general-duty and specialty valves for site construction piping.
2. Division 13 fire-suppression piping and fire pump Sections for fire-protection valves.
3. Division 15 Section "Mechanical Identification" for valve tags and charts.
4. Division 15 Section "HVAC Instrumentation and Controls" for control valves and actuators.
5. Division 15 piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

A. The following are standard abbreviations for valves:

1. CWP: Cold working pressure.
2. EPDM: Ethylene-propylene-diene terpolymer rubber.
3. NBR: Acrylonitrile-butadiene rubber.
4. PTFE: Polytetrafluoroethylene plastic.
5. SWP: Steam working pressure.
6. TFE: Tetrafluoroethylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

1.5 QUALITY ASSURANCE

A. ASME Compliance: ASME B31.9 for building services piping valves.

1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.

B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 VALVES, GENERAL

A. Refer to Part 3 "Valve Applications" Article for applications of valves.

B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.

C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.

D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.

F. Valve Actuators:

1. Chainwheel: For attachment to valves, of size and mounting height, as indicated in the "Valve Installation" Article in Part 3.
2. Gear Drive: For quarter-turn valves NPS 8 and larger.
3. Handwheel: For valves other than quarter-turn types.
4. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
5. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.

G. Extended Valve Stems: On insulated valves.

H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

I. Valve Grooved Ends: AWWA C606.

1. Solder Joint: With sockets according to ASME B16.18.

a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.

2. Threaded: With threads according to ASME B1.20.1.

J. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE ANGLE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 3, Bronze Angle Valves with Metal Disc and Renewable Seat:

    a. Conbraco Industries, Inc.; Apollo Div.
    b. Crane Co.; Crane Valve Group; Stockham Div.
    c. Grinnell Corporation.
    d. Milwaukee Valve Company.
    e. NIBCO INC.

C. Bronze Angle Valves, General: MSS SP-80, with ferrous-alloy handwheel.

D. Type 3, Class 200, Bronze Angle Valves: Bronze body with bronze disc and renewable seat. Include union-ring bonnet. Nibco #T-300-B

2.4 COPPER-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Two-Piece, Copper-Alloy Ball Valves:

    a. Conbraco Industries, Inc.; Apollo Div.
    b. Crane Co.; Crane Valve Group; Stockham Div.
    c. Grinnell Corporation.
    d. Milwaukee Valve Company.
    e. NIBCO INC.

2. Three-Piece, Copper-Alloy Ball Valves:

    a. Conbraco Industries, Inc.; Apollo Div.
    b. Grinnell Corporation.
    c. NIBCO INC.

C. Copper-Alloy Ball Valves, General: MSS SP-110.

D. Two-Piece, Copper-Alloy Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem. Nibco #S-585-70

E. Three-Piece, Copper-Alloy Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem. Nibco #T-595-Y

2.5 FERROUS-ALLOY BALL VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Conbraco Industries, Inc.; Apollo Div.

2. Crane Co.; Crane Valve Group; Stockham Div.
3. Milwaukee Valve Company.
4. NIBCO INC.

C. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.

D. Ferrous-Alloy Ball Valves: Class 150, full or regular port. Nibco #F-510-CS-R-66-FS

E. Ferrous-Alloy Ball Valves: Class 300, full or regular port. Nibco #F-530-CS-R-66-FS

2.6 BRONZE CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Grinnell Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.

C. Bronze Check Valves, General: MSS SP-80.

D. Type 4, Class 125, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat. Nibco #S-413

E. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat. Nibco #S-433

F. Type 4, Class 200, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat. Nibco #T-453

2.7 GRAY-IRON SWING CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type II, Gray-Iron Swing Check Valves with Composition to Metal Seats:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Grinnell Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.

C. Gray-Iron Swing Check Valves, General: MSS SP-71.

D. Type II, Class 125, gray-iron, swing check valves with composition to metal seats. Nibco #F-918-B

E. Type II, Class 250, gray-iron, swing check valves with composition to metal seats. Nibco #F-968-B

2.8 FERROUS-ALLOY WAFER CHECK VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Div.
   c. Grinnell Corporation.
   d. NIBCO INC.

C. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.

D. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body. Nibco #W-920-W

2.9 BRONZE GATE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze, Nonrising-Stem Gate Valves:

   a. Crane Co.; Crane Valve Group; Crane Valves.
   b. Crane Co.; Crane Valve Group; Stockham Div.
   c. Grinnell Corporation.
   d. Milwaukee Valve Company.
   e. NIBCO INC.

2. Type 3, Bronze, Rising-Stem, Split-Wedge Gate Valves:

   a. Crane Co.; Crane Valve Group; Jenkins Valves.
   b. Grinnell Corporation.
   c. NIBCO INC.

C. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

D. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge. Nibco #S-113

E. Type 3, Class 200, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet. Nibco #T-154-A

2.10 CAST-IRON GATE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Grinnell Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.

C. Cast-Iron Gate Valves, General: MSS SP-70, Type I.

D. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc. Nibco #F-619

E. Class 250, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc. Nibco #F-669

2.11 BRONZE GLOBE VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Type 1, Bronze Globe Valves with Metal Disc:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Grinnell Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.

2. Type 2, Bronze Globe Valves with Nonmetallic Disc:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Stockham Div.
c. Grinnell Corporation.
d. Milwaukee Valve Company.
e. NIBCO INC.

C. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

D. Type 1, Class 200, Bronze Globe Valves: Bronze body with bronze disc and union-ring bonnet. Nibco #T-256-AP

E. Type 2, Class 125, Bronze Globe Valves: Bronze body with nonmetallic disc. Nibco #S-211

F. Type 2, Class 150, Bronze Globe Valves: Bronze body with PTFE or TFE disc and union-ring bonnet. Nibco #T-235-Y

2.12 CHAINWHEEL ACTUATORS

A. Available Manufacturers:

B. Manufacturers:

1. Babbitt Steam Specialty Co.
2. Roto Hammer Industries, Inc.

C. Description: Valve actuation assembly with sprocket rim, brackets, and chain.

1. Sprocket Rim with Chain Guides: Ductile iron, of type and size required for valve.
2. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
3. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.

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

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE APPLICATIONS

A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, butterfly, or gate valves.
2. Throttling Service: Angle, ball, butterfly, or globe valves.
3. Pump Discharge: Spring-loaded, lift-disc check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Low-Pressure, Compressed-Air Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
4. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 125 or 150 ferrous alloy.

D. Medium-Pressure, Compressed-Air Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.

E. Domestic Water Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Two-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 125, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 125, gray iron.
5. Gate Valves, NPS 2 and Smaller: Type 1, Class 125, bronze.
6. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, NRS, bronze-mounted cast iron.
7. Globe Valves, NPS 2 and Smaller: Type 2, Class 125, bronze.

F. High-Pressure Steam Piping: Use the following types of valves:

1. Angle Valves, NPS 2 and Smaller: Type 2, Class 300, bronze.
2. Angle Valves, NPS 2-1/2 and Larger: Type II, Class 250, cast iron.
3. Ball Valves, NPS 2 and Smaller: Three-piece, 600-psig CWP rating, copper alloy.
4. Ball Valves, NPS 2-1/2 and Larger: Class 300, ferrous alloy.
5. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
6. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron
7. Gate Valves, NPS 2 and Smaller: Type 3, Class 200, bronze.
8. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, NRS, bronze-mounted cast iron.
9. Globe Valves, NPS 2 and Smaller: Type 1, Class 200, bronze.

G. Steam Condensate Piping: Use the following types of valves:

1. Ball Valves, NPS 2 and Smaller: Three-piece, 600-psig CWP rating, copper alloy.
2. Ball Valves, NPS 2-1/2 and Larger: Class 300, ferrous alloy.
3. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 200, bronze.
4. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
5. Gate Valves, NPS 2 and Smaller: Type 3, Class 200, bronze.
6. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 250, NRS, bronze-mounted cast iron.
7. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.

H. Select valves, except wafer and flangeless types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Solder-joint or threaded ends, except provide valves with threaded ends for heating hot water, steam, and steam condensate services.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded ends.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End, Copper Tubing: Valve ends may be grooved. Do not use for steam or steam condensate piping.

3.3 VALVE INSTALLATION

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

C. Locate valves for easy access and provide separate support where necessary.

D. Install valves in horizontal piping with stem at or above center of pipe.

E. Install valves in position to allow full stem movement.

F. Install chainwheel operators on valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor elevation.

G. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
3. Lift Check Valves: With stem upright and plumb.

3.4 JOINT CONSTRUCTION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 15110

SECTION 15122 - METERS AND GAGES

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 meters and gages for mechanical systems:

1. Thermometers.
2. Gages.
3. Test plugs.
4. Flowmeters.

B. Related Sections include the following:

1. Division 15 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
2. Division 15 Section "Steam and Condensate Piping" for steam and condensate meters.
3. Division 15 Section "Fuel Gas Piping" for gas meters inside the building.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Shop Drawings: Schedule for thermometers and gages indicating manufacturer's number, scale range, and location for each.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 BIMETALLIC-ACTUATED DIAL THERMOMETERS

A. Manufacturers:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Ernst Gage Co.
3. Weiss Instruments, Inc.

B. Description: Direct-mounting, bimetallic-actuated dial thermometers complying with ASME B40.3.

C. Case: Dry type, stainless steel with 3-inch diameter.

D. Element: Bimetal coil.

E. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

F. Pointer: Red metal.

G. Window: Glass.

H. Ring: Stainless steel.

I. Connector: Rigid, bottom type.

J. Stem: Metal, for thermowell installation and of length to suit installation.

K. Accuracy: Plus or minus 1 percent of range or plus or minus 1 scale division to maximum of 1.5 percent of range.

2.3 THERMOWELLS

A. Manufacturers:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Ernst Gage Co.
3. Weiss Instruments, Inc.

B. Manufacturers: Same as manufacturer of thermometer being used.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Manufacturers:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
2. Ernst Gage Co.
3. Weiss Instruments, Inc.

B. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch diameter.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4, bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red metal.
7. Window: Glass.
8. Ring: Stainless steel.
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.
11. Range for Fluids under Pressure: Two times operating pressure.

C. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.
2. Syphons: NPS 1/4 coil of brass tubing with threaded ends.
3. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

2.5 TEST PLUGS

A. Manufacturers:

1. MG Piping Products Co.
2. Peterson Equipment Co., Inc.
3. Watts Industries, Inc.; Water Products Div.

B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

D. Core Inserts: One or two self-sealing rubber valves.

1. Insert material for air, water, oil, or gas service at 20 to 200 deg F shall be CR.
2. Insert material for air or water service at minus 30 to plus 275 deg F shall be EPDM.

E. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, two thermometers, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.

1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
4. Carrying case shall have formed instrument padding.

PART 3 - EXECUTION

3.1 THERMOMETER APPLICATIONS

A. Install bimetallic-actuated dial thermometers in the following locations:

1. Inlet and outlet of each hydronic zone.
2. Inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
3. Inlet and outlet of each hydronic heat exchanger.

B. Install dry-case-type, bimetallic-actuated dial thermometers at suction and discharge of each pump.

C. Provide the following temperature ranges for thermometers:

1. Domestic Hot Water: 30 to 180 deg F, with 2-degree scale divisions.
2. Domestic Cold Water: 30 to 130 deg F, with 2-degree scale divisions.
3. Heating Hot Water: 30 to 240 deg F, with 2-degree scale divisions.
4. Chilled Water: 0 to 100 deg F, with 2-degree scale divisions.
5. Steam and Condensate: 50 to 400 deg F, with 5-degree scale divisions.
6. Air Ducts: Minus 40 to plus 110 deg F, with 2-degree scale divisions.

3.2 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install dry-case-type pressure gages at suction and discharge of each pump.

3.3 INSTALLATIONS

A. Install direct-mounting thermometers and adjust vertical and tilted positions.

B. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

C. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees where thermometers are indicated.

D. Duct Thermometer Support Flanges: Install in wall of duct where duct thermometers are indicated. Attach to duct with screws.

E. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

F. Install remote-mounting pressure gages on panel.

G. Install needle-valve and snubber fitting in piping for each pressure gage for fluids (except steam).

H. Install needle-valve and syphon fitting in piping for each pressure gage for steam.

I. Install test plugs in tees in piping.

J. Install flow indicators, in accessible positions for easy viewing, in piping systems.

K. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters as prescribed by manufacturer's written instructions.

L. Install flowmeter elements in accessible positions in piping systems.

M. Install differential-pressure-type flowmeter elements with at least minimum straight lengths of pipe upstream and downstream from element as prescribed by manufacturer's written instructions.

N. Install wafer-orifice flowmeter elements between pipe flanges.

O. Install permanent indicators on walls or brackets in accessible and readable positions.

P. Install connection fittings for attachment to portable indicators in accessible locations.

Q. Install flowmeters at discharge of hydronic system pumps and at inlet of hydronic air coils.

R. Assemble components and install thermal-energy meters.

S. Mount meters on wall if accessible; if not, provide brackets to support meters.

3.4 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance for meters, gages, machines, and equipment.

B. Connect flowmeter-system elements to meters.

C. Connect flowmeter transmitters to meters.

D. Connect thermal-energy-meter transmitters to meters.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.5 ADJUSTING

A. Calibrate meters according to manufacturer's written instructions, after installation.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 15122

SECTION 15140 - DOMESTIC WATER PIPING

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 domestic water piping inside the building.

B. Related Sections include the following:

1. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
2. Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.3 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing domestic water piping systems with 80 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Water Samples: Specified in Part 3 "Cleaning" Article.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.

B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.3 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.

a. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.

2.4 VALVES

A. Bronze and cast-iron, general-duty valves are specified in Division 15 Section "Valves."

B. Balancing and drain valves are specified in Division 15 Section "Plumbing Specialties."

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, trenching, and backfilling are specified in Division 2 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

B. Flanges may be used on aboveground piping, unless otherwise indicated.

C. Grooved joints may be used on aboveground grooved-end piping.

D. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

E. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

F. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. NPS 2 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
3. NPS 2 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

G. Non-Potable-Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
2. NPS 2 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
3. NPS 2 to NPS 6: Hard copper tube, Type L with grooved ends; copper grooved-end fittings; grooved-end-tube couplings; and grooved joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.
2. Install stop-and-waste drain valves where indicated.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow.

3.4 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."

C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Basic Mechanical Materials and Methods."

E. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

3.5 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

C. Grooved Joints: Assemble joints with grooved-end-pipe or grooved-end-tube coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

D. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

B. Pipe hanger and support devices are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.

1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.

2. NPS 1-1/2: 108 inches with 3/8-inch rod.

3. NPS 2: 10 feet with 3/8-inch rod.

4. NPS 2-1/2: 11 feet with 1/2-inch rod.

5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.

6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.

7. NPS 6: 12 feet with 3/4-inch rod.

8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.

2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.

3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

4. NPS 2-1/2: 108 inches with 1/2-inch rod.

5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

6. NPS 6: 10 feet with 5/8-inch rod.

7. NPS 8: 10 feet with 3/4-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow service and maintenance.

C. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:

1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 FIELD QUALITY CONTROL

A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

   a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 15140

SECTION 15150 - SANITARY WASTE AND VENT PIPING

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 for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.
3. Encasement for underground metal piping.

B. Related Sections include the following:

1. Division 15 Section "Chemical-Waste Piping" for chemical-waste and vent piping systems.
2. Division 15 Section "Sewage Pumps."

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

C. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Mission Rubber Co.

3) Tyler Pipe; Soil Pipe Div.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Mission Rubber Co.
4) Tyler Pipe; Soil Pipe Div.

3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) MG Piping Products Co.

2.5 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.

B. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.

C. Aboveground, vent piping shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
2. Copper DWV tube, copper drainage fittings, and soldered joints.

D. Underground, soil, waste, and vent piping shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

G. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

D. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

B. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6: 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.

2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

3. NPS 2-1/2: 108 inches with 1/2-inch rod.

4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

5. NPS 6: 10 feet with 5/8-inch rod.

6. NPS 8: 10 feet with 3/4-inch rod.

I. Install supports for vertical copper tubing every 10 feet.

J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15150

SECTION 15160 - STORM DRAINAGE PIPING

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 storm drainage piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working-pressure, unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Shop Drawings:

1. Design Calculations: Signed and sealed by a qualified professional engineer for selecting seismic restraints.
2. Controlled-Flow Storm Drainage System: Include calculations, plans, and details.

C. Field quality-control inspection and test reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.

1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Mission Rubber Co.
3) Tyler Pipe; Soil Pipe Div.

2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) ANACO.
2) Clamp-All Corp.
3) Mission Rubber Co.
4) Tyler Pipe; Soil Pipe Div.

3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.

a. Manufacturers:

1) MG Piping Products Co.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Aboveground, storm drain piping NPS 4 and smaller shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

B. Aboveground, storm drain piping NPS 5 and larger shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.

C. Underground, storm drain piping shall be any of the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, cast-iron couplings; and hubless-coupling joints.

3.3 PIPING INSTALLATION

A. Storm sewer and drainage piping outside the building are specified in Division 2 Section "Storm Drainage."

B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

D. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers. Cleanouts are specified in Division 15 Section "Plumbing Specialties."

E. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

G. Make changes in direction for storm piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

H. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

I. Install storm drainage piping at the following minimum slopes, unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

C. Hubless Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 15 Section "Mechanical Vibration Controls and Seismic Restraints."

B. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Individual, Straight, Horizontal Piping Runs: According to the following:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 15 Section "Hangers and Supports."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.

2. NPS 3: 60 inches with 1/2-inch rod.

3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.

4. NPS 6: 60 inches with 3/4-inch rod.

5. NPS 8 to NPS 12: 60 inches with 7/8-inch rod.

6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 15160

SECTION 15194 - FUEL GAS PIPING

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 fuel gas piping within the building. Products include the following:

1. Pipe, tube, fittings, and joining materials.
2. Protective pipe and fitting coating.
3. Piping specialties.
4. Specialty valves.
5. Pressure regulators.

B. Related Sections include the following:

1. Division 2 Section "Natural Gas Distribution" for natural gas service piping, specialties, and accessories outside the building.

1.3 PROJECT CONDITIONS

A. Gas System Pressures: Two pressure ranges. Primary pressure is more than 2.0 psig but not more than 5.0 psig, and is reduced to secondary pressure of 0.5 psig or less.

B. Design values of fuel gas supplied for these systems are as follows:

1. Nominal Heating Value: 1000 Btu/cu. ft..
2. Nominal Specific Gravity: 0.6.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.

B. Shop Drawings: For fuel gas piping. Include plans and attachments to other work. Show different pressure zones and indicate pressure for each zone.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Welding certificates.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Standard: Comply with NFPA 54, "National Fuel Gas Code."

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends according to ASME B1.20.1.
3. Cast-Iron Flanges and Flanged Fittings: ASME B16.1, Class 125.
4. Joint Compound and Tape: Suitable for natural gas.
5. Gasket Material: Thickness, material, and type suitable for natural gas.

2.4 PIPING SPECIALTIES

A. Flexible Connectors: ANSI Z21.24, copper alloy.

2.5 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

B. Valves, NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges.

C. Appliance Connector Valves: ANSI Z21.15 and CSA International listed.

1. Manufacturers:

a. Brass Craft Manufacturing Co.
b. Conbraco Industries, Inc.; Apollo Div.
c. Mueller Co.; Mueller Gas Products Div.
d. Watts Industries, Inc.; Water Products Div.

D. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

E. Gas Valves, NPS 2 and Smaller: ASME B16.33 and CSA International-listed bronze body and 125-psig pressure rating.

1. Manufacturers:

a. Crane Valves.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Watts Industries, Inc.; Water Products Div.

2. Tamperproof Feature: Include design for locking.

F. Plug Valves, NPS 2-1/2 and Larger: ASME B16.38 and MSS SP-78 cast-iron, lubricated plug valves, with 125-psig pressure rating.

1. Manufacturers:

a. Flow Control Equipment, Inc.
b. Nordstrom Valves, Inc.
c. Walworth Co.

2. Tamperproof Feature: Include design for locking.

G. General-Duty Valves, NPS 2-1/2 and Larger: ASME B16.38, cast-iron body, suitable for fuel gas service, with "WOG" indicated on valve body, and 125-psig pressure rating.

1. Gate Valves: MSS SP-70, OS&Y type with solid wedge.
2. Butterfly Valves: MSS SP-67, lug type with lever handle.

H. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

1. Manufacturers:

a. ASCO General Controls.
b. Goyen Valve Corp.; Tyco Environmental Systems.
c. Watts Industries, Inc.

I. Earthquake Valves: Listed in CSA International's "Certified Product Listing Directory: Components for Gas and Electrical Equipment" as complying with ASCE 25 and UL listed.

1. Earthquake-Valve, Type 1: Working-pressure rating is 25 psig. Cast-aluminum body with stainless-steel internal parts. Buna-N, reset-stem, O-ring seal. Threaded end connections.

a. Manufacturers:

1) Safe T Quake Corp.

2.6 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. Manufacturers:

a. Service Pressure Regulators:

1) American Meter Company.
2) Fisher Controls International, Inc.; Division of Emerson.
3) Invensys.

b. Line Pressure Regulators:

1) American Meter Company.
2) Fisher Controls International, Inc.; Division of Emerson.
3) Invensys.

2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.

3. NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

4. Service Pressure Regulators: ANSI Z21.80. Include 100-psig- minimum inlet pressure rating.
5. Line Pressure Regulators: ANSI Z21.80 with 5-psig- minimum inlet pressure rating.

B. Pressure Regulator Vents: Factory- or field-installed, corrosion-resistant screen in opening if not connected to vent piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for fuel oil piping system to verify actual locations of piping connections before equipment installation.

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

3.2 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.3 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

B. Install strainer upstream from each earthquake valve. Strainers are specified in Division 15 Section "Plumbing Specialties."

3.4 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping, 5 psig or Less:

1. NPS 2 and Smaller: Steel pipe, malleable-iron threaded fittings, and threaded joints.
2. NPS 2-1/2 and Larger: Steel pipe, steel welding fittings, and welded joints.

3.5 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance connector valve or gas stop.

B. Piping Line Valves, NPS 2 and Smaller: Gas valve.

C. Piping Line Valves, NPS 2-1/2 and Larger: Plug valve or general-duty valve.

3.6 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

   1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

C. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.

D. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

E. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

F. Connect branch piping from top or side of horizontal piping.

G. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

H. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

I. Install pressure gage downstream from each line pressure regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

J. Install flanges on valves, specialties, and equipment having NPS 2-1/2 and larger connections.

K. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.

3.7 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.8 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

1. Do not use gas pipe as grounding electrode.

F. Connect wiring according to Division 16 Section "Conductors and Cables."

3.10 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
2. Nameplates, pipe identification, and signs are specified in Division 15 Section "Mechanical Identification."

3.11 PAINTING

A. Use materials and procedures in Division 9 painting Sections.

B. Paint exterior pipe, pressure regulators, and specialty valves.

1. Color: Gray.

3.12 FIELD QUALITY CONTROL

A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

D. Verify correct pressure settings for pressure regulators.

E. Verify that specified piping tests are complete.

END OF SECTION 15194

SECTION 15410 - PLUMBING FIXTURES

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 plumbing fixtures and related components.

B. Related Sections include the following:

1. Division 15 Section "Drinking Fountains and Water Coolers."
2. Division 15 Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

1.3 DEFINITIONS

A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

1.4 SUBMITTALS

A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.

B. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.

1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.

B. Regulatory Requirements: Comply with the following requirements about plumbing fixtures for people with disabilities: Accessible plumbing fixtures shall comply with all requirements of CBC Section 1115B. Heights and location of all fixtures shall be according to CBC Table 1115B-1. Fixture controls shall comply with CBC Section 1118B.

C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.

D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.

F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:

1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
2. Hand Sinks: NSF 2 construction.
3. Plastic Lavatories: ANSI Z124.3.
4. Plastic Mop-Service Basins: ANSI Z124.6.
5. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
6. Vitreous-China Fixtures: ASME A112.19.2M.
7. Water-Closet, Flushometer Tank Trim: ASSE 1037.

G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:

1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
2. Faucets: ASME A112.18.1M.
3. Hose-Connection Vacuum Breakers: ASSE 1011.
4. Hose-Coupling Threads: ASME B1.20.7.
5. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
6. NSF Materials: NSF 61.
7. Pipe Threads: ASME B1.20.1.
8. Supply and Drain Fittings: ASME A112.18.1M.

H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:

1. Atmospheric Vacuum Breakers: ASSE 1001.
2. Brass and Copper Supplies: ASME A112.18.1M.
3. Manual-Operation Flushometers: ASSE 1037.
4. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.

I. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Floor Drains: ASME A112.21.1M.
2. Off-Floor Fixture Supports: ASME A112.6.1M.
3. Pipe Threads: ASME B1.20.1.

4. Plastic Toilet Seats: ANSI Z124.5.
5. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 COORDINATION

A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. For fixture descriptions in other Part 2 articles where the subparagraph titles "Products," and "Manufacturers" introduce a list of manufacturers and their products or manufacturers only, the following requirements apply for product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified in other Part 2 articles.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified in other Part 2 articles.

2.2 LAVATORY FAUCETS

A. Lavatory Faucet, see Lavatory Fixtures: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Manufacturers:

   a. Delta Cambridge Brass
   b. Chicago Faucet

2. Body Material: Cast brass.
3. Finish: Polished chrome plate.
4. Mounting: Deck, exposed.
5. Handle(s): Lever.
6. Spout Outlet: 0.5 gpm.
7. Drain: Grid.

2.3 SINK FAUCETS

A. Sink Faucet, see Sink Fixtures: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes and outlet with spout and fixture receptor.

1. Manufacturers:

   a. Delta Cambridge Brass
   b. Chicago Faucet

2. Body Material: Cast brass.
3. Finish: Polished chrome plate.
4. Mounting: Deck, concealed.
5. Handle(s): Lever.
6. Spout: Swing, shaped tube.
7. Spout Outlet: 2.5 gpm.
8. Drain: Lift and turn.

2.4 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Guard, see fixtures: Manufactured, pre-molded, plastic covering for hot- and cold-water supplies and trap and drain piping and complying with ADA requirements.

1. Manufacturers:

a. True-Bro, Lav-Guard
b. Plumberex, Pro-2000

2.5 FIXTURE SUPPORTS

A. Urinal Support, UR-1: Type II, urinal carrier with hanger and bearing plates. Include steel uprights with feet.

1. Manufacturers:

a. J.R. Smith
b. Zurn
c. Mifab

2. Accessible Fixture Support: Include rectangular steel uprights.

B. Lavatory Support, LV-1: Type III, lavatory carrier with hanger plate and tie rod. Include steel uprights with feet.

1. Manufacturers:

a. J.R. Smith
b. Zurn
c. Mifab

2. Accessible Fixture Support: Include rectangular steel uprights.

2.6 WATER CLOSETS

A. See drawings.

B. Products:

1. American Standard, Inc.

2. Kohler Co.
3. Toto USA, Inc.

C. Style: See drawings.

1. Bowl Type: Elongated. Include bolt caps matching fixture.
2. Design Consumption: 1.6 gal./flush.
3. Color: White.
4. Flushometer:

a. Sloan
b. Zurn

5. Toilet Seat:

a. Church #9400CSS
b. Olsonite #95CC

2.7 URINALS

A. See drawings.

B. Products:

1. American Standard, Inc.
2. Kohler Co.
3. Toto USA, Inc.

C. Style: See drawings.

1. Design Consumption: 1 gal./flush.
2. Color: White.
3. Flushometer:

a. Sloan
b. Zurn

2.8 LAVATORIES

A. See drawings.

B. Products:

1. American Standard, Inc.
2. Kohler Co.
3. Toto USA, Inc.

C. Style: See drawings.

1. Faucet Hole Punching: match faucet.

2. Color: White.
3. Supplies: NPS 3/8 chrome-plated copper with stops.
4. Drain: Grid.
5. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated cast-brass trap; NPS 1-1/2, 0.045-inch- thick tubular brass waste to wall; and wall escutcheon.
6. Protective Shielding Guards

2.9 STAINLESS STEEL SINKS

A. Products:

1. Dayton Products, Inc.
2. Elkay Manufacturing Co.; #LRAD-3319
3. Just Manufacturing Co.

B. Style: See drawings.

1. Faucet Hole Punching: match faucet.
2. Supplies: NPS 1/2 chrome-plated copper with stops.
3. Drain: Lift and turn.
4. Drain Piping: NPS 1-1/2 chrome-plated cast-brass trap, 0.045-inch- thick tubular brass waste to wall, continuous waste, and wall escutcheon.
5. Protective Shielding Guards

2.10 VITREOUS CHINA SINKS

A. Products:

1. American Standard, Inc.
2. Kohler Co.
3. Toto USA, Inc.

B. Style: See drawings.

1. Faucet Hole Punching: match faucet.
2. Color: White.
3. Supplies: NPS 1/2 chrome-plated copper with stops.
4. Drain: Lift and turn.
5. Drain Piping: NPS 1-1/2 chrome-plated cast-brass trap, 0.045-inch- thick tubular brass waste to wall, continuous waste, and wall escutcheon.
6. Protective Shielding Guards

2.11 TERRAZZO SERVICE SINKS

A. Products:

1. Stern Williams
2. Fiat

B. Style: See drawings.

1. Drain: Grid with NPS 3 outlet.

2.12 DRINKING FOUNTAIN

A. Products:

1. Haws
2. Sunroc
3. Halsey Taylor

B. Style: See drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.

B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

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

3.2 FIXTURE INSTALLATION

A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.

B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.

1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.

C. Install back-outlet, wall-hanging fixtures onto waste fitting seals and attach to supports.

D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.

E. Install wall-hanging fixtures with tubular waste piping attached to supports.

F. Install floor-mounting, back-outlet water closets attached to building floor substrate and wall bracket and onto waste fitting seals.

G. Install counter-mounting fixtures in and attached to casework.

H. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

I. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

J. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.

K. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.

L. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.

M. Install toilet seats on water closets.

N. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

O. Install water-supply, flow-control fittings with specified flow rates in fixture supplies at stop valves.

P. Install faucet, flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

Q. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes, unless otherwise indicated.

R. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.

S. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect water supplies from water distribution piping to fixtures.

C. Connect drain piping from fixtures to drainage piping.

D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.

E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.

3.4 FIELD QUALITY CONTROL

A. Verify that installed fixtures are categories and types specified for locations where installed.

B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.

C. Inspect installed fixtures for damage. Replace damaged fixtures and components.

D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.5 ADJUSTING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets, and flushometer valves to produce proper flow and stream.

C. Replace washers and seals of leaking and dripping faucets and stops.

3.6 CLEANING

A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:

1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
2. Remove sediment and debris from drains.

3.7 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15410

SECTION 15430 - PLUMBING SPECIALTIES

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 plumbing specialties:

1. Backflow preventers.
2. Water regulators.
3. Water filters.
4. Thermostatic water mixing valves.
5. Strainers.
6. Key-operation hydrants.
7. Trap seal primer valves.
8. Drain valves.
9. Miscellaneous piping specialties.
10. Sleeve penetration systems.
11. Flashing materials.
12. Cleanouts.
13. Floor drains.

B. Related Sections include the following:

1. Division 15 Section "Meters and Gages" for water meters, thermometers, and pressure gages.

1.3 DEFINITIONS

A. The following are industry abbreviations for plastic piping materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. PE: Polyethylene plastic.
3. PUR: Polyurethane plastic.
4. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with following minimum working-pressure ratings, unless otherwise indicated:

1. Domestic Water Piping: 125 psig.
2. Sanitary Waste and Vent Piping: 10-foot head of water.
3. Storm Drainage Piping: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: Include rated capacities and shipping, installed, and operating weights. Indicate materials, finishes, dimensions, required clearances, and methods of assembly of components; and piping for the following:

1. Backflow preventers and water regulators.
2. Water filters, and strainers.
3. Thermostatic water mixing valves.
4. Water hammer arresters, and trap seal primer valves and systems.
5. Drain valves, hose bibbs and hydrants.
6. Cleanouts and floor drains.
7. Sleeve penetration systems.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field test reports.

D. Maintenance Data: For plumbing specialties to include in maintenance manuals. Include the following:

1. Backflow preventers and water regulators.
2. Water filters.
3. Thermostatic water mixing valves.
4. Trap seal primer valves.
5. Hose stations and hydrants.

1.6 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of plumbing specialties and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. Plumbing specialties shall bear label, stamp, or other markings of specified testing agency.

C. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for piping materials and installation.

D. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components--Health Effects, Sections 1 through 9," for potable domestic water plumbing specialties.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Water Filter Cartridges: Equal to 200 percent of amount installed for each type and size indicated.

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. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 BACKFLOW PREVENTERS

A. Manufacturers:

1. Cla-Val Co.
2. Conbraco Industries, Inc.
3. Watts Industries, Inc.; Water Products Div.
4. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE standard, backflow preventers.

1. NPS 2 and Smaller: Bronze body with threaded ends.

2. NPS 2-1/2 and Larger: Bronze, cast-iron, steel, or stainless-steel body with flanged ends.

a. Interior Lining: AWWA C550 or FDA-approved, epoxy coating for backflow preventers having cast-iron or steel body.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.
5. Strainer: On inlet, if indicated.

C. Pipe-Applied, Atmospheric-Type Vacuum Breakers: ASSE 1001, with floating disc and atmospheric vent.

D. Hose-Connection Vacuum Breakers: ASSE 1011, nickel plated, with nonremovable and manual drain features, and ASME B1.20.7, garden-hose threads on outlet. Units attached to rough-bronze-finish hose connections may be rough bronze.

E. Intermediate Atmospheric-Vent Backflow Preventers: ASSE 1012, suitable for continuous pressure application. Include inlet screen and two independent check valves with intermediate atmospheric vent.

F. Reduced-Pressure-Principle Backflow Preventers: ASSE 1013, suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet; test cocks; and pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

G. Double-Check Backflow Prevention Assemblies: ASSE 1015, suitable for continuous pressure application. Include shutoff valves on inlet and outlet, and strainer on inlet; test cocks; and two positive-seating check valves.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

H. Antisiphon-Pressure-Type Vacuum Breakers: ASSE 1020, suitable for continuous pressure application. Include shutoff valves, spring-loaded check valve, spring-loaded floating disc, test cocks, and atmospheric vent.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

I. Dual-Check-Valve-Type Backflow Preventers: ASSE 1024, suitable for continuous pressure application. Include union inlet and two independent check valves.

J. Dual-Check-Valve-Type Backflow Preventers: ASSE 1032, suitable for continuous pressure application for carbonated beverage dispensers. Include stainless-steel body; primary and secondary checks; ball check; intermediate atmospheric-vent port for relieving carbon dioxide; and threaded ends, NPS 3/8.

K. Laboratory Faucet Vacuum Breakers: ASSE 1035, suitable for continuous pressure application and chrome plated; consisting of primary and secondary checks; intermediate vacuum breaker; and threaded ends, NPS 1/4 or NPS 3/8 as required.

L. Reduced-Pressure Detector Assembly Backflow Preventers: ASSE 1047, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; pressure-differential relief valve with ASME A112.1.2 air-gap fitting located between two positive-seating check valves; and bypass with displacement-type water meter, valves, and reduced-pressure backflow preventer.

1. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

M. Double-Check Detector Assembly Backflow Preventers: ASSE 1048, FM approved or UL listed, and suitable for continuous pressure application. Include outside screw and yoke gate valves on inlet and outlet, and strainer on inlet. Include test cocks; two positive-seating check valves; and bypass with displacement-type water meter, valves, and double-check backflow preventer.

1. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

N. Hose-Connection Backflow Preventers: ASSE 1052, suitable for at least 3-gpm flow and applications with up to 10-foot head of water back pressure. Include two check valves; intermediate atmospheric vent; and nonremovable, ASME B1.20.7, garden-hose threads on outlet.

O. Back-Siphonage Backflow Vacuum Breakers: ASSE 1056, suitable for continuous pressure and backflow applications. Include shutoff valves, check valve, test cocks, and vacuum vent.

2.3 WATER REGULATORS

A. Manufacturers:

1. Cla-Val Co.
2. Conbraco Industries, Inc.
3. Watts Industries, Inc.; Water Products Div.
4. Zurn Industries, Inc.; Wilkins Div.

B. General: ASSE 1003, water regulators, rated for initial working pressure of 150 psig minimum. Include integral factory-installed or separate field-installed, Y-pattern strainer.

1. NPS 2 and Smaller: Bronze body with threaded ends.

   a. General-Duty Service: Single-seated, direct operated, unless otherwise indicated.
   b. Booster Heater Water Supply: Single-seated, direct operated with integral bypass.

2. NPS 2-1/2 and Larger: Bronze or cast-iron body with flanged ends. Include AWWA C550 or FDA-approved, interior epoxy coating for regulators with cast-iron body.

   a. Type: Single-seated, direct operated.
   b. Type: Pilot-operated, single- or double-seated, cast-iron-body main valve, with bronze-body pilot valve.

3. Interior Components: Corrosion-resistant materials.
4. Exterior Finish: Polished chrome plate if used in chrome-plated piping system.

2.4 WATER FILTERS

A. Manufacturers:

1. CUNO, Incorporated.
2. Filtrine Manufacturing Company; Drinking Water Division.
3. U.S. Filter; Filterite Div.

B. General: Cartridge-type assemblies suitable for potable water. Include housing, fittings, filter cartridges, and cartridge end caps.

C. Wall-Mounting Type: Housing head section with threaded inlet and outlet, mounting bracket, and removable lower section for 10-inch- long filter cartridge.

1. Housing Material: Plastic, 125-psig minimum operating pressure.
2. Cartridge: Pleated-polypropylene filter media, 10 inches, 10-micron-particulate removable rating.

2.5 THERMOSTATIC WATER MIXING VALVES

A. Available Manufacturers:

B. Manufacturers:

1. Lawler Manufacturing Company, Inc.
2. Symmons Industries, Inc.
3. T & S Brass and Bronze Works, Inc.

C. General: ASSE 1017, manually adjustable, thermostatic water mixing valve with bronze body. Include check stop and union on hot- and cold-water-supply inlets, adjustable temperature setting, and thermometer.

1. Type: Bimetal thermostat, operation and pressure rating 125 psig minimum.

2.6 STRAINERS

A. Strainers: Y-pattern, unless otherwise indicated, and full size of connecting piping. Include ASTM A 666, Type 304, stainless-steel screens with 3/64-inch round perforations, unless otherwise indicated.

1. Pressure Rating: 125-psig minimum steam working pressure, unless otherwise indicated.
2. NPS 2 and Smaller: Bronze body, with female threaded ends.

3. NPS 2-1/2 and Larger: Cast-iron body, with interior AWWA C550 or FDA-approved, epoxy coating and flanged ends.

4. Y-Pattern Strainers: Screwed screen retainer with centered blowdown.

   a. Drain: Factory- or field-installed, hose-end drain valve.

5. Basket Strainers: Bolted flange or clamp cover, and basket with lift-out handle.

   a. Type: Simplex with one basket.
   b. Drain: Factory- or field-installed, hose-end drain valve.

2.7 KEY-OPERATION HYDRANTS

A. Manufacturers:

1. Smith, Jay R. Mfg. Co.
2. Watts Industries, Inc.; Drainage Products Div.
3. Woodford Manufacturing Co.

B. General: ASME A112.21.3M, key-operation hydrant with pressure rating of 125 psig.

1. Inlet: NPS 3/4 or NPS 1 threaded or solder joint.
2. Outlet: ASME B1.20.7, garden-hose threads.
3. Operating Keys: One with each key-operation hydrant.

C. Moderate-Climate, Concealed-Outlet Wall Hydrants: ASSE 1019, self-drainable with flush-mounting box with cover, integral nonremovable hose-connection vacuum breaker, and concealed outlet.

1. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
2. Box and Cover Finish: Rough bronze.
3. Box and Cover Finish: Satin chrome plate.

2.8 TRAP SEAL PRIMER VALVES

A. Supply-Type Trap Seal Primer Valves: ASSE 1018, water-supply-fed type, with the following characteristics:

1. Manufacturers:

a. MIFAB Manufacturing, Inc.
b. Precision Plumbing Products, Inc.
c. Watts Industries, Inc.; Water Products Div.

2. 125-psig minimum working pressure.

3. Bronze body with atmospheric-vented drain chamber.
4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI-WH 201, piston type with pressurized metal-tube cushioning chamber. Sizes indicated are based on ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

1. Manufacturers:

a. Precision Plumbing Products, Inc.
b. Sioux Chief Manufacturing Co., Inc.
c. Watts Industries, Inc.; Water Products Div.

B. Hose Bibbs: Bronze body with replaceable seat disc complying with ASME A112.18.1M for compression-type faucets. Include NPS 1/2 or NPS 3/4 threaded or solder-joint inlet, of design suitable for pressure of at least 125 psig; integral nonremovable, drainable hose-connection vacuum breaker; and garden-hose threads complying with ASME B1.20.7 on outlet.

1. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
2. Finish for Service Areas: Rough bronze.
3. Finish for Finished Rooms: Chrome or nickel plated.
4. Operation for Equipment Rooms: Wheel handle or operating key.
5. Operation for Service Areas: Wheel handle.
6. Operation for Finished Rooms: Operating key.
7. Include operating key with each operating-key hose bibb.
8. Include integral wall flange with each chrome- or nickel-plated hose bibb.

C. Roof Flashing Assemblies: Manufactured assembly made of 6-lb/sq. ft., 0.0938-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe with galvanized steel boot reinforcement, and counterflashing fitting.

1. Manufacturers:

a. Acorn Engineering Company; Elmdor/Stoneman Div.

2. Open-Top Vent Cap: Without cap.
3. Low-Silhouette Vent Cap: With vandal-proof vent cap.
4. Extended Vent Cap: With field-installed, vandal-proof vent cap.

D. Floor-Drain Inlet Fittings: Cast iron, with threaded inlet and threaded or spigot outlet, and trap seal primer valve connection.

E. Fixed Air-Gap Fittings: Manufactured cast-iron or bronze drainage fitting with semiopen top with threads or device to secure drainage inlet piping in top and bottom spigot or threaded outlet larger than top inlet. Include design complying with ASME A112.1.2 that will provide fixed air gap between installed inlet and outlet piping.

F. Stack Flashing Fittings: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.

G. Expansion Joints: ASME A112.21.2M, assembly with cast-iron body with bronze sleeve, packing gland, and packing; of size and end types corresponding to connected piping.

2.10 FLOOR DRAINS

A. Floor Drains, FD-1: Comply with ASME A112.21.1M.

1. Application: Floor drain.
2. Products:

a. Mifab
b. Smith, Jay R. Mfg. Co.; #2005A
c. Zurn Industries, Inc., Specification Drainage Operation;

3. Body Material: Gray iron.
4. Seepage Flange: Required.
5. Outlet: Bottom.
6. Top or Strainer Material: Nickel bronze.

7. Top Shape: Round.
8. Dimensions of Top or Strainer: 5”
9. Top Loading Classification: Light Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.
12. Trap Features: Trap seal primer valve drain connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install pressure regulators with inlet and outlet shutoff valves and balance valve bypass. Install pressure gages on inlet and outlet.

D. Install strainers on supply side of each control valve, pressure regulator, and solenoid valve.

E. Install trap seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

F. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

G. Install cleanout deck plates with top flush with finished floor, for floor cleanouts for piping below floors.

H. Install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall, for cleanouts located in concealed piping.

I. Install flashing flange and clamping device with each stack and cleanout passing through floors with waterproof membrane.

J. Install vent flashing sleeves on stacks passing through roof. Secure over stack flashing according to manufacturer's written instructions.

K. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

L. Fasten wall-hanging plumbing specialties securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated.

M. Fasten recessed-type plumbing specialties to reinforcement built into walls.

N. Install wood-blocking reinforcement for wall-mounting and recessed-type plumbing specialties.

O. Install individual shutoff valve in each water supply to plumbing specialties. Use ball, gate, or globe valve if specific valve is not indicated. Install shutoff valves in accessible locations. Refer to Division 15 Section "Valves" for general-duty ball, butterfly, check, gate, and globe valves.

P. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

Q. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect plumbing specialties to piping specified in other Division 15 Sections.

3.3 FLASHING INSTALLATION

A. Set flashing on floors and roofs in solid coating of bituminous cement.

B. Secure flashing into sleeve and specialty clamping ring or device.

C. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 7 Section "Sheet Metal Flashing and Trim."

D. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each backflow preventer and thermostatic water mixing valve.

1. Text: Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
2. Refer to Division 15 Section " Mechanical Identification" for nameplates and signs.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 15430

SECTION 15732 - ROOFTOP AIR CONDITIONERS

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 rooftop air conditioners:

1. Cooling and heating units 6 tons and smaller.
2. Cooling and heating units 7-1/2 to 20 tons.

1.3 DEFINITIONS

A. DDC: Direct-digital controls.

1.4 SUBMITTALS

A. Product Data: Include manufacturer's technical data for each model indicated, including rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection. Prepare the following by or under the supervision of a qualified professional engineer:
1. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
2. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that rooftop air conditioners, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For rooftop air conditioners to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of rooftop air conditioners and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

B. 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.

C. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

D. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

E. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

F. Comply with NFPA 54 for gas-fired furnace section.

G. ARI Certification: Units shall be ARI certified and listed.

H. ARI Compliance for Units with Capacities Less Than 135,000 Btuh: Rate rooftop air-conditioner capacity according to ARI 210/240, "Unitary Air-Conditioning and Air-Source Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

I. ARI Compliance for Units with Capacities 135,000 Btuh and More: Rate rooftop air-conditioner capacity according to ARI 340/360, "Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment."

1. Sound Power Level Ratings: Comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

1.6 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.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

C. Coordinate size, location, and installation of rooftop air-conditioner manufacturer's roof curbs and equipment supports with roof installer.

1. Coordinate installation of restrained vibration isolation roof-curb rails.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace components of rooftop air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Manufacturer's standard, but not less than five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Manufacturer's standard, but not less than 10 years from date of Substantial Completion.
3. Warranty Period for Solid-State Ignition Modules: Manufacturer's standard, but not less than three years from date of Substantial Completion.
4. Warranty Period for Control Boards: Manufacturer's standard, but not less than three years from date of Substantial Completion.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan Belts: One set for each belt-drive fan.
2. Filters: One set of filters for each unit.

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 ROOFTOP AIR CONDITIONERS 6 TONS AND SMALLER

A. Manufacturers:
   1. Carrier Corp.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, belt driven by single-speed motor.

E. Outside Coil Fan: Propeller type, directly driven by motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

G. Compressor: Hermetic scroll compressor with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief.

H. Refrigeration System:

   1. Compressor.
   2. Outside coil and fan.
   3. Indoor coil and fan.
   4. Four-way reversing valve and suction line accumulator.
   5. Expansion valve with replaceable thermostatic element.
   6. Refrigerant dryer.
   7. High-pressure switch.
   8. Low-pressure switch.
   9. Thermostat for coil freeze-up protection during low-ambient temperature operation or loss of air.
   10. Low-ambient switch.
   11. Brass service valves installed in discharge and liquid lines.
   12. Refrigerant Charge: R410A

I. Filters: Provide MERV 11, 65% efficiency filters by Camfil Farr in filter rack.

J. Heat Exchanger: Stainless-steel construction for natural-gas-fired burners with the following controls:

   1. Redundant single or dual gas valve with manual shutoff.
   2. Direct-spark pilot ignition.
   3. Electronic flame sensor.
   4. Induced-draft blower.
   5. Flame rollout switch.

K. Outside-Air Damper: Linked damper blades, for 0 to 25 percent outside air, with manual slide and hood.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Optional Accessories:
1. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
2. Dirty-filter switch.
3. Hail guards of steel, painted to match casing.

N. Isolation Roof Curb: Rigid upper and lower level steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

2.3 ROOFTOP AIR CONDITIONERS 7-1/2 TO 20 TONS

A. Manufacturers:
1. Carrier Corp.

B. Description: Factory assembled and tested; designed for exterior installation; consisting of compressor, indoor and outside refrigerant coils, indoor fan and outside coil fan, refrigeration and temperature controls, filters, and dampers.

C. Casing: Galvanized-steel construction with enamel paint finish, removable panels or access doors with neoprene gaskets for inspection and access to internal parts, minimum 1/2-inch-thick thermal insulation, knockouts for electrical and piping connections, exterior condensate drain connection, and lifting lugs.

D. Indoor Fan: Forward curved, centrifugal, belt driven with adjustable motor sheaves, grease-lubricated ball bearings, and motor.

E. Outside Coil Fan: Propeller type, directly driven by permanently lubricated motor.

F. Refrigerant Coils: Aluminum-plate fin and seamless copper tube in steel casing with equalizing-type vertical distributor.

G. Compressor(s): Two hermetic scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief.

H. Refrigeration System:

1. Compressor(s).
2. Outside coil and fan.
3. Indoor coil and fan.
4. Four-way reversing valve and suction line accumulator.
5. Check valves.
6. Expansion valves with replaceable thermostatic elements.
7. Refrigerant dryers.

8. High-pressure switches.
9. Low-pressure switches.
10. Thermostats for coil freeze-up protection during low-ambient temperature operation or loss of air.
11. Independent refrigerant circuits.
12. Refrigerant Charge: R410A

I. Filters: Provide MERV 11, 65% efficiency filters by Camfil Farr in filter rack.

J. Heat Exchanger: Stainless-steel construction for natural-gas-fired burners with the following controls:

1. Redundant dual gas valve with manual shutoff.
2. Direct-spark pilot ignition.
3. Electronic flame sensor.
4. Induced-draft blower.
5. Flame rollout switch.

K. Economizer: Return- and outside-air dampers with neoprene seals, outside-air filter, and hood.

1. Damper Motor: Fully modulating spring return with adjustable minimum position.
2. Control: Electronic-control system uses outside-air enthalpy to adjust mixing dampers.
3. Relief Damper: Gravity actuated with bird screen and hood.

L. Power Connection: Provide for single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in circuit breaker.

M. Unit Controls: Solid-state control board and components contain at least the following features:

1. Indoor fan on/off delay.
2. Default control to ensure proper operation after power interruption.
3. Service relay output.
4. Unit diagnostics and diagnostic code storage.
5. Field-adjustable control parameters.
6. Defrost control.
7. Economizer control.
8. Gas valve delay between first- and second-stage firing.
9. Indoor-air quality control with carbon dioxide sensor.
10. Low-ambient control, allowing operation down to 0 deg F.
11. Minimum run time.
12. Night setback mode.
13. Return-air temperature limit.
14. Low-refrigerant pressure control.

N. Optional Accessories:

1. Cold-Weather Kit: Electric heater maintains temperature in gas burner compartment.
2. Service Outlets: Two, 115-V, ground-fault, circuit-interrupter type.
3. Dirty-filter switch.
4. Hail guards of steel, painted to match casing.

O. Isolation Roof Curb: Rigid upper and lower level steel structure with vibration isolation springs having 2-inch static deflection and vertical and horizontal restraints; with elastomeric waterproof membrane.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances. Install according to ARI Guideline B.

B. Unit Support: Install unit level on structural [**curbs**] [**pilings**]. Coordinate wall penetrations and flashing with wall construction.[**Secure units to structural support with anchor bolts.**]

C. Isolation Curb Support: Install units on isolation curbs according to ARI Guideline B.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

1. Gas Piping: Comply with applicable requirements in Division 15 Section "Fuel Gas Piping." Connect gas piping to burner, full size of gas train inlet, and connect with union and shutoff valve with sufficient clearance for burner removal and service.

C. Duct installation requirements are specified in other Division 15 Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination in roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to rooftop unit with flexible duct connectors specified in Division 15 Section "Duct Accessories."
4. Terminate return-air duct through roof structure and insulate space between roof and bottom of unit with 2-inch- thick, acoustic duct liner.
5. Install normal-weight, 3000 psi, compressive strength (28-day) concrete mix inside roof curb, Insert thickness thick. Concrete, formwork, and reinforcement are specified in Division 3.

D. Electrical System Connections: Comply with applicable requirements in Division 16 Sections for power wiring, switches, and motor controls.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

F. 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.

3.3 FIELD QUALITY CONTROL

A. Perform the following field quality-control tests and inspections and prepare test reports:

1. After installing rooftop air conditioners and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions and do the following:

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, air-cooled outside coil, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean outside coil and inspect for construction debris.
10. Clean furnace flue and inspect for construction debris.
11. Connect and purge gas line.
12. Adjust vibration isolators.
13. Inspect operation of barometric dampers.
14. Lubricate bearings on fan.
15. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system in summer only.
    b. Complete startup sheets and attach copy with Contractor's startup report.

18. Inspect and record performance of interlocks and protective devices; verify sequences.
19. Operate unit for an initial period as recommended or required by manufacturer.
20. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency. Adjust pilot to stable flame.

    a. Measure gas pressure on manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.

c. Measure flue-gas temperature at furnace discharge.
d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

21. Calibrate thermostats.
22. Adjust and inspect high-temperature limits.
23. Inspect outside-air dampers for proper stroke and interlock with return-air dampers.
24. Start refrigeration system and measure and record the following:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outside-air, dry-bulb temperature.
    d. Outside-air-coil, discharge-air, dry-bulb temperature.

25. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
26. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outside-air intake volume.

27. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through outside coil or from outside coil to outside-air intake.

28. Verify operation of remote panel, including pilot-light operation and failure modes. Inspect the following:

    a. High-limit heat exchanger.
    b. Warm-up for morning cycle.
    c. Freezestat operation.
    d. Economizer to limited outside-air changeover.
    e. Alarms.

29. After startup and performance testing, change filters, vacuum heat exchanger and cooling and outside coils, lubricate bearings, adjust belt tension, and inspect operation of power vents.

3.5 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

END OF SECTION 15732

SECTION 15815 - METAL DUCTS

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 metal ducts for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg (minus 500 to plus 2500 Pa). Metal ducts include the following:

1. Rectangular ducts and fittings.
2. Single-wall, round spiral-seam ducts and formed fittings.
3. Duct liner.

B. Related Sections include the following:

1. Division 15 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset FRP ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
2. Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. NUSIG: National Uniform Seismic Installation Guidelines.

1.4 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and -distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

1.5 SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Other systems installed in same space as ducts.
3. Ceiling- and wall-mounting access doors and panels required to provide access to dampers and other operating devices.
4. Ceiling-mounting items, including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

B. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. NFPA Compliance:

1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.

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

2.3 DUCT LINER

A. Fibrous-Glass Liner: Comply with NFPA 90A or NFPA 90B and with NAIMA AH124.

1. Manufacturers:

    a. CertainTeed Corp.; Insulation Group.
    b. Johns Manville International, Inc.
    c. Owens Corning.

2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.

    a. Thickness: 1 inch.
    b. Thermal Conductivity (k-Value): 0.26 at 75 deg F mean temperature.
    c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
    d. Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    e. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.

        1) Tensile Strength: Indefinitely sustain a 50-lb- tensile, dead-load test perpendicular to duct wall.
        2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
        3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.

2.4 SEALANT MATERIALS

A. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.

2.5 HANGERS AND SUPPORTS

A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

    1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
    2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

B. Hanger Materials: Galvanized sheet steel or threaded steel rod.

    1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
    2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 RECTANGULAR DUCT FABRICATION

A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.

1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Nexus Inc.
c. Ward Industries, Inc.

C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Lockformer.

2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.

D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

2.7 APPLICATION OF LINER IN RECTANGULAR DUCTS

A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.

B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.

C. Butt transverse joints without gaps and coat joint with adhesive.

D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.

E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.

F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

1. Fan discharges.
2. Intervals of lined duct preceding unlined duct.
3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm (12.7 m/s) or where indicated.

I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.8 ROUND AND FLAT-OVAL DUCT AND FITTING FABRICATION

A. Diameter as applied to flat-oval ducts in this Article is the diameter of a round duct with a circumference equal to the perimeter of a given size of flat-oval duct.

B. Round, Spiral Lock-Seam Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

C. Duct Joints:

1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
2. Ducts 21 to 72 Inches in Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
3. Ducts Larger Than 72 Inches in Diameter: Companion angle flanged joints per SMACNA "HVAC Duct Construction Standards--Metal and Flexible," Figure 3-2.
4. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.

a. Manufacturers:

1) Ductmate Industries, Inc.
2) Lindab Inc.

D. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.

E. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.

F. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:

1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:

   a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
   b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
   c. Ducts 52 to 60 Inches in Diameter: 0.052 inch.
   d. Ducts 62 to 84 Inches in Diameter: 0.064 inch.

3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for material-handling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
4. Round Elbows 8 Inches and Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
5. Round Elbows 9 through 14 Inches in Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
6. Round Elbows Larger Than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
9. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

PART 3 - EXECUTION

3.1 DUCT APPLICATIONS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:

1. Supply Ducts (before Air Terminal Units): 2-inch wg.
2. Supply Ducts (after Air Terminal Units): 1-inch wg.
3. Supply Ducts (in Mechanical Equipment Rooms): 2-inch wg.
4. Return Ducts (Negative Pressure): 1-inch wg.
5. Exhaust Ducts (Negative Pressure): 2-inch wg.

3.2 DUCT INSTALLATION

A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.

B. Install round and flat-oval ducts in lengths not less than 12 feet unless interrupted by fittings.

C. Install ducts with fewest possible joints.

D. Install fabricated fittings for changes in directions, size, and shape and for connections.

E. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.

F. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.

J. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.

K. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

L. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.

M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.

N. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."

O. Install ducts with hangers and braces designed to withstand, without damage to equipment, seismic force required by applicable building codes. Refer to SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

P. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

Q. Paint interiors of metal ducts, that do not have duct liner, for 24 inches upstream of registers and grilles. Apply one coat of flat, black, latex finish coat over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.3 SEAM AND JOINT SEALING

A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.

B. Seal ducts before external insulation is applied.

3.4 HANGING AND SUPPORTING

A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.

B. Support vertical ducts at maximum intervals of 16 feet and at each floor.

C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections according to SMACNA's "HVAC Air Duct Leakage Test Manual" and prepare test reports:

1. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
2. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

3. Maximum Allowable Leakage: Comply with requirements for Leakage Class 3 for round and flat-oval ducts, Leakage Class 12 for rectangular ducts in pressure classes lower than and equal to 2-inch wg (both positive and negative pressures), and Leakage Class 6 for pressure classes from 2- to 10-inch wg.
4. Remake leaking joints and retest until leakage is equal to or less than maximum allowable.

3.7 CLEANING NEW SYSTEMS

A. Mark position of dampers and air-directional mechanical devices before cleaning, and perform cleaning before air balancing.

B. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Create other openings to comply with duct standards.
2. Disconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling sections to gain access during the cleaning process.

C. Vent vacuuming system to the outside. Include filtration to contain debris removed from HVAC systems, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

F. Cleanliness Verification:

1. Visually inspect metal ducts for contaminants.
2. Where contaminants are discovered, re-clean and reinspect ducts.

3.8 CLEANING EXISTING SYSTEMS

A. Use service openings, as required, for physical and mechanical entry and for inspection.

1. Use existing service openings where possible.
2. Create other openings to comply with duct standards.
3. Disconnect flexible ducts as needed for cleaning and inspection.
4. Reseal rigid fiberglass duct systems according to NAIMA recommended practices.
5. Remove and reinstall ceiling sections to gain access during the cleaning process.

B. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or larger) particles.
2. When venting vacuuming system to the outside, use filtration to contain debris removed from HVAC system, and locate exhaust down wind and away from air intakes and other points of entry into building.

D. Clean the following metal duct systems by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, and actuators except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide operative drainage system for washdown procedures.
7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present. Apply biocidal agents according to manufacturer's written instructions after removal of surface deposits and debris.

F. Cleanliness Verification:

1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
2. Visually inspect metal ducts for contaminants.
3. Where contaminants are discovered, re-clean and reinspect ducts.

G. Gravimetric Analysis: At discretion and expense of Owner, sections of metal duct system, chosen randomly by Owner, may be tested for cleanliness according to NADCA vacuum test gravimetric analysis.

1. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
2. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal duct system shall be re-cleaned and re-verified.

H. Verification of Coil Cleaning: Cleaning must restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.

END OF SECTION 15815

SECTION 15820 - DUCT ACCESSORIES

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. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Ceiling fire dampers.
6. Smoke dampers.
7. Combination fire and smoke dampers.
8. Turning vanes.
9. Duct-mounting access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

B. Related Sections include the following:

1. Division 13 Section "Fire Alarm" for duct-mounting fire and smoke detectors.
2. Division 15 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Motorized control dampers.
4. Fire dampers.
5. Ceiling fire dampers.
6. Smoke dampers.
7. Combination fire and smoke dampers.
8. Turning vanes.
9. Duct-mounting access doors.
10. Flexible connectors.
11. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Motorized-control damper installations.
4. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
5. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale and coordinating penetrations and ceiling-mounting items. Show ceiling-mounting access panels and access doors required for access to duct accessories.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

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

2.2 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.

B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

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

2.3 BACKDRAFT DAMPERS

A. Manufacturers:

1. Greenheck.
2. Ruskin Company.

B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners and mounting flange.

D. Blades: 0.025-inch- thick, roll-formed aluminum.

E. Blade Seals: Felt.

F. Blade Axles: Galvanized steel.

G. Tie Bars and Brackets: Galvanized steel.

H. Return Spring: Adjustable tension.

2.4 VOLUME DAMPERS

A. Manufacturers:

1. METALAIRE, Inc.
2. Nailor Industries Inc.
3. Ruskin Company.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

1. Pressure Classes of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating,[**with linkage outside airstream,**] and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic.
5. Tie Bars and Brackets: Galvanized steel.

D. Low-Leakage Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, low-leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.

1. Steel Frames: U-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Molded synthetic thrust or ball.
5. Blade Seals: Felt.
6. Tie Bars and Brackets: Galvanized steel.

E. Jackshaft: 1-inch- diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.

1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.

F. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 MOTORIZED CONTROL DAMPERS

A. Manufacturers:

1. Greenheck.
2. METALAIRE, Inc.
3. Ruskin Company.

B. General Description: AMCA-rated, parallel-blade design; minimum of 0.1084-inch- thick, galvanized-steel frames with holes for duct mounting; minimum of 0.0635-inch- thick, galvanized-steel damper blades with maximum blade width of 8 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Provide closed-cell neoprene edging.

2.6 FIRE DAMPERS

A. Manufacturers:

1. Greenheck.
2. METALAIRE, Inc.
3. Ruskin Company.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hours.

D. Frame: Curtain type with blades inside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.052 or 0.138 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 212 deg F rated.

2.7 CEILING FIRE DAMPERS

A. Manufacturers:

1. Greenheck.
2. METALAIRE, Inc.
3. Ruskin Company.

B. General Description: Labeled according to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Fusible Links: Replaceable, 212 deg F rated.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Greenheck.
2. Nailor Industries Inc.
3. Ruskin Company.

B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.

C. Fusible Links: Replaceable, 212 deg F rated.

D. Frame and Blades: 0.064-inch- thick, galvanized sheet steel.

E. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application.

F. Damper Motors: Modulating and two-position action.

1. Comply with requirements in Division 15 Section "Motors."
2. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
3. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
4. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
5. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
6. Electrical Connection: 115 V, single phase, 60 Hz.

2.9 TURNING VANES

A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.

B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.

1. Manufacturers:

a. Ductmate Industries, Inc.
b. Duro Dyne Corp.
c. METALAIRE, Inc.

C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.10 DUCT-MOUNTING ACCESS DOORS

A. General Description: Fabricate doors airtight and suitable for duct pressure class.

B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.

1. Manufacturers:

   a. Ductmate Industries, Inc.
   b. Greenheck.
   c. Nailor Industries Inc.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Provide number of hinges and locks as follows:

   a. Less Than 12 Inches Square: Secure with two sash locks.
   b. Up to 18 Inches Square: Two hinges and two sash locks.
   c. Up to 24 by 48 Inches: Three hinges and two compression latches.
   d. Sizes 24 by 48 Inches and Larger: One additional hinge.

C. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.

D. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers:

1. Ductmate Industries, Inc.
2. Duro Dyne Corp.
3. Ward Industries, Inc.

B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Select metal compatible with ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

F. Available Manufacturers:

1. Flexmaster U.S.A., Inc.
2. Hart & Cooley, Inc.
3. McGill AirFlow Corporation.

G. Insulated-Duct Connectors: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.

H. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.

F. Provide test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:

1. On both sides of duct coils.
2. Downstream from volume dampers, turning vanes, and equipment.
3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
5. On sides of ducts where adequate clearance is available.

I. Install the following sizes for duct-mounting, rectangular access doors:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body Plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Division 15 Section "Mechanical Identification."

K. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

L. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands.

P. Install duct test holes where indicated and required for testing and balancing purposes.

3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 15820

SECTION 15834 - AIR CURTAINS

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 air curtains.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for each unit.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Wiring Diagrams: Power, signal, and control wiring.

C. Coordination Drawings: Plans and details drawn to scale and coordinating penetrations of exterior walls.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Operation and Maintenance Data: For air curtains to include in maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air curtains and are based on the specific product indicated. Refer to Division 1 Section "Product Requirements."

B. 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.

C. Comply with AMCA 220, "Test Methods for Air Curtain Units," for airflow, outlet velocity, and power consumption.

D. Comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils," for components, construction, and rating.

1. Certify coils according to ARI 410.

E. Comply with NSF 37, "Air Curtains for Entranceways in Food and Food Service Establishments."

1.5 COORDINATION

A. Coordinate layout and installation of air curtains and suspension system components with other construction, including light fixtures, fire-suppression-system components, and partition assemblies.

B. Coordinate installation of wall penetrations and louvers. These items are specified in Division 10 Section "Louvers and Vents."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of air curtains that fail in materials or workmanship within specified warranty period.

1. Warranty Period (Nonheating Units): Five years.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below, before construction begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish one set of filters and fan belts for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Fantech.
2. Loren Cook Company.
3. Mars Air Products; Mars Air Door Division.

2.2 MATERIALS

A. Housing Materials: One-piece, molded, high-impact, white polymer material.

B. Intake Louvers: Integral part of the housing, mechanically field adjustable and capable of reducing air-outlet velocity by 60 percent with louver in totally closed position.

C. Discharge Nozzle: Integral part of the housing, containing adjustable air-directional vanes with 40-degree sweep front to back.

2.3 FANS

A. Fans: Centrifugal, forward curved, double width, double inlet; statically and dynamically balanced.

B. Fan Drives: Direct.

2.4 MOTORS

A. Motor Type: Multispeed, resiliently mounted, continuous duty.

B. Bearings: Permanently sealed, lifetime, prelubricated, ball bearings.

C. Disconnect: Internal power cord with plug and receptacle.

2.5 ACCESSORIES

A. Automatic Door Switch: Plunger type installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.

B. Time-Delay Relay: Factory installed and adjustable to allow air curtain to operate from 0.5 seconds to 10 hours.

C. Motor-Control Panel: Complete with motor starter, 115-V ac transformer with primary and secondary fuses, terminal strip, and NEMA 250, Type 12 enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions where air curtains will be installed for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 INSTALLATION

A. Install air curtains with clearance for equipment service and maintenance.

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 and prepare test reports:

1. After installing air curtains completely, perform visual and mechanical check of individual components.
2. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Repair or replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

A. Adjust belt tension.

B. Adjust motor and fan speed to achieve specified airflow.

C. Adjust discharge louver and dampers to regulate airflow.

D. Adjust air-directional vanes.

END OF SECTION 15834

SECTION 15838 - POWER VENTILATORS

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. Centrifugal roof ventilators.
2. Ceiling-mounting ventilators.
3. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

A. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound-power ratings.
3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
4. Material thickness and finishes, including color charts.
5. Dampers, including housings, linkages, and operators.
6. Roof curbs.
7. Fan speed controllers.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.
2. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension assembly members.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 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. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Belts: One set(s) for each belt-driven unit.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

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

1. Breidert Air Products.
2. Broan Mfg. Co., Inc.
3. Greenheck.
4. Loren Cook Company.

B. Description: Direct- or belt-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Belt-Driven Drive Assembly: Resiliently mounted to housing, with the following features:

1. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
3. Pulleys: Cast-iron, adjustable-pitch motor pulley.
4. Fan and motor isolated from exhaust airstream.

F. Accessories:

1. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
2. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 12 inches.
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.

2.2 CEILING-MOUNTING VENTILATORS

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

1. Breidert Air Products.
2. Broan Mfg. Co., Inc.
3. Greenheck.
4. Loren Cook Company.

B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.

C. Housing: Steel, lined with acoustical insulation.

D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

E. Grille: Painted aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.

F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

G. Accessories:

2.3 IN-LINE CENTRIFUGAL FANS

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

1. Breidert Air Products.
2. Greenheck.
3. Loren Cook Company.

B. Description: In-line, belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.

C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.

2. Companion Flanges: For inlet and outlet duct connections.
3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

2.4 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 7 Section "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 1 inch. Vibration-control devices are specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 16 Section "Grounding and Bonding."

D. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 15838

SECTION 15855 - DIFFUSERS, REGISTERS, AND GRILLES

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 ceiling- and wall-mounted diffusers, registers, and grilles.

B. Related Sections include the following:

1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension assembly members.
2. Method of attaching hangers to building structure.
3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Duct access panels.

C. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

D. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GRILLES AND REGISTERS

A. Adjustable Bar Grille:

1. Manufacturers:

a. Krueger.
b. METALAIRE, Inc.; Metal Industries Inc.
c. Nailor Industries of Texas Inc.
d. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, white.

B. Fixed Face Grille:

1. Manufacturers:

a. Krueger.
b. Nailor Industries of Texas Inc.
c. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, white.

2.3 CEILING DIFFUSER OUTLETS

A. Rectangular and Square Ceiling Diffusers:

1. Manufacturers:

a. Krueger.
b. METALAIRE, Inc.; Metal Industries Inc.
c. Nailor Industries of Texas Inc.
d. Titus.

2. Material: Aluminum.

3. Finish: Baked enamel, white.

B. Perforated Diffuser:

1. Manufacturers:

a. Krueger.
b. METALAIRE, Inc.; Metal Industries Inc.
c. Nailor Industries of Texas Inc.
d. Titus.

2. Material: Steel backpan and pattern controllers, with aluminum face.
3. Finish: Baked enamel, white.

C. Louver Face Diffuser:

1. Manufacturers:

a. METALAIRE, Inc.; Metal Industries Inc.
b. Nailor Industries of Texas Inc.
c. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Pattern: Four-way, core style.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

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

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make

final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

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

3.3 ADJUSTING

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

END OF SECTION 15855

1. Part 1 – General

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1.1 Related Documents

A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.

B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 15 Sections for details.

C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.

D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.

1.2 Definitions

A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.

B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level.

C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be

provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.

D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.

E. Control Sequence: An BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.

F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.

H. Node: A digitally programmable entity existing on the BMS network.

I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.

J. Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.

K. PC: IBM-compatible Personal Computer from a recognized major manufacturer

L. Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.

M. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.

N. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.

O. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.

P. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.

Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.

R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.

S. The following abbreviations and acronyms may be used in describing the work of this Division:

ADC - Analog to Digital Converter

AI	-	Analog Input
AN	-	Application Node
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASHRAE		American Society of Heating, Refrigeration and Air Conditioning Engineers
AWG	-	American Wire Gauge
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electronically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume

VDC	-	Volts, Direct Current
WAN	-	Wide Area Network

1.3 BMS Description

A. The Building Management System (BMS) shall be a complete system designed for use with the enterprise IT systems. This functionality shall extend into the equipment rooms. Devices residing on the automation network located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure in the facility. Contractor shall be responsible for coordination with the owner's IT staff to ensure that the BMS will perform in the owner's environment without disruption to any of the other activities taking place on that LAN.

B. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

C. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specifications together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.

D. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

E. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.

F. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.

G. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:

1. Operator information, alarm management and control functions.
2. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
3. Diagnostic monitoring and reporting of BMS functions.
4. Offsite monitoring and management access.
5. Energy management
6. Standard applications for terminal HVAC systems.

1.4 Quality Assurance

A. General

1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.

2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
3. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis.
4. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
5. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.

B. Workplace Safety And Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Owner within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manger shall be empowered to make

technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:

a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
b. Manage the financial aspects of the BMS Contract.
c. Coordinate as necessary with other trades.
d. Be responsible for the work and actions of the BMS workforce on site.

1.5 References

1. National Fire Protection Association (NFPA) Standards.
2. National Electric Code (NEC) and applicable local Electric Code.
3. Underwriters Laboratories (UL) listing and labels.
4. UL 864 UUKL Smoke Control
5. UL 268 Smoke Detectors.
6. UL 916 Energy Management
7. NFPA 70 - National Electrical Code.
8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
9. NFPA 92A and 92B Smoke Purge/Control Equipment.
10. Factory Mutual (FM).
11. American National Standards Institute (ANSI).
12. National Electric Manufacturer's Association (NEMA).
13. American Society of Mechanical Engineers (ASME).
14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
15. Air Movement and Control Association (AMCA).
16. Institute of Electrical and Electronic Engineers (IEEE).
17. American Standard Code for Information Interchange (ASCII).
18. Electronics Industries Association (EIA).
19. Occupational Safety and Health Administration (OSHA).
20. American Society for Testing and Materials (ASTM).
21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
22. Americans Disability Act (ADA)
24 ANSI/ASHRAE Standard 195-2004 (BacNet)

B. In the case of conflicts or discrepancies, the more stringent regulation shall apply.

C. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.6 Work By Others

A) The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX

BMS RESPONSIBILITY MATRIX				

WORK	FURNISH	INSTALL	Low Volt. WIRING	LINE POWER
BMS low voltage and communication wiring	BMS	BMS	BMS	N/A
VAV box nodes	BMS	15	BMS	16
BMS conduits and raceway	BMS	BMS	BMS	16
Automatic dampers	BMS	15	N/A	N/A
Manual valves	15	15	N/A	N/A
Automatic valves	BMS	15	BMS	N/A
VAV boxes	15	15	N/A	N/A
Pipe insertion devices and taps including thermowells, flow and pressure stations.	BMS	15	BMS	16
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
Power distribution system monitoring interfaces	16	16	BMS	16
Control air compressors	BMS	BMS	N/A	16
Concrete and/or inertia equipment pads and seismic bracing	15	15	N/A	N/A
BMS interface with Chiller controls(if applicable)	BMS	BMS	BMS	16
Chiller controls interface with BMS(if applicable)	15	15	BMS	16
BMS interface with Classroom unit controls	BMS	BMS	BMS	16
Classroom unit controls interface with BMS	15	15	BMS	16
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	16
Smoke Detectors	16	16	16	16
Fire/Smoke Dampers	15	15	16	16
Fire Dampers	15	15	N/A	N/A
Chiller Flow Switches (as applicable)	15	15	BMS	N/A
Boiler wiring (as applicable)	15	15	15	16
Water treatment system (as applicable)	15	15	15	16
VFDs	15	16	BMS	16
Refrigerant monitors(as applicable)	15	BMS	BMS	16
Computer Room A/C Unit field-mounted controls	15*	15	BMS	16
Fire Alarm shutdown relay interlock wiring	16	16	16	16
Fire Alarm smoke control relay interlock wiring	16	16	16	16
Fireman’s Smoke Control Override Panel	16	16	16	16
Fan Coil Unit controls	BMS	BMS	BMS	16
Unit Heater controls	BMS	BMS	BMS	16
Packaged RTU space mounted controls	15*	BMS	BMS	16
Packaged RTU factory-mounted controls	15*	15	BMS	16
Packaged RTU field-mounted controls	BMS	BMS	BMS	16

Cooling Tower Vibration Switches (as applicable)	15	15	16	16
Cooling Tower Level Control Devices (as applicable)	15	15	16	16
Cooling Tower makeup water control devices (as applicable)	15	15	16	16
Pool Dehumidification Unit Controls (as applicable)	15*	15	BMS	16
Starters, HOA switches	16	16	N/A	16
Control damper actuators	BMS	BMS	BMS	16

1.7 Submittals

A. Shop Drawings, Product Data, and Samples

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Owner.
5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BMS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:
   a. BMS network architecture diagrams including all nodes and interconnections.
   b. Systems schematics, sequences and flow diagrams.
   c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
   d. Samples of Graphic Display screen types and associated menus.
   e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
   f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
   g. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.

~~h.~~ Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address

i. Details of all BMS interfaces and connections to the work of other trades.

j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 Record Documentation

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:

   a. Table of contents.

   b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.

   c. Manufacturers product data sheets or catalog pages for all products including software.

   d. System Operator’s manuals.

   e. Archive copy of all site-specific databases and sequences.

   f. BMS network diagrams.

   g. Interfaces to all third-party products and work by other trades.

2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide Letter of Warranty from Factory Main Branch Office for all BMS items being provided. Letter of warranty shall be provided by Johnson Controls, Cypress CA Building Systems, No exceptions.. Letter of Warranty provided shall require main branch office approval and acceptance prior to any submittal review. This includes all BMS controls, controllers, and building interface panels. NO EXCEPTION. Letter of warranty from any distributors, resellers, wholesalers, or any non- Main Branch BMS factory owned control representative shall not be accepted.

2. Provide a one-year labor and material warranty on the BMS.

3. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor.

4. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor’s normal business hours.

2. Part 2 – Products

2.1 General Description

A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.

B. The Building Management System shall consist of the following:

1. REFER TO MECHANICAL CONTROL DRAWINGS FOR REQUIRED CONTROL DEVICES. Refer to this specification for cross reference o products required as shown on Mechanical Control drawings. Where no control drawings are provided or additional items are required to meet sequence of operation, refer to this specification for product and installation requirements.
2. Standalone Network Automation Engine(s)
3. Field Equipment Controller(s)
4. Input/Output Module(s)
5. Local Display Device(s)
6. Portable Operator's Terminal(s)
7. Distributed User Interface(s)
8. Network processing, data storage and communications equipment
9. Other components required for a complete and working BMS

C. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
2. The System shall maintain all settings and overrides through a system reboot.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.

E. Acceptable Manufacturers

1) Johnson Controls, Metasys Main Branch, Cypress CA (DISTRICT STANDARD)

2.2 BMS Architecture

A. Automation Network

1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers.

3. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
4. Network Automation Engines (NAE) shall reside on the automation network.
5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
6. Tie into existing JCI District Network and front End.

B. Control Network (Building Control Panels and interface)

1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support the following communication protocols:
   a. BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
      ◊ The NAE shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
      ◊ The NAE shall be tested and certified as a BacNet Building Controller (B-BC).
2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. The Network Control Engine (NCE) shall be a fully user-programmable, supervisory controller. The NCE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
6. The Network Control Engine (NCE) shall be a fully user-programmable, digital controller that includes a minimum of 33 I/O points.
7. Automation Network – The NCE shall reside on the automation network and shall support a subnet of 32 Field controllers.
8. User Interface – Each NCE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.

C. Integration

1. Hardwired
   a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
   b. There will be one separate physical point on each system for each point to be integrated between the systems.
2. Direct Protocol

a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels.

b. All data required by the applications shall be mapped into the Automation Engine's database and shall be transparent to the operator.

c. Point inputs and outputs from third-party controllers shall have real-time interoperability with BMS software features such as Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization and Local Area Network Communications.

3. BacNet Protocol Integration

a. The neutral protocol used between systems will be BacNet over Ethernet and comply with ASHRAE BacNet standard 135-2003.

b. The ability to command, share point object data, change of state data and schedules between the host and BacNet systems shall be provided.

2.3 User Interface

A. Dedicated Web Based User Interface

1. Where indicated on plans the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.

2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

a. Microsoft Internet Explorer for user interface functions

b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions

c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports

d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries

3. PC Hardware – The personal computer(s) shall be configured as follows:

a. Minimum Memory – 4 GB

b. CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)

c. Hard Drive –1 TB free hard drive space minimum

d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department

e. CD/DVD RW ROM Drive –

f. Ports – (2) Serial and (1) parallel, (2) USB ports

g. Keyboard – 101 Keyboard and 2 Button Mouse

h. Display:

◊ Each Display – 24" Flat Panel Monitor 1280 x 1024 resolution minimum

i. LAN communications – Ethernet communications board; 3Comm or equal

4. Operating System Software
   a. Windows XP Professional or latest
   b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
   c. Provide software registration cards to the Owner for all included software.

B. Distributed Web Based User Interface

1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.

2. The software shall run on the Microsoft Internet Explorer (8.0 or higher) browser supporting the following functions:
   - ◊ Configuration
   - ◊ Commissioning
   - ◊ Data Archiving
   - ◊ Monitoring
   - ◊ Commanding
   - ◊ System Diagnostics

3. Minimum hardware requirements:
   - ◊ 512 MB RAM
   - ◊ 2.0 GHz Clock Speed Pentium 4 Microprocessor
   - ◊ 100.0 GB Hard Drive.
   - ◊ 1 Keyboard with 83 keys (minimum).
   - ◊ SVGA 1024x768 resolution display with 64K colors and 16 bit color depth
   - ◊ Mouse or other pointing device

C. Site Management User Interface Application Components

1. Operator Interface
   a. An integrated browser based client application shall be used as the user operator interface program.
   b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
   c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
   d. The user interface software shall provide help menus and instructions for each operation and/or application.
   e. The system shall support customization of the UI configuration and a home page display for each operator.

f. The system shall support user preferences in the following screen presentations:
   - ◊ Alarm
   - ◊ Trend
   - ◊ Display
   - ◊ Applications

g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.

h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
   - ◊ User access for selective information retrieval and control command execution
   - ◊ Monitoring and reporting
   - ◊ Alarm, non-normal, and return to normal condition annunciation
   - ◊ Selective operator override and other control actions
   - ◊ Information archiving, manipulation, formatting, display and reporting
   - ◊ BMS internal performance supervision and diagnostics
   - ◊ On-line access to user HELP menus
   - ◊ On-line access to current BMS as-built records and documentation
   - ◊ Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications

i. The system shall support a list of application programs configured by the users that are called up by the following means:
   - ◊ The Tools Menu
   - ◊ Hyperlinks within the graphics displays
   - ◊ Key sequences

j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees

a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.

c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task

bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Alarms
   a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
      ◊ Log date and time of alarm occurrence.
      ◊ Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
      ◊ Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
      ◊ Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
      ◊ Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
      ◊ Any attribute of any object in the system may be designated to report an alarm.
   b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
   c. The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.
   d. The BMS shall annunciate application alarms at minimum, as required by Part 3.
4. Reports and Summaries
   a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
      ◊ All points in the BMS
      ◊ All points in each BMS application
      ◊ All points in a specific controller
      ◊ All points in a user-defined group of points
      ◊ All points currently in alarm
      ◊ All points locked out
      ◊ All BMS schedules
      ◊ All user defined and adjustable variables, schedules, interlocks and the like.
   b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
   c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.

d. The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.

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e. Provide the capability to view, command and modify large quantities of similar data in tailored summaries created online without the use of a secondary application like a spreadsheet. Summary definition shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported. Summary viewing shall be available over the network using a standard Web browser.

5. Schedules

a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:

◊ Weekly schedules
◊ Exception Schedules
◊ Monthly calendars

b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.

c. It shall be possible to define one or more exception schedules for each schedule including references to calendars

d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.

e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.

f. Schedules and Calendars shall comply with ASHRAE SP135/2003 BacNet Standard.

g. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.

6. Password

a. Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.

b. Each user shall have the following: a username, password and access level.

c. The system shall allow each user to change his or her password at will.

d. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.

e. A minimum of five levels of access shall be supported

f. A minimum of 100 unique passwords shall be supported.

g. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.

h. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

7. Screen Manager

a. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

8. Dynamic Color Graphics

a. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.

b. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.

c. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:

◊ All graphics shall be fully scalable
◊ The graphics shall support a maintained aspect ratio.
◊ Multiple fonts shall be supported.
◊ Unique background shall be assignable on a per graphic basis.
◊ The color of all animations and values on displays shall indicate if the status of the object attribute.

d. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device

e. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.

◊ The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
◊ In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.

f. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.

9. Historical trending and data collection

a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
   - ◊ Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
     - Defined time interval
     - Upon a change of value
   - ◊ Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.

10. Trend data viewing and analysis
    a. Provide a trend viewing utility that shall have access to all database points.
    b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
    c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
    d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
    e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
    f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
    g. Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.
    h. The Display shall support the user's ability to change colors, sample sizes, and types of markers.

11. Database Management
    a. Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
    b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
    c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
       - ◊ Backup
       - ◊ Purge
       - ◊ Restore
    d. The Database Manager shall support four tabs:
       - ◊ Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Databases.
       - ◊ Maintenance – shall provide an easy method of purging records from the Server trend, alarm (event), and audit databases by supporting

separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.

- ◊ Backup – Shall provide the means to create a database backup file and select a storage location.
- ◊ Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.

e. The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:

- ◊ Ready
- ◊ Purging Record from a database
- ◊ Action Failed
- ◊ Refreshing Statistics
- ◊ Restoring database
- ◊ Shrinking a database
- ◊ Backing up a database
- ◊ Resetting internet information Services
- ◊ Starting the Device Manager
- ◊ Shutting down the Device Manager
- ◊ Action successful

f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.

g. The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

h. The Monitoring Settings window shall have the following sections:

- ◊ General – Shall allow the user to set and review scan intervals and start times.
- ◊ Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
- ◊ Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.
- ◊ Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
- ◊ Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.

i. The Monitoring Settings Taskbar shall provide the following informational icons:

- ◊ Normal – Indicates by color and size that all databases are within their limits.
- ◊ Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
- ◊ Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.

j. The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

D. Portable Operator Terminal

1. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BMS Contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:

a. Personal Laptop Computer Manufacturer – Dell, Compaq or HP
b. 1 GB RAM (256 MB minimum) – XP Professional
c. 1.8 GHz Clock Speed Pentium 4 Microprocessor (800 MHz minimum)
d. 40 GB Hard Drive (40 GB minimum)
e. (1) CD-ROM Drive, 32x speed
f. (1) Serial (1) Parallel (2) USB ports
g. 1 Keyboard with 83 keys (minimum).
h. Integral 2 button Track Point or Track Ball.
i. 10” SVGA 1024x768 resolution color display
j. Two PCMCIA Type II or one Type III card slot
k. Complete operator workstation software package, including any hardware or software.
l. Original printed manuals for all software and peripherals.
m. Original installation disks or CD for all software, device drivers, and peripherals
n. Software registration cards for all included software shall be provided to the Owner.
o. Carrying case
p. Spare battery.
q. External power supply/battery charger

2. Proprietary Portable Terminal

a. Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
b. The proprietary terminal shall meet the same operator interface software requirements as specified above.

3. Software

a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
b. When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
c. When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

E. Access Portal User Interface

1. BMS Contractor shall provide and install all computer hardware and software required for the purpose of configuration and consolidation of information and programs required for the delivery of a Task Focused, Web Based Portal to the

BMS. This Access Portal shall provide a natural, complementary extension to the site management user interface previously described.

2. Access Portal Architecture – The architecture of the system shall be implemented to conform to industry standards, so that it can accommodate the required applications provided by the BMS Contractor as well as communicate information too and from the system Site Director.
3. PC Hardware – The personal computer(s) shall be configured as follows:
   a. Memory – 2 GB (1 GB Minimum)
   b. CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)
   c. Hard Drive – 200 GB free hard drive space (80 GB minimum)
   d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
   e. DVD ROM Drive – 16X performance
   f. Ports – (1) Serial, (2) USB ports
   g. Keyboard – 101 Keyboard and 2 Button Mouse
   h. CRT configuration
      ◊ 17" Flat Panel Monitor 1280 x 1024 resolution minimum
      ◊ 16 bit or higher color resolution
   i. LAN communications – Ethernet communications board; 100Mbps Min.
4. Operating System Software
   a. Windows XP Professional, IIS Version 5.1, .Net Version 2.0, SQL server 2005 Express software with SP2 or <Alternately> Microsoft Windows Server 2003 OS with SP2, IIS Version 6.0, .Net version 2.0 and SQL Server 2005 with SP@
   b. Provide required software and hardware required for for integration of computing hardware on enterprise IT network.
   c. Provide software registration cards to the Owner for all included software.
5. User Interface Application Components
   a. The ready access portal shall provide an intuitive user interface to key functions and tasks via web browser.
   b. Plug-ins or special software shall not be required for access to alarm, summary, schedule and trend data.
   c. The portal shall include the ability to view full graphical representations of systems and equipment on PC platforms
   d. The control system shall provide Secure Sockets Level (SSL) and Active Directory service support. If the Active Directory service and Single Sign-On features are enabled and the user is logged in to the Windows desktop, the login screen does not appear and access to the system is automatic.
   e. Provide a common tool for graphics creation, schedule creation, custom programming, user access and hardware definition
   f. Information shall be accessible on both personal computer and handheld device platforms as follows:
      ◊ Personal computers – Internet Explorer Version 7.0 recommended
      ◊ Handheld devices – Internet Explorer for Window Mobile Version 5.0 or 6.0 recommended. UI is optimized for devices with a 240 x 320 pixel screen size (QVGA). Other devices may display the UI but full functionality is not guaranteed.

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6. Operator Interface
   a. Password access shall be as described previously for management portal UI
   b. Once logged in, the System shall display a pre-selected screen tailored to the task requirements of the individual user.
   c. The User Interface shall utilize an intuitive navigation and display method designed for operators who access the system for casual information and control or on an infrequent basis. It shall feature three basic components.
      - ◊ Radio buttons for selection of the type of information to be displayed including Alerts, Summary, Schedules and Diagnostics
      - ◊ Navigation tree for selection of the specific data to be displayed on screen for the selected type. The navigation tree may be hidden and expanded by the operator to optimize the display of information
      - ◊ A display window that provides the selected information by type in a pre-configured tabular format
   d. The user interface software shall provide help menus and instructions for each operation and/or application.
   e. The system shall provide support for up to 100 concurrent users from an unlimited universe individuals with defined password access to the system
   f. The system shall utilize Secure Sockets Level (SSL) support as required to allow the access portal to communicate across a network in a way designed to prevent eavesdropping, tampering, and message forgery. It provides endpoint authentication and communications privacy over the network using cryptography
   g. The system shall have the capability to display multiple navigation trees that correspond to the user views configured in the management portal UI.
   h. The alert summary of the remote access portal shall, at the minimum, provide the following information
      - ◊ Alert (Alarm) type
      - ◊ Date and time of alert occurrence
      - ◊ Priority (color coded to level)
      - ◊ Item name.
      - ◊ Item value (if applicable)
      - ◊ Message
      - ◊ Any attribute of any object in the system may be designated to report an alarm
   i. A standard summary on the remote access portal shall, at the minimum, provide the following information
      - ◊ Point type graphic icon
      - ◊ Item name
      - ◊ Item value
      - ◊ Item status
      - ◊ Access to the Change Value window (if applicable) for the purpose of setting, holding or releasing an item value
   j. The schedule detail summary of the remote access portal shall, at the minimum, provide the following information
      - ◊ Scheduled occurrences including time and value
      - ◊ Scheduled overrides including start time, end time and value

- ◊ A list of all scheduled items including name and attribute, value, status and priority
- ◊ Access to the Add Temporary Override window for the purpose of adding a temporary override to the schedule

k. The diagnostic (trend) summary of the remote access portal as viewed on a personal computing device shall provide the following information.

- ◊ Item name
- ◊ Item status
- ◊ Trend name
- ◊ Trend status
- ◊ Full path name
- ◊ Access to trend detail summary including trended value, time and date arranged in a user selectable format of 1 hour, 12 hours, 24 hours, 48 hours or 72 hours

2.4 DDC System Controllers

A. Field Equipment Controller (Ancillary Devices)

1. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BacNet MS/TP protocol.
   a. The FEC shall support BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
      1) The FEC shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
      2) The FEC shall be tested and certified as a BacNet Application Specific Controller (B-ASC).
      3) A BacNet Protocol Implementation Conformance Statement shall be provided for the FEC.
      4) The Conformance Statement shall be submitted 10 days prior to bidding.
2. The FEC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
3. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FEC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.

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4. The FEC shall include a removable base to allow pre-wiring without the controller.

B. Networked Thermostat (by Johnson Controls, Inc. only District standard)

1. The Network Thermostat shall communicate over the Field Controller Bus using BacNet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
2. The Network Thermostat shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
   a. The Network Thermostat shall be tested and certified as a BacNet Application Specific Controller (B-ASC).

b. A BacNet Protocol Implementation Conformance Statement shall be provided for the Network Thermostat.
c. The Conformance Statement shall be submitted 10 days prior to bidding.
d. The Network shall be available in ZigBee BacNet Application.

3. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interfaceable through a Network Automation Engine only.
4. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Fan, Heat, and Cool status
   c. Five (5) User Interface Keys
      ◊ Mode
      ◊ Fan
      ◊ Override
      ◊ Degrees C/F
      ◊ Up/Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms
5. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor
   b. Duct Mount Air Temperature Sensor
   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator
   d. Two configurable binary inputs
6. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
   a. Three Speed Fan Control
   b. Two On/Off
   c. Two Floating
   d. Two Proportional (0 to 10V)
7. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
8. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
9. Adjustable heating/cooling cycles per hour from 4 to 8
10. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

C. Networked Thermostat **(TEC 26X6 By Johnson Controls, Inc.)**

1. The Networked Thermostat shall be capable of controlling constant volume units for DX units, DX with gas heating, HP units, FC units DX, FC units with chill and hot water coils modulating control valves.
2. The Networked Thermostat shall communicate over the Field Controller Bus using BacNet Standard protocol SSPC-135, Clause 9.
   a. The Networked Thermostat shall support remote read/write and parameter adjustment from the web based User Interface able through a Network Automation Engine.
3. The Networked Thermostat shall include an intuitive User Interface providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Fan, Heat, and Cool status
   c. Five (5) User Interface Keys
      ◊ Mode
      ◊ Fan
      ◊ Override
      ◊ Degrees C/F
      ◊ Up/Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms
4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor
   b. Duct Mount Air Temperature Sensor
   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
   d. Two configurable binary inputs
5. The Networked Thermostat shall provide the flexibility to support any one of the following outputs:
   a. Three Speed Fan Control
   b. Two On/Off
   c. Two Floating
   d. Two Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

D. Networked Thermostat **(TEC 26X7 By Johnson Controls, Inc.)**

1. The Networked Thermostat shall be capable of controlling a pressure dependent Variable Air Volume System or other similar zoning type systems employing reheat.
2. The Networked Thermostat shall communicate over the FC Bus using BacNet Standard protocol SSPC-135, Clause 9.
   a. The Networked Thermostat shall be capable of remote read/write and parameter adjustment from the web based User Interface (UI) through an NAE.
3. The Networked Thermostat shall include an intuitive UI providing plain text messages.
   a. Two line, 8 character backlit display
   b. LED indicators for Heating, and cooling status
   c. Three (3) User Interface Keys
      ◊ Override
      ◊ Up
      ◊ Down
   d. The display shall continuously scroll through the following parameters:
      ◊ Room Temperature
      ◊ System Mode
      ◊ Schedule Status – Occupied/Unoccupied/Override
      ◊ Applicable Alarms
4. The Networked Thermostat shall provide the flexibility to support any one of the following inputs:
   a. Integral Indoor Air Temperature Sensor
   b. Duct Mount Air Temperature Sensor
   c. Remote Indoor Air Temperature Sensor with Occupancy Override and LED Indicator.
   d. Two configurable binary inputs
5. The Networked Thermostat shall provide the flexibility to support either of the following outputs:
   a. Two On/Off or Floating
   b. Two Proportional (0 to 10V)
6. The Networked Thermostat shall provide a minimum of six (6) levels of keypad lockout.
7. The Networked Thermostat shall provide the flexibility to adjust the following parameters:
   a. Adjustable Temporary Occupancy from 0 to 24 hours
   b. Adjustable heating/cooling dead band from 2º F to 5º F
   c. Adjustable heating/cooling cycles per hour from 4 to 8
8. The Networked Thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.

E. Network Sensors **(By Johnson Controls, Inc.)**

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
   a. Zone Temperature
   b. Zone Humidity

c. Zone Setpoint
d. Discharge Air Temperature

2. The NS shall transmit the information back to the controller on the Sensor-Actuator Bus (SA Bus) using BacNet Standard protocol SSPC-135, Clause 9.
3. The NS shall be BacNet Testing Labs (BTL) certified and carry the BTL Label.
   a. The NS shall be tested and certified as a BacNet Smart Sensors (B-SS).
   b. A BacNet Protocol Implementation Conformance Statement shall be provided for the NS.
   c. The Conformance Statement shall be submitted 10 days prior to bidding.
4. The Network Zone Sensors shall include the following items:
   a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
   b. An LED to indicate the status of the Override feature
   c. A button to toggle the temperature display between Fahrenheit and Celsius
   d. A button to initiate a timed override command
   e. Available in either surface mount or wall mount
   f. Available with either screw terminals or phone jack

3. Part 3 – Performance / Execution

3.1 Installation Practices

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 16 Electrical. All wiring shall comply with the requirements of applicable portions of Division 16 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.
4. Class 2 Wiring
   a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
   b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5’ from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
5. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.

6. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 16.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2”.
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

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E. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.

   Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer’s recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – Genera1

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.
4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors
   a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
   b. Sensors shall be installed with a rain proof, perforated cover.
6. Water Differential Pressure Sensors
   a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
   b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
   c. The transmitters shall be installed in an accessible location wherever possible.
7. Building Differential Air Pressure Applications (-1” to +1” w.c.):
   a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
   b. The interior tip shall be inconspicuous and located as shown on the drawings.
8. Duct Temperature Sensors:
   a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
   b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
   c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
   d. The sensor shall be mounted to suitable supports using factory approved element holders.
9. Space Sensors:
   a. Shall be mounted per ADA requirements.
   b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
10. Low Temperature Limit Switches:
   a. Install on the discharge side of the first water or steam coil in the air stream.
   b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.

c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.

11. Air Differential Pressure Status Switches:

a. Install with static pressure tips, tubing, fittings, and air filter.

12. Water Differential Pressure Status Switches:

a. Install with shut off valves for isolation.

I. HVAC Output Devices

1. All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
2. Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
3. Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
4. Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI. The maximum pressure drop for steam applications shall be 7 PSI.
5. Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.2 Training

A. The BMS contractor shall provide the following training services:

1. One day of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.

3.3 **Commissioning**

A. Fully commission all aspects of the Building Management System work.

B. Acceptance Check Sheet

1. Prepare a check sheet that includes all points for all functions of the BMS
2. Submit the check sheet to the Engineer for approval
3. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.

C. VAV box performance verification and documentation:

1. The BMS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible

results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.

2. The BMS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.

D. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

SECTION 15950 - TESTING, ADJUSTING, AND BALANCING

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 TAB to produce design objectives for the following:

1. Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.

2. Existing systems TAB.
3. Verifying that automatic control devices are functioning properly.
4. Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

C. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

D. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

E. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

F. Report Forms: Test data sheets for recording test data in logical order.

G. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. TAB: Testing, adjusting, and balancing.

K. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

L. Test: A procedure to determine quantitative performance of systems or equipment.

M. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

D. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

E. Sample Report Forms: Submit two sets of sample TAB report forms.

F. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by NEBB.

B. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support personnel. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items: Include at least the following:

a. Submittal distribution requirements.

b. The Contract Documents examination report.
c. TAB plan.
d. Work schedule and Project-site access requirements.
e. Coordination and cooperation of trades and subcontractors.
f. Coordination of documentation and communication flow.

C. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

E. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."

F. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1. Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

A. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Contract Documents are defined in the General and Supplementary Conditions of Contract.
2. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine equipment for installation and for properly operating safety interlocks and controls.

O. Examine automatic temperature system components to verify the following:

1. Dampers, valves, and other controlled devices are operated by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.
7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at indicated values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to indicated values.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

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

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

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

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, 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.

C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling unit components.

L. Check for proper sealing of air duct system.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

   a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
   b. Measure static pressure directly at the fan outlet or through the flexible connection.
   c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
   d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

   a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.
6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a maximum set-point airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outside-air dampers at minimum, and return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
8. Record the final fan performance data.

C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Balance systems similar to constant-volume air systems.
2. Set terminal units and supply fan at full-airflow condition.
3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
5. Measure operating static pressure at the sensor that controls the supply fan, if one is installed, and verify operation of the static-pressure controller.
6. Set supply fan at minimum airflow if minimum airflow is indicated. Measure static pressure to verify that it is being maintained by the controller.
7. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow as described for constant-volume air systems.

    a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.

8. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced airflow terminal units so they are distributed evenly among the branch ducts.
2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
3. Set terminal units at full-airflow condition.
4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units as described for constant-volume air systems.
5. Adjust terminal units for minimum airflow.
6. Measure static pressure at the sensor.
7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outside airflow. Adjust the fan and balance the return-air ducts and inlets as described for constant-volume air systems.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer, model, and serial numbers.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.

1. Measure and record the operating speed, airflow, and static pressure of each fan.
2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
3. Check the refrigerant charge.
4. Check the condition of filters.
5. Check the condition of coils.
6. Check the operation of the drain pan and condensate drain trap.
7. Check bearings and other lubricated parts for proper lubrication.
8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished.

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.

4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

C. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows and determine the new fan, speed, filter, and coil face velocity.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated airflow and water flow rates. If 5 percent or less, equipment adjustments are not required.
4. Air balance each air outlet.

3.10 TEMPERATURE-CONTROL VERIFICATION

A. Verify that controllers are calibrated and commissioned.

B. Check transmitter and controller locations and note conditions that would adversely affect control functions.

C. Record controller settings and note variances between set points and actual measurements.

D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

E. Check free travel and proper operation of control devices such as damper and valve operators.

F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

G. Check the interaction of electrically operated switch transducers.

H. Check the interaction of interlock and lockout systems.

I. Check main control supply-air pressure and observe compressor and dryer operations.

J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

K. Note operation of electric actuators using spring return for proper fail-safe operations.

3.11 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.

2. Air Outlets and Inlets: 0 to minus 10 percent.
3. Heating-Water Flow Rate: 0 to minus 10 percent.
4. Cooling-Water Flow Rate: 0 to minus 5 percent.

3.12 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.13 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.
2. Name and address of TAB firm.
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 firm who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer, type size, and fittings.
14. Notes to explain why certain final data in the body of reports varies from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outside-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

F. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data: Include the following:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Sheave dimensions, center-to-center, and amount of adjustments in inches.
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.

2. Motor Data:

   a. Make and frame type and size.
   b. Horsepower and rpm.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Sheave dimensions, center-to-center, and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat coil static-pressure differential in inches wg.
   g. Cooling coil static-pressure differential in inches wg.
   h. Heating coil static-pressure differential in inches wg.
   i. Outside airflow in cfm.
   j. Return airflow in cfm.
   k. Outside-air damper position.
   l. Return-air damper position.
   m. Vortex damper position.

G. Apparatus-Coil Test Reports:

1. Coil Data:

   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft..
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outside-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Water flow rate in gpm.
   i. Water pressure differential in feet of head or psig.

j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.
o. Inlet steam pressure in psig.

H. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btuh.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btuh.
i. High-fire fuel input in Btuh.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btuh.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btuh.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.

c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center-to-center, and amount of adjustments in inches.

2. Motor Data:

a. Make and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center-to-center, and amount of adjustments in inches.
g. Number of belts, make, and size.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

a. System and air-handling unit identification.
b. Location and zone.
c. Test apparatus used.
d. Area served.
e. Air-terminal-device make.

f. Air-terminal-device number from system diagram.
g. Air-terminal-device type and model number.
h. Air-terminal-device size.
i. Air-terminal-device effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Air velocity in fpm.
c. Preliminary airflow rate as needed in cfm.
d. Preliminary velocity as needed in fpm.
e. Final airflow rate in cfm.
f. Final velocity in fpm.
g. Space temperature in deg F.

L. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Unit make and model number.
d. Compressor make.
e. Compressor model and serial numbers.
f. Refrigerant weight in lb.
g. Low ambient temperature cutoff in deg F.

2. Test Data (Indicated and Actual Values):

a. Inlet-duct static pressure in inches wg.
b. Outlet-duct static pressure in inches wg.
c. Entering-air, dry-bulb temperature in deg F.
d. Leaving-air, dry-bulb temperature in deg F.
e. Condenser entering-water temperature in deg F.
f. Condenser leaving-water temperature in deg F.
g. Condenser-water temperature differential in deg F.
h. Condenser entering-water pressure in feet of head or psig.
i. Condenser leaving-water pressure in feet of head or psig.
j. Condenser-water pressure differential in feet of head or psig.
k. Control settings.
l. Unloader set points.
m. Low-pressure-cutout set point in psig.
n. High-pressure-cutout set point in psig.
o. Suction pressure in psig.
p. Suction temperature in deg F.
q. Condenser refrigerant pressure in psig.
r. Condenser refrigerant temperature in deg F.
s. Oil pressure in psig.
t. Oil temperature in deg F.

u. Voltage at each connection.
v. Amperage for each phase.
w. Kilowatt input.
x. Crankcase heater kilowatt.
y. Number of fans.
z. Condenser fan rpm.
aa. Condenser fan airflow rate in cfm.
bb. Condenser fan motor make, frame size, rpm, and horsepower.
cc. Condenser fan motor voltage at each connection.
dd. Condenser fan motor amperage for each phase.

M. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.14 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.
2. Randomly check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Measure sound levels at two locations.
e. Measure space pressure of at least 10 percent of locations.
f. Verify that balancing devices are marked with final balance position.
g. Note deviations to the Contract Documents in the Final Report.

B. Final Inspection:

1. After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. TAB firm test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
6. TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.
7. Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

3.15 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

END OF SECTION 15950

SECTION 16010
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS

A. General

1. Review of contractors submittals is for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.

2. The Contractor shall review each submittal in detail for compliance with the requirements of the contract documents prior to submittal to the Architect. The Contractor shall "Ink Stamp" and sign each item of the submittal with a statement "CERTIFYING THE SUBMITTAL HAS BEEN REVIEWED BY THE CONTRACTOR AND COMPLIES WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS".

3. Where the construction documents indicate specific manufacturer(s) for any given product, it shall be considered a substitution if the contractor proposes to use any manufacturer other than those specifically named. The Contractor shall clearly and specifically identify each individual proposed substitution or proposed deviation from the requirements of the contract documents with a statement "THIS ITEM IS A SUBSTITUTION".

B. Material Lists and Shop Drawings:

1. Submit material list and equipment manufacturers for approval within 35 days of award of contract. Give name of manufacturer and where applicable, brand name, type and/or catalog number of each item. Listing of more than one manufacturer for any one item of equipment, or listing items "as specified", without both make and model or type designation, is not acceptable. Shop drawings shall not be submitted before approval of manufacturers list. The right is reserved to require submission of samples of any material whether or not particularly mentioned herein.

2. Within three weeks after approval of the material and equipment manufacturers list, submit shop drawings for approval. Shop drawings shall be submitted in completed bound groups of materials (i.e., all lighting fixtures or all switchgear, etc.). Shop drawing shall be prepared by factory authorized representatives. Departure from the above procedure will result in resubmittals and delays.

3. Submittals which are intended to be reviewed as substitution or departure from the contract documents must be specifically noted as such or the requirements of the contract documents will prevail regardless of the acceptance of the submittal.

4. Shop drawings shall include dimensioned plans, elevations, details, wiring diagrams and descriptive literature of components parts where applicable.

5. The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all code requirements relating to clear working space about electrical equipment prior to submitting shop drawings for approval.

6. Shop drawings shall include the manufacturer's projected days for shipment from the factory of completed equipment, after the equipment is released for production by the Contractor. It shall be the responsibility of the Contractor to insure that all material and equipment is ordered and installed in time to provide an orderly progression of the work, and to allow full occupancy and full operation of the facility at the scheduled completion date. The Contractor shall notify the Architect of any changes in delivery which would affect the project completion date.

C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the substitution of specified contract materials or work.

D. Maintenance and Operating Manuals

1. The Contractor shall furnish three copies of typewritten maintenance and operating manuals for all electrical equipment, fire alarm equipment, sound system equipment, etc., to the District and instruct District's personnel in correct operation of all equipment at completion of project.

2. Where these specifications indicate to provide District personnel with instructional training sessions, the Contractor shall videotape all such instructional sessions. The Contractor shall provide all equipment and personnel required to create a color VHS video and audio recording and shall turn over to the District a total of two (2) copies of each tape prepared.

3. Maintenance and operating manuals shall be bound in three-ring, hard-cover, plastic binders and shall be delivered to the District with letter of transmittal, carbon copy to the Architect.

E. Portable or Detachable Parts: The Contractor shall retain in his possession, and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of contract work. These parts shall then be delivered to the District or his authorized representative and an itemized receipt obtained, with copies of receipt sent to the Architect.

F. Record Drawings

1. Provide and maintain in good order at the job site a complete set of electrical contract prints. Changes to the contract to be clearly recorded on this set of prints. No pay request by the Contractor will be granted without verification that the jobsite prints are up-to-date and current with the project construction. At the end of the project, the Contractor shall transfer all changes to one set of transparencies to be delivered unfolded to the Architect. Transparency drawings shall be prepared in an organized and clearly legible fashion by persons skilled in drafting techniques.

2. The actual location and elevation of all buried lines, boxes, monuments, vaults, stub-outs and other provisions for future connections shall be referenced to the building lines or other clearly established base lines and to approved bench marks. All measurements shall be witnessed by the job inspector who shall make his own record of the dimensions. Before the inspector signs the record drawings, he shall check his own dimensions against those on the drawings. If any necessary dimensions are omitted from the record drawings, the Contractor shall, at his own expense, do all excavation required to expose the buried work and to establish the correct locations.

3. The Contractor shall keep the "record" prints up to date and current with all work performed.

4. A mandrel shall be pulled through each conduit upon completion of the duct bank. All mandrelling must be done in the presence of the job inspector.

1.03 GENERAL SUMMARY OF ELECTRICAL WORK

A. The specifications and drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. Refer to the drawings and shop drawings of other trades for additional details which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

C. Before submitting a bid, the Contractor shall familiarize himself with all features of the building drawings and site drawings which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.

D. If there are omissions or conflicts between the drawings and specifications, clarify these points with the Architect before submitting bid.

1.04 LOCATIONS OF EQUIPMENT

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

B. Where outlets are placed on a wall, locate symmetrically with respect to each other and other features or finishes on the wall.

C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes made without cost, providing the change is ordered before the conduit runs, etc., and work directly connected to same is installed and no extra materials are required.

D. Lighting fixtures in mechanical spaces are shown in their approximate location only. Do not install light outlets or fixtures until mechanical piping and duct work is installed, then install lights in a location to provide best lighting.

E. The locations of existing utilities, building, equipment and conduit shown on the drawings is approximate. Verify exact locations and routing of existing systems in the field. Include all costs in contract price for adjustment required to accommodate existing conditions.

F. Coordinate and cooperate in every way with other trades in order to avoid interference and assure a satisfactory job.

1.05 AIR CONDITIONING, HEATING, PLUMBING EQUIPMENT WIRING

Provide electrical work, materials, and control components required for proper operation of the air conditioning, heating and plumbing systems.

1.06 POWER UTILITIES' SERVICES

A. Utility Co. services and metering facilities shall conform to the requirements of the serving utility companies. Contractor shall verify service locations and requirements prior to rough-in.

B. Conform to all requirements of the serving utility companies. Location of transformer pad and or manholes and pull boxes and routing of service conduits indicated on the drawings are approximate and shall be verified with the serving utility company prior to installation. Installation of service shall not begin until approved drawings have been received from the serving utility company.

C. Within 30 calendar days of receipt of notice that the contract award has been made, the Contractor shall notify the New Business Departments of the District Office of the serving utility companies and shall provide information as to the total power, telephone, and signal requirements of the contract. The Contractor shall furnish at the same time information as to the estimated completion date of job or the date when the respective utility company circuits, will be ready for installation, energizing and activation of the service.

D. In addition to the requirements of the serving utility companies, all power, service conduits for utility company circuits, shall be completely encased with concrete.

1.07 QUALITY ASSURANCE

A. Work and materials in full accordance with the latest rules and regulations of the California Code of Regulations Title 24, Part 3 "California Electrical Codes", Title 8 "Division of Industrial Safety", the National Electrical Code, the National Life Safety Code, and other applicable Federal and State laws and regulations.

B. All material and equipment shall be new and shall be delivered to the site in unbroken packages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized testing laboratories, where such listings are available. Comply with all installation requirements and restrictions pertaining to such listings.

C. Work and material shown on the drawings and in the specifications is new and included in the contract unless specifically indicated as existing or N.I.C. (not-in-contract).

D. Keep a copy of all applicable codes available at the job site at all times while performing work under this section. Nothing in plans or specifications shall be construed to permit work not conforming to the most stringent of codes.

1.08 CLEANING EQUIPMENT, MATERIALS, PREMISES

All parts of the equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.09 JOB CONDITIONS - PROTECTION

Protect all work, materials and equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. All electrical equipment shall be stored in a weather-tight structure. Provide for the safety and good condition of all the work until final acceptance of the work by the District and replace all damaged or defective work, materials and equipment before requesting final acceptance.

1.10 CUTTING AND PATCHING

Perform cutting and patching of the construction work which may be required for the proper installation of the electrical work. Patching shall be of the same material, thickness, workmanship and finish as existing and accurately match surrounding work to the satisfaction of the Architect. Cutting of structural members shall not be done without notifying the Architect and obtaining DSA approval.

1.11 IDENTIFICATION

A. Panelboards, terminal cabinets, circuit breakers, disconnect switches, starters, relays, time switches, contactors, pushbutton control stations, and other apparatus used for the operation or control of feeders, circuits, appliances, or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to the apparatus and wiring.

B. Nameplates shall be engraved laminated phenolic. Shop drawings with dimensions and format shall be submitted to the Architect before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws or machine screws. Self-adhering or adhesive backed nameplates shall not be used.

C. Plates: All cover and device plates shall be furnished with engraved or etched designations under any one of the following conditions:

1. Three gang or larger gang switches.

2. Keyed and/or locking switches.

3. Pilot light switches.

4. Switches in locations from which the equipment or circuits controlled cannot be readily seen.

5. Manual motor starting switches.

6. Switches which serve other than lighting loads.

7. Where so indicated on the drawings.

8. As required on all control circuit switches, such as heater controls, etc.

9. Where receptacles are other than standard duplex receptacles to indicate voltage and phase.

D. Provide black-on-white laminated plastic nameplates engraved in minimum 1/4" high letters to correspond with the designations on the drawings. Provide other or additional information on nameplates where indicated.

E. Wire and Cable Identification

1. Provide identification on individual wire and cable including sign systems, fire alarm, electrical power systems (each individual phase, neutral and ground), empty conduit pull ropes, and control circuit.

2. Identification shall be provided at each termination location, splice location, pullbox, junction box and equipment enclosure.

   a. Individual wire and cable larger than #6 AWG or 0.25 inch diameter, shall be provided with polypropylene identification tag holders, with yellow polypropylene tags interchangeable black alpha/numeric characters. Character height 0.25 inch or TECH Products-“EVERLAST” series. Attach identification tags with plastic “tie” wraps, minimum of two for each tag. As manufactured by Almetek Industries-“EZTAG” series.

   b. Individual wire and cable #6 AWG and smaller or smaller than 0.25 inch diameter, shall be provided with water and oil resistant, flexible, pressure sensitive machine embossed plastic tags that wrap a minimum of 360 degrees around the wire/cable diameter. The entire tag shall then be covered with a clear flexible waterproof plastic cover wrapped a minimum of 540 degrees around the wire/cable diameter and completely covering the identification.

   c. Each identification tag location shall indicate the following information: circuit number, circuit phase, source termination and destination termination equipment name (or outlet number as applicable).

3. Install identification after installation/pulling of wire/cable is complete, to prevent loss or damage to the identification.

F. Cardholders and cards shall be provided for circuit identification in panelboards. Cardholders shall consist of a metal frame retaining a clear plastic cover permanently attached to the inside of panel door. List of circuits shall be typewritten on card. Circuit description shall include name or number of circuit, area, and connected load.

G. Junction and pull boxes shall have covers marked with circuit numbers according to panel schedule. Data shall be lettered in a conspicuous manner with a color contrasting to finish.

1.12 TESTING

A. The Contractor shall obtain an independent NETA certified testing laboratory that will provide all instrumentation and tests on the electrical system and equipment as hereinafter described and further directed by the Architect. The test shall be performed after the completion of all electrical systems. All tests shall be recorded and documented and submitted to the Architect for review.

B. The Testing Laboratory shall meet Federal OSHA criteria for accreditation of Testing Laboratories Title 29 Part 1907. Membership in the National Electrical Testing Association shall constitute proof of meeting aid criteria, for testing of electrical system.

1. Test for Phase to Ground Condition:

   a. Open main service disconnect.

   b. Isolate the system neutral from ground by removing the neutral disconnect link located in the service switchboard.

   c. Close all submain disconnects.

   d. Close all branch feeder circuit breakers.

   e. Measure the resistance of each phase to ground. A properly calibrated "megger" type test instrument to be used. The test voltage shall be 500 volts.

   f. Record all readings after one minute duration and document into a complete report.

2. Isolating Grounds: In the event that low resistance grounds are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.

C. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.

1. Perform "fall-of-potential" tests on each grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5. When suitable locations for test rods are not available, a low resistance dead earth or reference ground will be utilized.

2. Perform the two-point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance at each ground bus in distribution boards and distribution panels and transformer neutrals.

D. All instrumentation and personnel required for testing shall be furnished by the Contractor.

E. The testing, calibrating and setting of all ground and ground fault equipment circuit breakers, device protection relays, and meters adjustable settings shall be by an independent testing laboratory. Set as recommended by the respective manufacturer and coordination study so as to be coordinated with other protection devices within the electrical design. Four (4) bound and tabulated copies of the test and settings shall be sent to the ARCHITECT.

F. Ampere and voltage measurements:

1. Take and record ampere and line voltage measurements under full load on all panel feeders, switchboard and switchgear feeders, motor control centers and motor circuits provided in the contract. Record measurements at the equipment tested and submit to the ARCHITECT for review.

2. Ampere voltage readings shall be:

   a. Phase A-B, A-C and B-C.
   b. Phase A-Neutral, B-Neutral and C-Neutral.

3. The ampere and voltage readings shall be not less than 20 minutes duration for each test. Record and submit the measured minimum, maximum and 20 minute average for each ampere and voltage value and test location. Voltage and ampere measurements shall occur at the connected load end of each respective feeder, not at the source of supply end of each feeder.

4. Test equipment shall be accurate within plus or minus 1-percent.

5. Branch circuit devices 40 ampere or less and motor boards 10 horsepower or smaller are excluded from ampere and voltage testing requirement.

G. If, in the opinion of the Architect, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility for proper electrical service and then verify that such has been provided.

1.13 SERIES RATED EQUIPMENT

Circuit protective devices identified as "Series Rated" or "Current Limiting" (i.e. CLCB - current limiting circuit breaker; CLF - current limiting fuse; etc.) shall be series rated and tested (UL 489 and CSA5) by the manufacturer with all equipment and circuit protective devices installed down stream of the identified series rated or current limiting devices. Provide nameplates on all equipment located down stream, including the CLCB and CLF devices, to comply with N.E.C. paragraphs 110-22 and 240-83 "CAUTION SERIES RATED SYSTEM - NEW DEVICE INSTALLATIONS AND REPLACEMENTS SHALL BE THE SAME MANUFACTURER AND MODELS."

1.14 SPARE FUSES

Provide (3) three spare fuses for each size and type to match the installed fuses where the fuses are provided as part of the contract.

1.15 WALL MOUNTED ELECTRICAL EQUIPMENT

A. Provide multiple horizontal sections of metal “C” channels for support and attaching wall mounted equipment to walls. Channels shall provide “turned lips” at longitudinal edges to hold “lock-in” fasteners and shall comply with ANSI-1008 and ASTM-A569 latest revision. The channels shall be steel hot dip zinc galvanized. As manufactured by Unistrut or Kindorf.

B. The “C” channels shall be positioned horizontally within 3 inches of the top and bottom of each, equipment section cabinet and located behind each equipment vertical section. Provide additional intermediate “C” channels at not less than 36 inches on center between the “top” and “bottom” “C” channel positions, located behind each equipment vertical section.

C. The “C” channels shall be of sufficient length to provide connection to not less than two (2) vertical structural wall framing elements separated by not less than 16 inches; but in no case shall the “c” channel length be less than the width of the respective equipment section.

D. Attach the “C” channels to the wall structural elements after the wall, finish surface, installation (including painting) is complete.

E. Attach the “C” channels with fasteners to the building wall framing structural elements as follows: welded to steel framing; bolted to wood framing; cast in place concrete inserts for masonry and concrete construction; drilled “afterset” expansion anchors for existing masonry and concrete construction.

F. Attach the equipment to the “C” channels with threaded and bolted fasteners to “prelocate” and lock into the channel “turned lips” and channel walls.

1.16 ELECTRICAL WORK CLOSEOUT

A. Prepare the following items and submit to the Architect before final acceptance.

1. Two copies of all test results as required under this section.

2. Two copies of local and/or state code enforcing authorities final inspection certificates.

3. Copies of as-built record drawings as required under the General Conditions, pertinent Division One Sections and Electrical General Provisions.

4. Two copies of all receipts transferring portable or detachable parts to the District when requested.

5. Notify the Architect in writing when installation is complete and that a final inspection of this work can be performed. In the event any defect or deficiencies are found during this final inspection they shall be corrected to the satisfaction of the Architect before final acceptance can be issued.

B. The Contractor shall complete the following work before any electrical equipment is energized:

1. All equipment shall be permanently anchored.

2. All bus connections shall be tightened per manufacturer's instructions and witnessed by the DSA Inspector.

3. All ground connections shall be completed and identified. Perform and successfully complete all required megger and ground resistance tests.

4. All feeders shall be connected and identified.

5. The interiors of all electrical enclosures including busbars and wiring terminals shall be cleaned of all loose material and debris, paint, plaster, cleaners or other abrasive's overspray removed and equipment vacuumed clean. The DSA Inspector shall observe all interiors before covers are installed.

6. All dry wall work and painting shall be completed within the electrical rooms.

7. All doors to electrical equipment rooms shall be provided with locks in order to restrict access to energized equipment.

8. Electrical rooms shall not be used as a storage room after power is energized.

9. The coordination study shall be complete, circuit breakers ground relays set, tested and calibrated accordingly.

END OF SECTION
120711/270032

SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all outlet boxes, floor boxes, wiring devices, device plates, relays, contactors, timeswitches, fuses, mounting accessories for outlet boxes and safety switches.

B. Submit detailed shop drawings including dimensioned plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature for all component parts for transformers, relays, time clocks, and photocells.

PART 2 - PRODUCTS

2.01 OUTLET AND JUNCTION BOXES

A. Flush or concealed outlet and junction boxes: Pressed steel, hot-dip galvanized, knockout type with conduit entrances sized to match conduits. Provide boxes of proper code size for the number of wires or conduits passing through or terminating therein, but in no case shall box be less than 4 inches square by 2 1/8-inch deep, unless specified elsewhere or noted otherwise on the drawings. Provide extension rings on flush outlets to finish flush with finished surfaces. Boxes installed in concrete shall be U.L. approved for installation in concrete, and shall allow the placing of conduit without displacing reinforcing bars.

1. Provide fixture supporting device in outlet boxes for surface mounted fixtures as required.

2. Provide solid gang boxes for three or more switches, for mounting behind a common device plate. Provide barriers for all 277 volt devices where more than one device is installed in an outlet box.

3. Intrusion detection outlets and television wall outlets: 4-11/16-inch square by 2-1/8-inch deep with single-gang ring. Television boxes containing directional couplers shall be 8” x 8” x 6”D.

4. Computer and telephone outlets: 4-11/16-inch square by 2-1/8-inch deep with a 1/2-inch (minimum) single-gang plaster ring.

B. Surface mounted outlet boxes: Cast iron type FS or FD, with threaded hubs as required. Provide plugs in all unused openings. Provide weatherproof gaskets for all exterior boxes.

2.02 FLOOR BOXES AND OUTLETS

A. Boxes in wooden floors or in concrete floors 3 inches thick or less shall be rectangular and concrete-tight with leveling screws, cast iron body, and brass flange.

1. Single-gang: Hubbell B-2414 or Walker 880CM1
2. Two-gang: Hubbell B-4214 or Walker 880CM2
3. Three-gang: Hubbell B-4314 or Walker 880CM3

B. Boxes in concrete floors 3 inches thick or greater shall be rectangular and concrete-tight with cast iron body, brass flange, leveling screws, and adjustment mechanism to permit leveling of the box after the concrete pour:

1. Single-gang: Hubbell B-2436 or Walker 880CS1
2. Two-gang: Hubbell B-4233 or Walker 880CS2
3. Three-gang: Hubbell B-4333 or Walker 880CS3

C. Floor box covers shall be rectangular brass and shall be provided on each floor box.

1. Pedestal Outlet: Hubbell S-2425 or Walker 829CK-1
2. Duplex receptacle: Hubbell S-3825 or Walker 828R
3. Single receptacle: Hubbell S-3425 or Walker 829CK
4. Signal system outlet: Hubbell S-2625 or Walker 829CK-1

D. Carpet flanges shall be rectangular brass and shall be provided on each floor box.

1. Single-gang: Hubbell SB-3083 or Walker 817C
2. Two-gang: Hubbell SB-3084 or Walker 827C
3. Three-gang: Hubbell SB-3085 or Walker 837C

E. Boxes in a stage/platform wood flooring system shall be rectangular, 2 13/16-inch deep maximum, with leveling screws, shallow formed steel body, bottom knockouts, and brass flange.

1. Single-Gang: Hubbell B-2429 or Walker 880M1
2. Two-Gang: Walker 880M2
3. Three-Gang: Walker 880M3

F. Recessed Combination Power/Signal Floor Box

1. Floor box shall be cast iron, U.L. listed for concrete installation with leveling screws. Walker "Resource" RFB4-CI Series or equal.

2. Floor box shall be listed for thru wiring.

3. Floor box shall contain four independent, barriered wiring compartments.

4. Overall dimensions shall not exceed 14½-inch long x 11-7/8-inch wide x 3½-inch deep.

5. Box cover shall be flush with floor and shall provide wire/cable egress points through cover notches. The trim and cover shall be of metal composition. Covers shall be hinged. Walker RAKMTR-BUFF Series or equal.

6. Unit shall include two duplex receptacles as herein specified and two signal system outlets. Walker CIHT-D and CILT-2T.

7. Activation assemblies shall include device mounting brackets, access plates, gommets, partitions, adjusting rings and all associated hardware.

G. Flush duplex convenience receptacle in a cast iron floor box as herein specified shall be grounding type, 125 volts, 20 amperes, and shall have two current carrying contacts and one grounding contact which is internally connected to the frame. Receptacle shall be P & S, Leviton, or Hubbell #5342, Sierra #1460 or Leviton #5014, with standard length mounting strap as required by the manufacturer of floor box being furnished.

H. Flush floor microphone and projector outlet shall be installed in a cast iron floor box as herein specified.

2.03 SHEET STEEL PULL BOXES

A. Sizes as indicated on the drawings and in no case of less size or material thickness than required by the governing code.

1. General purpose sheet steel pull boxes: Install only in dry protected locations with removable screw covers. Manufacturer's standard baked enamel finish.

2. Weatherproof sheet steel pull boxes: Fabricate of code gauge, hot-dip galvanized steel with gasketed weathertight cover of same material. Manufacturer's standard baked exterior enamel finish.

3. Concrete pull boxes: After cables have been pulled and inspected, seal box between cover and frame with a mastic compound similar to Parmagum or Dukseal.

2.04 CONCRETE PULLBOXES 2'-O-inch X 3'-0-inch AND LARGER

A. Pullboxes shall be reinforced concrete with concrete bases and conduit knockouts on all walls.

B. Each concrete precast section shall be identified by having the manufacturers name and address cast into an interior face or permanently attached thereto. Associated Concrete Products-Quikset, Brooks Products or equal.

C. Pullboxes shall be provided one precast concrete 6-inch extension grade ring "tongue and groove" mating surfaces to insure rigid assembly.

D. Pullbox sizes shall be as indicated on drawings but in no case less than required by applicable codes. Minimum depth of the pullbox shall not be less than 30".

E. Provide floor sump extending through the concrete floor into the gravel bedding below the pullbox. Provide cast iron grate over sump. Provide minimum of 18 to 24 inches of gravel at bottom of vault for drainage.

F. Cover and frame assemblies:

1. Traffic rated cover shall be hot dip galvanized steel flush fitting with threaded flush, slotted head, stainless steel studs.

2. Top ring frame shall be hot dip galvanized steel angle frame where the pullbox is installed in paving or concrete work. Assembly shall be rated for H-20 bridge loading.

3. Top ring frame shall be armor bank type where the pull box is installed in exposed earth or landscaping. Assembly shall be rated for H-10 loading.

4. Covers for 2'-0" x 3'-0" pullboxes shall be a single plate assembly Quikset TE-1000 series or equal.

5. Covers for 3'-0" x 5'-0" pullboxes shall be a double leaf, torsion spring-assisted hinged assembly. Quickset TL-400 Series or equal.

6. Covers shall be permanently marked in the cover metal as follows:

a. "Electric" for covers on structures containing power circuits

b. "Signal" for covers containing signal circuits.

G. Furnish complete with galvanized pull irons, cable racks, hooks and porcelain insulator cable cradles.

2.05 CONCRETE PULL BOXES SMALLER THAN 2'-0" X 3'-0"

Boxes shall be reinforced concrete with base and drainage sump. Provide traffic steel bolt down cover permanently marked. Provide minimum of 18 inches of gravel at bottom of vault for drainage.

2.06 SWITCHES

A. Provide circuit switches totally enclosed, bakelite or composition base, toggle type with 277 volt A.C. rating for full capacity or contacts for incandescent or fluorescent lamp loads. Switch ratings shall be 20 ampere only. Color as selected by Architect. Switches controlling circuits connected to emergency power shall be red.

B. Where switches are mounted in multiple gang assembly and are operating at 277 volts and/or 277 volts and 120 volts mounted in same outlet box, there shall be a barrier installed between each switch.

C. Switches shall be any of the following products. Catalog numbers shown below are to establish the quality of the device only and are not necessarily the color required by the Architect.

1. Single Pole Switches

Make	Toggle Type 20 Amps	Lock Type 20 Amps
Hubbell	#1221	
P & S	#20AC1	#20AC1-KL
Sierra	#5021	
Leviton	#1221	
General Electric	#GE-5951	

2. Double Pole Switch

Hubbell	#1222	
P & S	#20AC2	#20AC2-KL
Sierra	#5022	
Leviton	#1222	
General Electric	#GE-5952	

3. Three-Way Switches

Hubbell	#1223	
P & S	#20AC3	#20AC3-KL
Sierra	#5023	
Leviton	#1223	
General Electric	#GE-5953	

4. Momentary Contact Switches - 20A at 277V

Make	3-Position Toggle Type	3-Position Lock Type
Hubbell	#1557	
P & S	#1251	#1251-KL

Sierra	#5120
Leviton	#1251
General Electric	#GE-5935

5. Maintained Contact Switches (Double Throw, Center Off), 20A at 277V.

Make	Toggle Type		Lock Type	
	1-Pole	2-Pole	1-Pole	2-Pole
P & S	#1225	#1226	#1225-KL	#1226-KL
Hubbell	#1385	---		
Sierra	#5122	---	.....	---
Leviton	#1385	#1386	.....	---
General Electric	#5957	---	.....	---

6. Pilot lights used in conjunction with circuit switches shall be neon type with red jewel, P & S #2151 Red (120 volt) or approved equal.

2.07 DIMMER SWITCHES

A. Dimmer switches shall be as indicated herein unless specifically noted otherwise on the drawings.

B. Dimmer cover plate shall be the same color as switch cover plates in the same area.

C. Dimmer switches shall be self cooling and shall not require forced air cooling when individually or gang mounted. All dimmers shall be by the same manufacturer and the same appearance.

D. Dimmers shall include "RF" filters and be voltage stabilized.

E. Incandescent lighting wall dimmer switches shall be color as selected by Architect and shall be the following products:

1. 120 volt lighting fixtures:

   a. Lutron: #N-2000
   b. Prescolite: #HT20

2. Low voltage incandescent light dimmers shall be specifically designed for dimming low voltage light fixture transformers. Lutron or equal.

2.08 RECEPTACLES

A. All receptacles in flush type outlet boxes shall be installed with a bonding jumper to connect the box to the receptacle ground terminal. Grounding through the receptacle mounting straps is not acceptable. The bonding jumper shall be sized in accordance with the branch circuit protective device as tabulated herein under "Grounding". Bonding jumper shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws 6-32 or larger (except isolated ground receptacles). For

receptacles in surface mounted outlet boxes direct metal-to-metal contact between receptacle mounting strap (if it is connected to the grounding contacts) and outlet box may be used. Color as selected by Architect. Catalog numbers shown below are intended to establish the quality of the device only and are not necessarily the color required. Receptacles connected to emergency power circuits shall be red. Receptacles with white plastic coverplates shall be white. Receptacles with stainless steel coverplates shall be gray.

B. Duplex convenience receptacles shall be grounding type, 120 volt, 20 ampere, and shall have two current carrying contacts and one grounding contact which is internally connected to the frame. Outlet shall accommodate standard parallel blade cap and shall be side wired.

1. P & S #5362.
2. Leviton #5362.
3. Hubbell #5362.
4. Sierra #1460.
5. General Electric #GE-4108.

C. Ground fault convenience receptacles: Provide separate ground fault receptacle at each location indicated on drawings.

1. Leviton #6898
2. Hubbell #GF5362
3. P & S #2091-S

D. Weatherproof receptacle: Ground fault type duplex receptacle, mounted in a flush hinged door enclosure with lock and key. Enclosure shall be a P & S #4600-26 with a P & S #1591 receptacle or equal by C.W. Cole. On roofs weatherproof ground fault type receptacle as herein before specified, installed in "FS" box with one of the following spring door type covers:

1. P & S #4511
2. Hubbell #RCV1-GFR

E. Special outlets shall be as indicated on the drawings.

2.09 PLATES

A. Provide 0.04-inch brushed stainless steel coverplates for every switch, receptacle, telephone, television, microphone, and speaker jack outlet unless indicated otherwise. All plates shall be Type 302 alloy composed of 18% chromium and 8% nickel. Plates shall be manufactured by P & S, Hubbell, Leviton, General Electric or equal.

B. Coverplates for computer outlets shall be white plastic per Sectin 16750.

2.10 VANDALPROOF FASTENINGS

Provide approved vandalproof type screws, bolts, nuts where located outdoors throughout the project. Provide District with six (6) screwdrivers for tamperproof screws.

2.11 STRUCTURAL AND MISCELLANEOUS STEEL

Structural and miscellaneous steel used in connection with electrical work and located out-of-doors or in damp locations, to be hot-dip galvanized unless otherwise specified. Included are underground pull box covers and similar electrical items. Galvanizing average 2.0 ounce per square foot and conform to ASTM A123.

2.12 FLASHING ASSEMBLIES

Provide Semco Fig. #1100-4 Series or equal by Oaty lead flashing assemblies at all roof penetrations. Seal the joint between flashing and pipe with waterproofing compound.

2.13 RELAYS AND CONTACTORS

A. Individual Control Relays (HVAC/Plumbing Control Functions)

1. Individual control relays shall have convertible contacts rated a minimum of 10 amperes, 600 volts regardless of usage voltage. Coil voltage, number and type of contacts shall be verified and supplied to suit the specific usage as shown in the wiring diagrams and/or schedules on the electrical, mechanical and plumbing specifications and drawings. Coil control circuit shall be independently fused, sized to protect coil. Relays shall be installed on prefabricated mounting strips. Each relay shall have a surge supreme to limit coil transient voltages. Furnished in the NEMA Type I enclosure unless indicated otherwise.

2. The following relays are approved:

Manufacturer	Type
Cutler-Hammer	M-600
General Electric	CR120BP
Square D Co.	Class 8501, Type X
Westinghouse	AR
Allen Bradley	700N

B. Contactors and/or Relays

1. Contactors and/or relays for control of lighting and/or feeders and/or panels shall be 600 volt A.C., electrically operated, mechanically held units, open type for panel mounting with number of poles and of size as indicated on the drawings. Provide auxiliary control relay for operation of each contactor and/or relay with a two-wire and/or three wire control circuit as described on the plans.

2. Contactors and/or relays shall be mounted in panelboards in barriered section under separate hinged lockable doors or in contactor and/or relay cabinets as called for on the drawings. Contactors and/or relays shall be installed on sound absorbing rubber mounts.

3. Contactors and/or relays shall be Automatic Switch Co. (ASCO) Bulletin #920 Series for 2 and 3 pole, and Automatic Switch Co. Bulletin 917 Series for contactors and/or relays containing 4 or more poles. Coil control circuit shall be independently fused, sized to protect coil.

4. Contactors and/or relays shall be equipped with a switch, in the proper configuration, to disconnect the control circuit controlling the coil of the respective device. Control circuit disconnect switch shall be labeled showing function of device.

2.14 TIMESWITCHES AND PHOTOCELLS

A. All timeswitches shall have synchronous motor drive for operation on 120 or 277 volts, 60 Hertz, A.C. and shall be furnished with a ten-hour, spring-driven, reserve-power motor. Contacts shall be rated 40A per pole.

1. Timeswitches for HVAC or plumbing control shall be 7 day, 24 hour with day-omitting device, DPST, Tork T902L Series or equal by Paragon or Intermatic.

2. Timeswitches for lighting control shall be Astronomic, 7 day, 24 hour with day-omitting device, DPST, Tork T902L series or equal by Paragon or Intermatic.

B. All timeswitches shall be mounted in NEMA surface lockable enclosures unless indicated otherwise.

C. Photocell with rating of 2000 watts, 16.6 amps, 120V, 60Hz AC. Suitable for -30°F to 158 °F and weatherproof. Load to remain "ON" in case of cell failure and a time delay of 15 seconds Tork 2001/2002 Series or Paragon CW201 Series or equal unless herein specified otherwise, photocell to face north.

2.15 SAFETY SWITCHES

Switches shall be rated 600 or 250 volt A.C. as applicable, NEMA Type HD, quick-make, quick-break, h.p.- rated, nonfusible or fusible, Class "R", in NEMA Type I enclosure, lockable in the "open" and "closed" positions with number of poles and amperage as indicated on the drawings. Where enclosure is located exterior, in kitchens, at HVAC and plumbing equipment, where water is present or indicated W.P. (weatherproof) switches shall be raintight NEMA Type 3R enclosure, lockable. Maximum voltage, current and horsepower rating clearly marked on the switch enclosure and switches having dual element fuses shall have rating indicated on the metal plate.

2.16 TRANSFORMERS

A. Provide dry type transformers constructed to meet Underwriters' Laboratories Specification UL 506 and tested in accordance with USAS I and NEMA Standards. Performance on transformers equal to or better than ANSI, NEMA, IEEE and N.E.C. published criteria. Insulation shall be U.L. Class 220°C.

B. All transformers shall have a grounded electrostatic aluminum shield between the primary and secondary windings to attenuate common mode and transverse mode electrical noise. Transformer shall be U.L. listed K-4 for high harmonic non-linear loads per IEEE C57.110. Temperature rise shall be 115°C in 40°C ambient at 100% continuous KVA rating. Provide lugs and/or bus structures to accommodate all line and load side conductors indicated.

C. Transformers shall be equipped with four 2-1/2% full capacity taps, 2 above and 2 below normal voltage. Primary and secondary terminals to be accessible, located behind removable front cover plate.

D. Transformers mounted per Korfund Literature for weight of transformer, and connected by one of the following methods:

   1. Underfloor conduit resulting in no rigid connections to transformer. (Use ground strap for equipment ground.)

   2. Sealtite flexible conduit. (Use ground wire for equipment ground.)

   3. Pullbox or wireways from transformer which are isolated from transformer with an approved sound absorbing neoprene basket. (Use ground strap for equipment ground.)

E. Transformers shall be anchored as indicted.

F. Test Requirements: The transformers furnished to this specification shall be subjected to the following production tests:

   1. Applied Potential

   2. Induced Potential

   3. No Load Loss

   4. Voltage Ratio

   5. Polarity

   6. Continuity

G. The manufacturer shall have performed the following additional tests on units identical to the design type being supplied to this specification. Proof of performance of these tests in the form of test data sheets shall be provided at the time shop drawings are submitted for approval.

1. Sound Levels

2. Temperature

3. Full Load Losses

4. Regulation

5. Impedance

H. Transformer shall contain a built-in vibration dampening system to minimize and isolate sound transmission.

I. Sound levels shall be guaranteed by the manufacturer not to exceed the following values:

9 KVA and below	40 db
10 KVA to 50 KVA	45 db
51 KVA to 150 KVA	50 db
151 KVA to 300 KVA	55 db
301 KVA to 500 KVA	60 db

J. Transformer windings shall be copper or aluminum.

K. Transformers shall be manufactured by the same manufacturer as the main switchboard – Westinghouse, Siemens, General Electric, or Square D Co.

2.17 PLYWOOD BACKBOARDS

A. Plywood backboards shall be 3/4 inch thick marine "A-C" grade. Provide backboard on the wall for equipment racks, incoming cable raceways and terminal blocks. Plywood shall extend from the finish floor to 8 ft. above the finish floor. "A" side of plywood shall be exposed and painted. Attach plywood to wall structural framing with mechanical fasteners a minimum 6 inches on center vertically on walls at each framing vertical member, and along the length of the wall, but not less than 16 inches on center horizontally along the length of the wall.

2.18 CONCRETE WORK

A. Prepare concrete for use as electrical equipment footings, lighting pole bases and equipment slabs on grade, in accordance with pertinent sections of Specification Section 03300.

B. Non-reinforced concrete for duct/conduit encasement shall be 2.00 sacks (94 pounds each) of cement per cubic yard of 3/8" pea gravel with sufficient water to make a workable slurry mix. Provide a minimum of ten (10) pounds of red oxide concrete coloring powder per cubic yard of slurry.

2.19 TRANSIENT VOLTAGE SURGE PROTECTOR (TVSS)

A. General

1. The unit shall be modular in construction and operate in parallel with 60 H.Z. A.C. line voltage, four (4) wire or five (5) wire, grounded or ungrounded systems, as applicable; voltage, KVA and ampere capacity as indicated on the drawings. Suitable for connection through a external circuit breaker or combination switch/fuse protective device rated 30 ampere, continuous duty, rated for Service Entrance equipment connection.

2. The unit shall operate correctly with any combination of resistive, inductive, or capacitive loads. The unit shall automatically shunt to ground the electrical transients and EMI/RFI noise occurring above the specified values. The unit shall automatically reset after transient condition has passed. Operating temperature - 40° centigrade to 85° centigrade.

3. Provide one or more individual self-contained protection module(s) for each line voltage phase, plug-in type. Provide one spare individual plug-in protection module. Provide incoming line, neutral and ground conductor termination lugs rated CU/AL #14 thru #4 AWG. Lugs shall be barriered from and prewired to the respective protection modules.

4. Provide a NEMA 12 housing to contain all unit modules, devices and conductor terminations. The housing shall include a hinged padlockable door. Surface mounted, with conduit entrance knockouts. Maximum housing size shall not exceed 36" wide x 72" high x 8" deep.

5. As manufactured by EFI Corporation Model #MXPB/TVSS; MCG Electronics; Current Technology; Liebert or equal.

B. Operational Characteristics

1. Transient voltage protection, testing, listing and certification.

   a. UL 1449 (latest edition) and CSA, for Transient Voltage Surge Suppresser, UL 1283 for transient voltage electrical noise attenuation, ANSI/IEEE C62.45, C62.1 for C62.41, (latest edition) transient clamping voltages for both Normal Mode and Common Modes against Category A & B ring wave and Category B impulse wave.

   b. The unit connected to the service entrance shall also withstand a minimum of 1000 sequential ANSI/IEEE C62.41 Category C surges without failure following IEEE test procedures in C62.1, C62.41 and C62.45.

2. Transient voltage protection, EMI noise rejection, and RFI noise rejection shall be provided for Common Mode (line-to-neutral), Normal Mode (line-to-line) and neutral to ground.

3. EMI and RFI noise rejection.

   Conducted line noises interference both electromagnetic (EMI) and radio frequency (RFI) shall be reduced by the unit over a continuous spectrum of 0.5 MHz to 1.0 MHz. The basis for reduction shall be a standardized 50-OHM insertion loss MIL -STD-220A test. Provide spectrum analysis test dB attenuation reports showing RFI filtering over specified frequencies. Test data based on calculated or computer simulation is not acceptable.

4. Three phase and grounded "WYE" performance requirements.

Characteristics	208/120 Volt	480/277 Volt
a. Nominal line to line	208 Volt	480 Volt
b. Nominal line to neutral	120 Volt	277 Volt
c. Internal capacitance (Microfarads)	2.5	2.5
d. Maximum response time	1-nanosecond	1-nanosecond
e. EMI/RFI noise rejection	25-35DB	25-35DB
f. Nominal peak clamp Voltage line to neutral and line to ground	205 Volts	330 Volts
g Minimum transient energy dissipation per phase (at 8 x 20 microseconds (waveform)	1000 Joules	1500 Joules
h. Peak transient withstand (at 8 X 20 microseconds waveform) without failure of the unit	50000 Amp	60000 Amp
1. Category-C3	80,000Amp	100,000Amp
2. Category-B3	60,000Amp	80,000Amp
3. Category-A3	50,000Amp	60,000Amp

C. Diagnostic indicators

1. Shall display the "Normal" and "Fault" status of each line suppression circuit, along with protection circuit "on" indication.

2. Shall provide a sonic audible fault alarm with silence push-button.

D. Surge Suppressor Protection Categories

1. Surge protectors shall comply with ANSI C62.41 (Latest Revision) Standard Protection Categories for "impulse" and "ringwave" transients, based on the installation locations shown in the contract documents.

a. Service entrance, main switchboard or substation locations - Category "C3", high exposure.

b. Mid building, distribution panels, distribution panels over 400 ampere main bus rating locations - Category "B3", high exposure.

c. Branch circuit panelboards 400 ampere or less main bus rating - Category "A3", high exposure.

PART 3 - EXECUTION

3.01 OUTLET AND JUNCTION BOXES

A. Accurately place boxes and securely fasten to structural members. Where outlets are shown at same location but at different mounting heights, install outlets in one vertical line. Where outlets are shown at same location and mounting height, mount outlets as close together as possible. Where switches and receptacles are shown at the same location and mounting height, mount in common outlet box with barriers between devices. Where switches are shown on wall adjacent to hinge side of doors, box shall be installed to clear door when door is fully opened.

B. Flush mounted boxes shall be attached to two studs or structure members by means of metal supports so that all boxes are rigid with no deflection under 100 lb horizontal force. On wood construction, provide 2" x 4" blocking between studs in lieu of metal supports.

C. Boxes above accessible ceilings shall be attached to structural members. Where boxes are suspended, they shall be supported independently of conduit system by means of preformed steel channels. Boxes shall be supported independently of all piping, duct work, equipment, ceiling hanger wires and suspended ceiling grid system.

D. Where surface exposed conduit is connected to an outlet box, the outlet box shall be surface mounted.

E. Surface mounted outlets shall be attached to concrete or masonry walls by means of expansion shields.

F. Floor boxes shall be installed square and level with finish floor and within adjustable limits of floor ring. Where outlets are shown at same or adjacent location, use recessed combination power/signal floor boxes.

G. Floor boxes installed in stage/platform wood flooring systems shall be set on top of the concrete slab and adjusted to the finish height of the floor. Provide blocking around box perimeter to prevent the wood floor from deflecting around the box.

H. Outlet boxes installed flush in walls shall be horizontally separated by not less than 24 inches from device outlet boxes and rings in common wall surfaces located on the opposite (back) side of the same wall. Where the separation cannot be maintained, provide a solid backing behind the outlet box. The backing shall extend the width of the wall cavity (i.e. between "Studs" or masonry cells) behind the box and 12 inches above and below the outlet box center line. The backing shall consist of 5/8 inch thickness gypsum board anchored in place for "stud" wall construction and solid "mortar" to completely fill the outlet box "cell" in masonry construction.

I. Provide pullboxes, pulling ells, junction boxes, and condulets on metallic conduit runs whose total number of bends is 360 degrees or greater. Pulling and splicing enclosures shall be located in accessible ceiling spaces unless noted otherwise.

3.02 CONCRETE PULLBOXES

A. Excavate for installation of precast structures remove excess excavated material from the site. Saw cut existing paving and concrete as required for excavation.

B. Provide a minimum of 36" deep bedding base of crushed rock 3/8" - 1/2" size in the bottom of the excavation. Bedding shall be level and well compacted by a minimum of four passes with a plate type mechanical vibrator.

C. Back fill and compact earth around precast structure after installation of the structure to 90% minimum compaction in 12" lifts. Replace paving concrete, landscaping above structure to match existing.

D. Install precast structures per manufacturers recommendations to provide a dry watertight installation. Set cover flush with existing grade or finish surface. Where precast structure is installed in pedestrian walkway or vehicular traffic way with a sloping finish grade. Slope cover to match existing.

E. Install structures to avoid surface water drainage flow lines, and existing utilities.

F. Entrances of conduits/ducts shall terminate with endbells inside the precast structure.

3.03 SWITCHES AND RECEPTACLES

Install all receptacles and switches securely to the backbox or wall surface, using the device strap mounting screws. Provide adequate wall surface or extension rings, where required to properly support the mounting strap. Use of the coverplate screws to support the device is not acceptable.

3.04 DIMMER SWITCHES

A. Do not break off dimmer cooling fins.

B. Large dimmers shall be surface wall mounted at the location indicated on the drawings.

3.05 GROUNDING (ADDITIONAL REQUIREMENTS)

A. Grounding shall be executed in accordance with all applicable codes and regulations, both of the State of California and local authorities having jurisdiction.

B. Each pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

C. The maximum resistance to ground shall not exceed 5 ohms.

3.06 CONCRETE WORK

A. Concrete work shall be executed in accordance with all applicable codes and regulations of the California Code of Regulations, Title 24, Part 2, Chapter 26.

B. Mixing: Use batch machine mixer for concrete used for duct encasement of approved type. After ingredients are in mixer, mix for at least 1-½ minutes.

D. Transit Mixing: In lieu of mixing at site, transit mixing may be used if rate of delivery, haul time, mixing time, and hopper capacity is such that concrete delivered will be placed in forms within 90 minutes from time of introduction of cement and water to mixer.

3.07 TESTING (ADDITIONAL REQUIREMENT)

A. Perform excitation test on dry type transformers. Energize primary winding with system voltage. Measure secondary voltage with the secondary wiring disconnected.

B. Verify transformer taps and connect transformer to desired tap.

C. Inspect for physical damage, broken insulation, tightness of connections, defective wiring and proper mounting.

3.08 TIMESWITCHES

A. Set all timeswitches per direction of the District.

END OF SECTION
120711/270032

SECTION 16111
CONDUIT AND WIRE

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all wire, conduit, fittings and splicing materials.

B. Submit redrawn site plans, indicating the proposed conduit routing with the proposed depths and widths of the trenches for coordination with the other trades.

C. Submit redrawn building foundation plans indicating the proposed conduit routing with the proposed depths and widths of the trenches for coordination with structural pads, footings, grade beams and other elements.

D. Trenching shall not commence until these drawings have been prepared, reviewed, coordinated and agreed upon by the Contractor and all other contractors whose work is affected by underground conduits.

PART 2 - PRODUCTS

2.01 CONDUIT

A. GENERAL

1. The interior surfaces of conduits and fittings shall be continuous and smooth, with a constant interior diameter. Conduits and conduit fittings shall provide conductor raceways of fully enclosed circular cross section. The interior surfaces of conduits and fittings shall be without ridges, burrs irregularities or obstructions. Conduits and fittings of the same type shall be of the same uniform weight and thickness.

2. Type of conduit, type of conduit fittings and conduit supports shall be suitable for the conditions of use and the conditions of location of installation, based on the manufacturer's recommendations and based on applicable codes.

3. All fittings for metal conduit shall be suitable for use as a grounding means, pursuant to the applicable code requirements. All metal conduit and metal conduit fittings shall provide 3 second duration ground fault current carrying ratings, when installed and connected to the respective conduit, as follows:

    a. RMC and EMT conduit fittings.

        1) 0.75 inch through 1.5 inch conduit/fitting size - 10,000 ampere RMS.

        2) 2.0 inch and larger conduit/fitting size - 20,000 ampere RMS.

    b. FMC and LTFMC Conduit Fittings

        1) 0.75 inch through 1.25 inch conduit/fitting size-1,000 ampere RMS (without external bonding jumper).

        2) 1.5 inch through 4.0 inch fitting size-10,000 ampere RMS with bonding jumper.

4. Protective corrosion resistant finish for metal conduit fabricated from steel and metal conduit fittings fabricated from steel, shall be as follows:

    a. Clean all metal surfaces (including metal threads) with acid bath “pickle” prior to coating, to remove dirt, oil and prepare surfaces for galvanizing.

    b. Hot-dip galvanized zinc coating on all interior and exterior steel surfaces. Minimum finish zinc coating thickness shall not be less than 0.002 inches.

    c. Threads shall be hot-dip zinc coated after machine fabrication.

    d. Exterior metal surfaces shall be finished with clear organic polymer topcoat layer, after galvanizing.

    e. The inner metal surfaces shall be finished with a lubricating topcoat after galvanizing, to facilitate conductor pulling through the conduit/fitting.

5. Threads for metal conduit and metal conduit fittings shall be taper-pipe-thread, National Pipe Standards(NPS) and shall comply with ANSI-B1.20.1.

6. Metal conduit termination connector fittings shall be provided with a manufacturer installed, insulating throat bushing inside the fitting. The bushing shall protect the wire conductor insulation from cutting, nicks and abrasion during conductor installation and electrical load “cycling” after installation is complete. The bushing shall comply with UL 94V-0 flammability.

7. Provide conduit bonding/grounding jumper from metal enclosures with “concentric ring” knockouts, to positively ground/bond each respective conduit(s) to the metal enclosure.

8. Conduit fittings connecting to PVC coated conduit shall be PVC coated to match the conduit.

B. Rigid metal conduit (RMC)

1. Rigid metal, round tubing, machine threaded at both ends.

   a. The conduit and conduit fittings shall comply with the requirements for a equipment grounding conductor, pursuant to applicable codes.

   b. The conduit shall be watertight and airtight without cracks and pinholes.

2. RMC raceway types shall be as follows:

   a. Rigid galvanized steel conduit (RGS), minimum yield strength shall be 35,000 PSI. Shall comply with NEMA standard 5-19 (latest revision); ANSI C80.1 and ANSI-C80.4 (latest revision); U.L. 514-B and UL 6 (latest revisions); National Pipe Standard Specification (latest revision).

   b. Intermediate steel conduit (IMC). Shall comply with NEMA Standard 5-19 (latest revision) ANSI-C80.6 (latest revision); UL 2142 (latest revision).

3. RMC Fittings

   a. Fittings shall be compatible with RGS and IMC.

   b. Fittings shall be rated “liquid tight”.

   c. Fittings imbedded in concrete shall be rated “liquid tight” and “concrete tight”.

   d. Connectors and couplings for terminating, connecting and coupling to RMC conduit shall be threaded metal.

   e. Fittings shall comply with ANSI C80.4 and ANSI C33-84 (latest revision); NEMA FB1 (latest revision); UL 514 (latest revision).

   f. Conduit Seal Fittings

      1) Conduit seals shall prevent the passage of gasses, liquids and vapors past the location of the seal installation in the conduit.

      2) Conduit seals shall be suitable for installation in both vertical and horizontal conduit locations.

      3) Conduit seals shall be visible and accessible for inspection after installation is complete.

      4) Conduit seals shall be rated for the following locations:

         a) Wet locations
         b) Classified hazardous locations materials NEC Class 1 Division 1.
         c) Temperature ranges from 0 [minus 20] degrees centigrade through 90 degrees centigrade.

5) Conduit seals, sealing compound and sealing compound dam shall be the product of the same manufacturer.

4. RMC Fittings as manufactured by:

a. For threaded enclosure, termination connection.

1) Thomas & Betts - 106 Series bonding locknut, 5302 series sealing ring with stainless steel retainer.

b. For non threaded enclosure, termination connector.

1) Thomas & Betts - 370 Series watertight threaded sealing hub, 106 series threaded bonding lock nut, Sta-Con Series enclosure bonding jumper and 3870 Series threaded ground bushing.

2) OZ/Gedney-CHMT/CHT watertight threaded hub with bonding locknut and GH50G Series enclosure bonding jumper.

c. For RMC to RMC conduit-to-conduit coupling

1) Erickson - 674 (threaded) Series

2) OZ/Gedney Type 4 (threaded) Series

3) Threaded RMC conduit couplings, product of the same manufacturer as the RMC conduit.

d. For RMC Conduit Seals

1) OZ/Gedney-EYA and EYAM (threaded) Series

2) Appleton-EYF and EYM (threaded) Series

C. Electrical Metallic Tubing (EMT)

1. Rigid metal round tubing, “thin wall” steel construction, with non-threaded ends.

a. The conduit and conduit fittings shall comply with the requirements for a equipment grounding conductor pursuant to applicable codes.

b. The conduit shall be watertight and airtight without cracks and pinholes.

2. EMT shall be allowed for conduit size ranges from 0.5 inch through 3.0 inch.

3. Comply with ANSI C80.3, C80.4, and ANSI C33.98 (latest revisions); UL 594 and UL 797 (latest revisions); CEC Section 12500 (latest revision).

4. EMT Fittings

    a. Connectors and couplings for terminating, connecting and coupling to EMT conduit, shall be non-threaded metal.

    b. EMT termination connector fittings shall be as follows:

        1) Set screw type “concrete tight” when installed in dry interior locations.

        2) Compression type “raintight” and “concrete tight” when installed in wet or damp locations, outdoors and in concrete or masonry construction.

    c. Fittings shall comply with ANSI C33.84 (latest revision); UL 514 (latest revision); NEMA FB-1.

5. EMT Fittings as manufactured by:

    a. For threaded and non threaded enclosure, termination connector

        1) Thomas & Betts-TC5031 (set screw type) Series (with locknuts).

        2) OZ/Gedney-4000ST (set screw type) Series.

        3) Thomas & Betts-5123 (compression type) Series (with 2 locknuts).

        4) OZ/Gedney-7000ST (compression type) Series (with locknut).

        5) Thomas & Betts-4240 (compression type) Series (90 degree angle with locknut).

        6) OZ/Gedney-8000WT (compression type) Series (90 degree angle with locknut).

    b. For EMT to EMT conduit-to-conduit coupling:

        1) Thomas & Betts-TK121 (set screw type) Series (with locknut).

        2) OZ/Gedney-5000 (set screw type) Series (with locknut).

        3) Thomas & Betts-5120 (compression type) Series.

        4) OZ/Gedney-6000S (compression type) Series.

    c. For EMT to RMC conduit to conduit combination coupling:

        1) Thomas & Betts-HT221 (set screw type) Series.

        2) OZ/Gedney-ESR (set screw type) Series.

3) Thomas & Betts-530 (compression type) Series.

4) OZ/Gedney-ETR (compression type) Series.

D. Flexible Metal Conduit (FMC):

1. Round flexible conduit, fabricated from a single continuous steel strip. The steel shall be factory formed into continuous interlocking convolutions to form a complete lock between steel strips and provide raceway flexibility.

2. Metal to metal grounding contact shall be maintained throughout the length of the FMC conduit.

3. FMC shall be allowed for conduit size ranges from 0.75 inch through 3.0 inch.

4. FMC shall comply with ANSI-C.33.84 and ANSI C33.92; NEMA FB-1; CEC 12-1100.

5. FMC Fittings

   a. FMC fittings shall be malleable iron construction or steel construction.

   b. Fitting shall automatically cause the FMC raceway throat opening to be centered with respect to the fitting throat opening.

   c. Straight and angled connector termination fittings shall be threaded on one end and shall include a threaded locknut, suitable for connection to threaded and unthreaded enclosures.

   d. The attachment of the fittings to FMC shall be angled saddle type, to engage and interlock with the FMC spiral groove, and shall be unaffected by vibration. Direct bearing screw type fittings shall not be used.

   e. Direct FMC conduit-to-FMC conduit coupling of FMC shall not be permitted.

   f. Shall comply with ANSI C33.9, and ANSI C33.92 (latest revision); NEMA FB1 (latest revision); U.L. 514.

6. FMC connectors shall be Bridgeport #520-DCI/521-DCI series or equal by Efcor.

E. Liquid Tight Flexible Metal Conduit (LTFMC)

1. The metal conduit core of LTFMC shall comply with the same requirements as FMC conduit, with the addition of a thermoplastic exterior flexible jacket over the metal core.

2. The exterior jacket shall be positively locked to the metal core to prevent jacket “sleeving”.

3. The LTFMC shall be rated for installation and operating service temperatures of between 0 [minus 20] degrees centigrade through plus 90 degrees centigrade.

4. The LTFMC jacket shall be suitable for continuous exposure to sunlight, rainwater, water vapor, mineral oils and liquid solvents, without penetrating into the conduit and without deteriorating the jacket.

5. LTFMC sizes from 0.5 inch through 1.25 inches shall include an additional internal ground conductor, fabricated by the manufacturer, as a integral part of the conduit core.

6. Direct LTFMC conduit-to-LTFMC conduit coupling of LTFMC shall not be permitted.

7. LTFMC shall be allowed for conduit size ranges from 0.5 inch through 4.0 inches.

8. In addition to the requirements for FMC conduit, LTFMC shall also comply with ANSI C-33.84 (latest revision); NEMA-FB1 (latest revision); CEC 12-1400 (latest revision).

9. LTFMC fittings

   a. Fittings shall include an external mechanical ground/bond wire connector.

   b. The attachment of the fitting to LTFMC shall be threaded compression type onto the conduit core with locknut and liquid tight jacket compression seal. The fitting shall automatically prevent “sleeving” of the jacket.

   c. Straight and angled termination connector fittings shall be threaded on one end and shall include locknut suitable for connection to threaded and unthreaded enclosures.

10. LTFMC Fittings as manufactured by:

    a. Termination connector fittings:

	Straight	45 and 90 Degree Angle Connectors
1)	Thomas & Betts-5331 GR Series.	Thomas & Betts-5341GR and 5351GR Series.
2)	Appleton-STB Series; STN-L Series for use with preformed “knockouts”.	Appleton-STB-L Series; STN-L Series Series for use with preformed “knockouts”.
3)	OZ/Gedney-4QLT Series.	OZ/Gedney-4QLT Series

b. LTFMC to RMC conduit to conduit combination coupling fittings:

1) Thomas & Betts-5271 GR Series.

2) OZ/Gedney-4QFML Series

F. Rigid Non Metallic Conduit (RNMC)

1. General

a. Conduit and fittings shall be 90 degree centigrade conductor rated. Fabricated from homogeneous material, free from visible cracks holes or foreign inclusions, with integral “end-bell”. The conduit and conduit fittings shall be watertight and airtight.

b. Conduit, conduit fittings and conduit fitting assembly “solvent cement” shall all be the product of the same manufacturer. Conduit fittings shall be solvent cement welded watertight.

c. Conduit and fittings shall be identified with legible markings showing ratings, size and manufacturer’s name.

d. RNMC and fitting shall be corrosion resistant, watertight.

e. Conduit shall be suitable for conductor operating temperatures from minus 20 degrees centigrade to 90 degrees centigrade.

f. RNMC shall comply with NEMA TC-2 (PVC 40 conduit, latest revision) NEMA TC-6 (EB conduit latest revision) and NEMA TC-3 (fittings, latest revision); UL 514 and UL 651 (latest revision).

2. Polyvinyl Chloride (PVC)-RNMC

a. PVC-schedule 40 heavy wall construction.

b. PVC-schedule 80 extra heavy wall construction.

c. PVC-type EB.

G. Expansion Joint, Deflection Joint and Seismic Joint conduit fittings.

1. Expansion Conduit Fitting - Fitting shall provide for a minimum of two (2) inches straight line movement between two connecting conduits in each direction (total four (4) inches conduit expansion and contraction) parallel to the respective conduit lengths. Fitting shall be watertight.

2. Deflection Conduit Fitting - Fitting shall provide for a minimum of 30 degrees angular deflection movement (“Shear” deflection) between two connecting conduits, in any direction perpendicular to the length of the respective conduits. Fitting shall be watertight.

3. Combination Expansion/Deflection Conduit Fitting - Fitting shall provide the combined "expansion" and "deflection" movement capacity between two connecting conduits as described for separate "expansion" and "deflection" conduit fittings. Fitting shall be approved for installation concealed in both masonry/concrete construction and exposed non-masonry/concrete construction. Fitting shall be watertight.

4. Fittings shall comply with U.L.

5. Fittings as manufactured by:

   a. Conduit expansion fittings exposed or concealed locations as manufactured by:

      1) OZ/Gedney - AX8 Series for RMC conduit.

      2) OZ/Gedney - TX Series for EMT conduit.

      3) Appleton - XJ8 Series for RMC conduit and EMT conduits. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion fitting.

   b. Combination expansion/deflection conduit fittings exposed or concealed conduit locations as manufactured by:

      1) OZ/Gedney - AXDX Series for RMC conduit.

      2) OZ/Gedney - AXDX Series for EMT conduit. Provide RMC to EMT combination conduit coupling fittings for each end of the expansion/deflection fitting.

   c. Conduit expansion/deflection fittings for FMC and LTFMC conduit.

      1) Provide a minimum of 12 inches of "slack" LTFMC in each FMC or LTFMC conduit at building and structure seismic or expansion joint conduit crossings.

      2) Note: Each FMC "slack" expansion/deflection location, shall be considered as not less than a 90 degree conduit bend location, for compliance with the maximum quantity of conduit bends allowed in a raceway.

6. Conduit Fitting Bonding Jumper

   a. The grounding/bonding path of metal conduit shall be maintained by the fitting.

   b. Provide a bonding jumper at each expansion, deflection and combination expansion deflection conduit fitting.

   c. The jumper shall be a bare flexible copper "braid". The copper braid electrical current carrying capacity shall be equal to the metal conduit.

   d. Provide a factory terminated ground clamp on each end of the braid with adjusting steel conduit grounding clamps and connect to each respective conduit end.

e. The jumper braid length shall be eight (8) inches longer than the respective conduit fitting.

f. Bonding jumper for FMC and EMT fittings as manufactured by:

1) OZ/Gedney - BJ Series

2) Appleton - XJB Series

I. Conduit Bodies Conduit Fitting

1. Conduit bodies shall provide conductor access with a removable conduit body cover and wiring area enclosed in metal housing. The conduit body shall facilitate pulling conductors.

2. In-line form “C” conduit bodies shall be prohibited.

3. The interior space “length” of 90 degree “elbow” conduit bodies shall not be less than 6 times the diameter size of the largest conduit connecting to the conduit body.

4. Conduit body covers shall be removable, gasketed, watertight “domed” metal cover with threaded screw attachment to the conduit body.

5. Lubricated, reusable, wire roller guards inside the conduit body shall protect wire from insulation damage during wire “pulling”.

6. Conduit body fittings shall comply with UL 514.

7. Conduit bodies as manufactured by:

a. For RMC Conduit

OZ/Gedney - LB 6X/Mogul (90 degree elbow) Series - threaded body.

Appleton - LB/Mogul (90 degree elbow) Series - threaded body.

b. For EMT Conduit

1) Same as for RMC conduit. Provide EMT to RMC conduit combination coupling fitting for each outlet body connection.

2.02 CONDUIT SUPPORTS

A. General

1. Conduit Supports, hangers and fasteners for metal conduit shall be steel, hot dip zinc galvanized.

2. Conduit supports, hangers and fasteners for PVC coated conduit shall be PVC coated to match the conduit PVC coating.

3. Threaded hardware shall be continuous, free running threads.

4. Conduit support systems, including support channels, pipe clamps, braces, anchors, hardware, fasteners, shall be sized to support the full capacity circuit conductors weight, plus the installed conduit weight, plus the conduit fitting weight and support hardware weight, plus a 300 percent additional weight capacity safety factor.

5. Provide lock washer at each “bolted”/threaded connection.

6. Conduit supports, fasteners, channels, braces, hardware, anchors, pipe clamps and hangers as manufactured by Unistrut or Kindorf.

7. Supports shall be free of “BURRS” and sharp edges.

8. Metal supports cut in the field shall be zinc galvanized after cutting to prevent rust.

B. Conduit Hangers

1. Threaded steel hanger rods.

   a. Hanger rods smaller than 0.375 inches in diameter shall not be used for support of individual conduits.

   b. Hanger rods smaller than 0.5 inches in diameter shall not be used for support of multiple conduits.

2. Conduit hanger wires shall be not less than 12 gauge steel.

3. Conduit hangers shall attach to structure fasteners with steel “Clevis” or “Swing” hangers and shall provide a minimum of 45 degrees of angular movement in any direction at the point of the conduit hanger attachment to the structure fasteners.

4. Conduits individually suspended by conduit hangers shall fasten to the respective hangers with “Clevis” type pipe hangers. The pipe hangers shall be steel, adjustable to fit conduit size and shall completely enclose the conduit circumference.

C. Conduit support channels

1. “C” channels shall be factory preformed with a minimum 12 gauge thickness metal. The channel shall be factory “punched” with regularly spaced slotted holes for fastener attachments along the length of the channel.

2. The “C” channel shall not deflect more than 0.1 inches between channel supports at maximum installed design load, including required safety factor.

3. Channels shall comply with ANSI-1008 (latest revision) and ASTM-A569 latest revision).

4. Channels shall provide “turned lips” at longitudinal edges to hold (lock-in) fasteners.

5. Conduit support channels suspended from conduit hangers shall attach to conduit hangers with treaded connections. Provide a minimum of two hangers (trapeze style) connected to each channel.

6. Non-suspended conduit support channels shall connect to structure fasteners with threaded connectors.

D. Fasteners

1. Channel Fasteners

   a. Channel fasteners shall “prelocate” and lock into the channel ”turned lips” and channel “walls”.

   b. A separate metal strap shall “tie” each conduit to each channel with conduit channel fasteners.

2. Structure Fasteners

   a. Structure fasteners for wall and floor mounted conduit attachments shall attach to existing masonry and concrete structures with structure fasteners using drilled, mechanical, expansion shield anchors.

   b. Structure fasteners for wall and floor mounted conduit attachments shall attach to new masonry and concrete structures with structure fasteners using steel threaded inserts precast into the structures.

   c. Structure fasteners shall attach to steel structural members with “swing-beam clamps”, with set-locking screw structure fasteners. Beam clamps shall include integral safety rod, strap or “J”-hook to secure the clamp to the beam flanges on both sides of the beam.

   d. Structure fasteners for wall and floor mounted conduit attachments shall attach to wood structural members with flush “through-bolted” wood beam/wood framing stud structure fasteners.

   e. Structure fasteners for wall mounted conduit attachments shall attach to steel framing studs and steel structural elements with spot welded steel structure fasteners or drilled and bolted structure fasteners.

E. Brace Connectors

1. Provide lateral brace connectors to resist horizontal, lateral and vertical movement of suspended conduits during seismic earthquakes.

2. The braces shall connect from each conduit support, attach as close to the conduit as possible, and attach to fixed rigid, nonsuspended building “main” structural elements with fixed anchoring.

3. Brace attachment connectors and fasteners shall be rigid preformed steel channels or flexible #10 gauge steel hanger wire.

4. Connect and attach the brace connectors to fixed structural elements in the same manner as conduit support hangers. The connection of braces to structural elements shall be independent of the conduit support hanger structure fasteners.

2.03 WIRE AND CABLE

A. All wire and cable shall be copper, 600 volt, #12 AWG minimum unless indicated otherwise. Conductors #10 AWG and smaller shall be solid. Conductors #8 AWG and larger shall be stranded. Type of insulation as noted on drawings and as follows:

1. Type THHN/THWN insulation used for #10 AWG and smaller.

2. Type THHN/THWN or THW insulation used for branch circuits using #8, #6, or #4 AWG except as noted otherwise.

3. Type THHN/THWN or XHHW used for all feeders.

4. Type THHN/THWN insulation used for circuit conductors installed in fluorescent lighting fixture raceways, for conductors connected to the secondary of metal halide fixture ballasts or other hot locations.

5. Type THHN/THWN or XHHW insulation shall be used where conductors are installed in conduit exposed to the weather.

6. The following color code for branch circuits:

   Neutral . . . . White (Tape feeder neutrals with white tape near connections) where separate neutral conductors are indicated for branch circuits, color code the white neutral conductor with a colored stripe corresponding to the phase of the respective line conductors.

   a. Normal Power

120/208 Volt		480/277 Volt	
Ground	Green	Ground	Green
Phase A	Black	Phase A	Brown
Phase B	Red	Phase B	Orange
Phase C	Blue	Phase C	Yellow

7. Feeders identified as to phase or leg in each panelboard with printed identifying tape.

8. Fire alarm conductors: See Section 16722.

9. Color coding for mechanical and plumbing control wiring shall be an agreed upon color code between the Mechanical/Plumbing Contractor and the Electrical Contractor, and color code shall be submitted to the Architect in writing for approval prior to installation.

2.04 CHEMICAL GROUND ROD

A. General

1. Self contained ground rod(s) using chemically enhanced grounding shall be provided where specifically indicated on the drawings. As manufactured by Lyncole XIT Grounding systems, 22412 South Normandie Avenue, Torrance, CA . TEL #(800) 962-2610; Superior Grounding Systems, Irwindale, CA Telephone #(800) 747-7925; ERICO.

2. The ground rod shall operate from changes in atmospheric pressure pumping air through the ground rod, hygroscopically extracting moisture from the air to activate the ground electrolytic chemicals and improve the ground rod performance.

3. Ground rod system shall be U.L. listed.

4. Ground rod system shall be 100% self-activating, sealed and maintenance free. The addition of chemical or water solutions shall not be required.

B. Ground Rod

1. Ground rod shall consist of a 2 inch nominal diameter hollow, copper tube. The tube shall be permanently capped on the top and bottom, air breather holes shall be provided in the top of tube. Drainage holes shall be provided in the bottom and sides of the tube for electrolyte drainage into the surrounding soil.

2. The ground rod shall be chemically filled at the factory with environmentally non-hazardous water-soluble metallic salts to enhance electrical grounding performance.

3. Ground rod shall be a minimum of ten feet long for straight (vertical) installation; or “L” shape minimum twenty feet long for horizontal installation.

4. Ground wire clamping “U-Bolt” with pressure plate on the top end of the tube sized for 1#2 thru 500 MCM AWG ground electrode conductor connection, and stranded 4/0 AWG copper pigtail exothermically welded to the side of rod for ground electrode conductor connection.

C. Ground Box

1. Precast concrete box with slots for conduit entrances. Approximately ten-inch diameter by twelve inches high. Cast iron grate flush cover with “Breather” slots XIT Box #B-12.

D. Backfill Material

1. Natural volcanic, non-corrosive Bentonite Clay backfill material.

2. Shall absorb water at a minimum of thirteen times its dry volume or approximately 14 gallons for 50 pounds of clay.

3. PH value 8-10 with maximum resistivity of 2.5 OHMS-M at 300% moisture content by weight.

PART 3 - EXECUTION

3.01 TRENCHING, FOOTINGS, SLEEVES

A. Provide trenching, concrete encasement of conduits, backfilling, and compaction for the underground electrical work, in accordance with applicable sections of this specification.

B. Provide footings for all post and/or pole-mounted lighting fixtures: concrete shall conform to the applicable sections of this specification.

C. Sleeves

1. Provide sleeves for raceways and conduit passing through building foundations.

2. Sleeves shall be installed at exact penetration locations and angles to accommodate raceway and conduit routings.

3. The layout and design of raceways and conduits located in or routed through masonry or reinforced beams or walls shall be reviewed by the Architect before any work is performed. All sleeving shall be accomplished according to the instructions of the Architect and shall be accepted before any concrete is poured.

4. Sleeves, raceways and conduit shall be located to clear steel reinforcing bars in beams. Reinforcing bars in walls shall be offset to clear piping and sleeves.

5. Provide 1/2" continuous clearance between inside of sleeve and exterior of conduits and raceways passing through the sleeve, unless otherwise specified. Where sleeves pass through outside walls below grade, provide full 1" clearance between exterior of conduits and raceways passing through the sleeve. For seismic joints, clearance shall be 3".

6. Sleeve material shall be Schedule 40 black steel pipe, seal outer surface watertight.

3.02 GROUNDING

A. Grounding shall be executed in accordance with all applicable codes and regulations, both of the State of California and local authorities having jurisdiction.

B. The Contractor shall install the proper sized copper ground wire in all conduits having circuits operating at more than 100 volts to ground, for use as an equipment ground. The electrical metallic raceway system shall be grounded to this ground wire.

C. The maximum resistance to ground from any outlet shall not exceed 5 ohms.

D. In branch circuit conduits, a green insulated, copper ground wire, sized in accordance with the following table, shall be installed. Install ground wire in each conduit with phase conductors.

1. Branch

Circuit Protection	Ground Wire Size
20 Amp	#12
30 to 60 Amp	#10
70 to 100 Amp	#8

E. Ground conductors for branch circuit wiring shall be attached at each outlet to the back of the box using drilled and tapped holes and washer head screws, 6-32 or larger.

F. Each panelboard, switchboard, pull box or any other enclosure in which several ground wires are terminated shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

G. The interior metal water piping system shall be bonded to the electrical equipment in each respective building.

3.03 CONDUIT

A. The sizes of the conduits for the various circuits shall be as indicated on the drawings and as required by code for the size and number of conductors to be pulled therein. Conduits to be concealed except as noted otherwise.

B. Rigid steel conduit shall be used in the following locations:

1. Exposed on interior of buildings below five feet.

2. Exposed on exterior of building.

3. Exposed on roofs.

4. Embedded in concrete or masonry walls.

Rigid galvanized steel conduit shall not be installed in direct contact with earth or sand.

C. PVC Schedule 40 nonmetallic conduit shall be used for all underground runs except combi-duct. Nonmetallic conduit shall not be run in slabs or walls, above ceilings or exposed. End bells shall be provided at conduit terminations.

D. Risers on underground conduit runs shall be PVC Schedule 40 below grade and rigid galvanized steel where the run daylights above finished floor. Provide inside threaded coupling flush with finish concrete surface.

E. Electrical metallic tubing up to and including 4 inch may be installed as permitted by codes except as otherwise referenced within these specifications.

F. Flexible Steel Conduit:

1. The use of flexible steel conduit above ceilings shall be limited to final connections to lighting fixtures from outlet boxes or to clear obstructions above ceilings.

2. Flexible steel conduit may be used where concealed horizontally in metal or wood stud walls. Vertical runs exceeding 36" shall be rigid conduit.

3. Homerun conduits shall not be flexible steel conduit.

G. Liquid-tight flexible conduit shall be used for final connection to motors, control devices mounted on vibrating or rotating equipment, mechanical, plumbing and kitchen equipment indicated on drawings to have flexible conduit connections, and in all areas where exposed flexible connections are required.

H. Conduit Installation:

1. Securely and rigidly support all conduits from building structure. Provide supports maximum of ten feet on centers and within three feet of all bends, outlets, junction boxes, cabinets, panels and fittings. Conduits shall be supported independent of all piping, duct work, equipment ceiling hanger wires, and suspended ceiling grid systems. Secure by means of UL listed and approved pipe clamps, “C” channels, fasteners, or straps.

2. Individual suspended conduits shall be supported by means of hanger rods and pipe clamps. Multiple suspended conduits shall be supported by means of trapeze type hangers and pipe clamps. Conduits and conduit trapeze support systems shall be guyed to prevent swaying in any direction.

3. Individual conduits placed against brick, masonry or concrete walls or slabs shall be secured with pipe clamps and expansion shields. Individual conduits placed against dry wall or plaster construction shall be secured by means of pipe clamps and screws attached to studs or other structural members. The use of toggle bolts is prohibited. Provide preformed channel supports for all multiple conduits placed against walls or slabs.

4. Rigid steel conduit or electrical metallic tubing shall not be strapped or fastened to equipment subject to vibration or mounted on shock absorbing bases.

5. Conduits turned up from below grade shall terminate in flush coupling at floor and then extend into terminal cabinets and panelboards.

6. Conduit run exposed shall be run at right angles or parallel to the walls or structures. All changes in directions, either horizontally or vertically, shall be made with conduit outlet bodies as manufactured by Crouse Hinds or equal. Conduits run exposed shall be painted to match surrounding surfaces.

7. Provide two locknuts and an insulated bushing at threaded metallic conduit terminating at outlet boxes, junction boxes, terminal cabinets, switchboards and panelboards.

8. Provide insulated bushing at each metallic conduit stub location. Bushings shall have ground lugs when installed on a metallic extension of PVC conduit run.

9. From each panel and signal system cabinet which is flush mounted in a wall, stub up from top of the panel a minimum of four 3/4" conduits to the nearest ceiling spaces or other accessible location and cap for future use.

10. Individual conduits penetrating a fire-rated, wall, or ceiling shall be installed using an approved fire-stop sealant system equal to 3M Corporation FS-195/CP-25 or Hilti Inc. CS240 series.

11. Underground conduits entering concrete pullboxes shall enter the sidewalls of the pullbox unless indicated otherwise. Provide end bell fitting on the end of each conduit 2" or larger entering the pullbox. Provide waterproof sealant after conductors have been installed.

12. Where underground conduits penetrate a waterproof membrane, the membrane shall be bonded around each conduit individually to maintain the watertight integrity of the membrane.

13. Provide metallic or plastic caps on all conduit during construction until installation of conductors.

14. Provide expansion and deflection fittings, and bonding jumper at all building expansion crossings, seismic joint crossings, and where conduits cross the separation between adjacent relocatable classrooms.

17. Provide all trenching, excavation, shoring and backfilling required for the proper installation of underground conduits. Make trenches a minimum of 6 inches wider than the duct bank. Compaction to be as directed by Architect.

18. Install underground conduit not less than 24" below finished grade in nontraffic areas and 30" below finished grade in traffic areas, including roads and parking areas. Install long radius bends in all underground conduits in excess of 100 feet long.

19. Conduit below slab on grade or underground exterior to building shall be spaced a minimum of 3" between identical systems and 12" between power and all other systems except at termination points. Multiple conduits in common trenches shall be racked on prefabricated plastic spacers a minimum of 10 feet on center over the length of the trench. Utility company conduits shall be installed in a separate trench.

20. All conduits below grade shall be fully encased in concrete.

21. Utility company conduits shall be fully encased in concrete over their entire length.

22. Where concrete encasement is specified, provide a minimum of 3" of concrete between each conduit, the top, bottom and sides of the duct bank.

23. The Contractor shall demonstrate the usability of underground raceways installed as part of this contract. A round tapered rigid mandrel with a diameter approximately 1/4" smaller than the diameter of the raceway shall be pulled through after the raceway installation is completed. Conduits which stubout only, shall have the mandrel pulled before and after the concrete encasement is completed, but prior to completing the backfill. The raceway testing for usability shall be witnessed by the District representative and by a representative of the respective utility company where applicable. Contractor shall repair/replace any conduit which will not readily pass the mandrel test.

24. Provide a red magnetic detector tape over the entire length of all underground conduits and ductbanks shown on site electrical plans. Place tape in backfill at a depth not to exceed 12 inches below finish grade or as required by the manufacturer.

25. All ductbanks shall be backfilled to within 12 inches of finished grade with damp sand. Remainder of backfill to be native having no stones or aggregate greater than 3". Do not backfill until installation has been approved and as-built drawings are up to date. Promptly install all conduits after excavation has been done, so as to keep the excavations open as short a time as possible. All excess soil from trenching shall be removed from the site.

26. Conduits which are installed at this time and left empty for future use shall have polyvinyl rope left in place for future use. Provide a 3/8" minimum rope for Utility Company conduits per their requirements.

27. Conduits stubbed outside of building line for future use shall be terminated a minimum of five feet clear of building or adjacent concrete walks or A.C. paving and capped. Provide concrete monuments, 6" x 6" x 15" deep, buried flush with grade over the capped ends. The face of monument shall be furnished with 3" square brass plates securely mounted and engraved with the number and size of conduits and type of service (i.e., "POWER", "TEL.", etc.).

3.04 WIRE AND CABLE

A. Branch circuit and fixture joints for #10 AWG and smaller wire shall be made with UL-approved connectors listed for 600 volts, approved for use with copper and/or aluminum wire. Connector to consist of a cone-shaped, expandable coil spring insert, insulated with a nylon shell and 2 wings placed opposite each other to serve as a built-in wrench or shall be molded one-piece as manufactured by "Scotchlok".

B. Branch circuit joints of #8 AWG and larger shall be made with screw pressure connectors made of high strength structural aluminum alloy and UL-approved for use with both copper and/or aluminum wire as manufactured by Thomas & Betts. Joints shall be insulated with plastic splicing tape, half-lapped and at least the thickness equivalent to the conductor insulation. Tapes shall be fresh and of quality equal to Scotch.

C. Use U.L. listed pulling compound for installation of conductors in conduits.

D. Correspond each circuit to the branch number indicated on the panel schedule shown on the drawings except where departures are approved by the Architect or the District's inspectors.

E. Control wiring to conform to the mechanical and plumbing specifications and wiring diagrams shown on the drawings and the manufacturer's wiring diagrams.

F. All splices in exterior pull boxes and light poles shall be cast resin encapsulated. Power conductor splices - 3M scotchcast Series 82/85/90; Plymouth or equal. No underground splices shall be made in control or signal circuits.

G. Neatly group and lace all wiring in panelboards, motor control centers and terminal cabinets with plastic ties at 3" on centers. Mark all spare conductors.

3.05 TESTING (ADDITIONAL REQUIREMENTS)

A. Visual and mechanical inspection of cables - 600 volts and less.

1. Inspect cables for physical damage and proper connection.

2. Test cable mechanical connections to manufacturer's recommended values with a calibrated torque wrench.

3. Check cable color coding and labeling of conductors and spares.

B. Electrical Tests of cables - 600 volts and less.

1. Perform "megger" tests on each feeder and power circuit No. 8 AWG and larger with respect to ground and between conductors.

END OF SECTION
120711/270032

SECTION 16114
CABLE TRAY

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all cable trays, all related components, and NEMA VE1.

B. Submit cable tray support details.

C. Provide reproducible floor plan shop drawings, with the same scale as the contract floor plan drawings. The drawings shall show the proposed cable tray layout plan views. An elevation view shall be provided at each riser or change in horizontal elevation in the cable tray. The shop drawing plans shall show all building elements, expansion/seismic joints, air ducts, piping and components that cross the path of the cable tray, along with separation of the cable tray from the crossing components.

PART 2 - PRODUCTS

2.01 CABLE TRAY

A. Material and installation shall comply with NEMA - "VE1" latest edition, Cable Tray Systems, N.E.C., California Title 24 and Title 8. As manufactured by Globe Tray, Chalfant, P-W Industries or equal.

B. Cable tray shall include two longitudinal side rails, ladder type, with transverse 6 inch rung spacing welded to side rails. Rungs shall have a minimum cable-bearing surface of 0.75 inches. Rungs shall not extend below bottom of side rails. Splice plates shall be locking bolt type to connect tray sections together without decreased tray strength. Provide expansion/deflection fitting at each building seismic and expansion joint crossing.

C. Trays shall be steel or aluminum. Steel trays shall be hot dip galvanized after fabrication ASTM A 123 with ANSI type 304 and 316 stainless steel hardware. Aluminum trays shall be extruded from 6063-T6-aluminum alloy with 5052-H32-aluminum alloy hardware.

D. The complete cable tray system and supports shall be designed for the following minimum uniformly distributed working load but not less than indicated on the drawings, with a 1.5 minimum safety factor, when supported as a single span. In addition, the cable tray shall support 200 pounds concentrated at span midpoint without permanent distortion.

   a. Cable tray wider than 12 inches or deeper than 6 inches, live loading 200 pounds per linear foot.

   b. Cable tray 12 inches or less in width and 6 inches or less in depth live loading 100 pounds per linear foot.

E. Provide ladder type "elbows", "tees", horizontal "crosses", expansion connectors, reducer sections, connectors, straight sections, curved sections, fittings, supports, hangers, blind ends, risers and accessories to provide a complete installation of the cable tray shown on the drawings. Provide trapeze brackets and individual threaded hanger suspension rods in any combination required to support the cable tray system. Provide all materials and labor necessary for a complete installation.

F. Cable tray runs shall be minimum 6 inches deep x 12 inches wide, but not less than indicated on drawings. Dimensions are outside dimensions of the cable tray rails.

G. Similar cable tray parts and hardware shall be interchangeable with each other. The cable tray system shall be free of sharp edges, burrs or projections that can damage cable insulation.

PART 3 - EXECUTION

3.01 CABLE TRAY

A. Cable trays shall be seismically anchored and supported to the building structure to prevent horizontal or lateral movement with 1.0 gravity acceleration, including specified live load conductor capacity, complying with State of California seismic codes. Support hangers from the building structure shall provide a 2.0 weight carrying safety factory including specified live cable weight. Cable tray hangers shall be provided with a spacing to insure the maximum cable tray deflection with the specified live cable loading does not exceed 0.75 inches between supports and hangers. In no case shall cable tray support or hanger spacing be greater than 12 feet on center.

B. Cable trays and trapeze shall be anchored to structure to resist seismic force of CBC Chapter 16A and Section 1632A and Table 16A-0.

C. Punching or drilling of structural side members shall not be performed except for splice plate boltholes.

D. Provide expansion adapters where cable trays cross a building expansion joint, and to comply with tray manufacturer's recommendation for the cable tray thermal expansion requirements.

E. All cable trays including non-connected tray sections shall be made electrically continuous. Provide grounding jumpers minimum equivalent to #8 AWG, where required to provide continuity.

F. Grounding for cable trays shall comply with Article 318-6 of NEC.

G. Provide curved "radius" cable trays at each "horizontal" or "vertical" change in direction of the cable tray. Provide "tees" and "crosses" at each intersection of cable trays. Provide "blind ends" at the end of each cable tray "run".

H. Provide removable fire blocking "bagstyle" at cable tray penetrations of fire barriers.

END OF SECTION
120711/270032

SECTION 16160
PANELBOARDS AND TERMINAL CABINETS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide manufacturers catalog data for panelboards, cabinets and circuit breakers.

B. Provide shop drawing showing panelboard circuit arrangements, size, voltage, ampacity, overcurrent protective devices, etc.

C. Provide nameplate engraving schedule.

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. Panelboards shall be flush or surface mounting as indicated with circuit breakers as shown on panel schedule, hinged lockable doors, index card holders and proper bussing.

B. Where indicated on the drawings and herein specified, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contactors, time switches, relays, etc., as required.

C. All panelboards shall be keyed alike.

D. All panelboards shall be finished with one coat of zinc chromate and a coat of primer sealer after a thorough cleaning. Prime coated panelboard shall be painted to match surroundings after installation. Panelboards shall be fabricated of sheet steel of the following minimum gauges: Door and trim #12; enclosure - code gauge steel.

E. Panelboards shall have flush locks and keys.

F. Fasten the trim to panelboards by means of concealed, bolted or screwed fasteners accessible only when the door is open.

G. Panelboards 208/120 volt, three phase, 4 wire, S/N or 120/240 volt, single phase, 3 wire, S/N.

Panelboard types as manufactured by:

1. Westinghouse Pow-R-Line Series
2. General Electric Type A Series
3. Square D Type NQOD
4. Siemens Type S Series

H. Panelboard for bussing sizes thru 600 amp shall be 20" wide. Recess mounted type shall have a 20" wide (maximum) recess metal enclosure with trim plate cover extending 1" on all sides of enclosure. Depth shall be 5-3/4" nominal. Height of panel as required for devices.

I. Distribution panelboards with buss sizes 400 ampere and greater shall be 40" (maximum) wide by 12" (maximum) deep units. Distribution panelboards shall be as manufactured by:

1. Siemens Type S Series or F Series
2. General Electric Type CCB or QMR
3. Square D Co. Type HCN or HCM
4. Westinghouse Pow-R-Line 4 Series

J. Panelboards shown on the drawings with relays, time clocks or other control devices shall have a separate metal barriered compartment mounted above panel with separate hinged locking door to match panelboard. Provide mounting subbase in cabinet for control devices and wiring terminal strips.

K. Panelboard shall have a circuit index card holder removable type, with clear plastic cover. Index card shall have numbers imprinted to match circuit breaker numbers.

L. Panelboard enclosures shall be furnished without prepunched conduit knockouts. Conduit knockouts shall be punched in field.

M. Panelboards shall be manufactured by the same manufacturer as the main switchboard.

N. TVSS - Transient Voltage Surge Suppresser

1. Provide each of the following branch circuit panelboards types with a TVSS where indicated on drawings:

a. 208/120 volt - single phase and/or three phase, 400 ampere and smaller main bus rating.

2. The TVSS shall be installed inside the respective panelboard housing and shall be factory connected to each main phase ground and neutral bus inside the panel.

3. The TVSS monitor/annunciator indicators shall be visible only when the panel access door is in the open position.

4. The TVSS and panelboard shall be UL labeled and listed. See related specification sections for additional TVSS requirements.

2.02 CIRCUIT BREAKERS

A. Breakers shall be molded-case types with a minimum short circuit interrupting rating of 10,000A symmetrical for panelboard voltages thru 240 volt and 14,000A for panelboards thru 600 volts. Breakers shall have a minimum short circuit of 22,000 A symmetrical for distribution panelboards.

B. Branch circuit breakers in panelboards shall be series-rated with their respective upstream overcurrent devices for the full fault duty rating of those upstream devices.

C. Main circuit breakers in distribution panelboards with a frame size of 400 amps or larger shall conform to the following:

1. Circuit breaker shall employ current sensors and static electronic automatic trip system. Three phase, or single phase operation as noted on the drawings. Current carrying components shall be completely isolated from the static trip units. The trip unit shall be independent of external power sources.

2. Breaker solid state trip control functions shall provide the following field adjustable features:

a. Adjustable ampere setting to vary the continuous current carrying capacity, minimum range of 80% thru 100% of full load trip rating.

b. Fixed long-time pickup and delay.

c. Adjustable short-time pickup to vary the level of high current the breaker can carry for short periods of time, minimum range of 2 times thru 8 times of ampere setting.

d. Fixed short-time delay I2t ramp.

e. Fixed or field adjustable instantaneous trip.

f. Individual fault trip indicators shall provide local indication on the breaker for overload and short circuit (and ground fault where applicable) conditions.

D. Panelboards and circuit breakers shall be products of the same manufacturer.

E. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other

previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

F. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

G. Where branch circuit breakers supply the power to motors, the fire alarm control panel, and head end equipment for signal systems, the breakers shall be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.

H. Panelboard circuit breakers shall be bolt on type.

2.03 BUSSING

A. Bussing shall be rectangular cross section copper, or silver or tin-plated aluminum. Bussing shall be the full length of the enclosure.

B. Bussing shall be braced to withstand symmetrical short circuit ratings as follows or as noted on drawings. In no case shall bus short circuit bracing be less than specified circuit breakers:

1. Panelboards:

a. 240 volt and below 10,000 amp.

b. Greater than 240V 14,000 amp.

2. Distribution panelboards: 22,000 Amp.

C. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

D. Provide space and all hardware and mounting attachments for future devices as indicated on the drawings.

E. The ampere rating of the neutral bus of panelboards and distribution panels shall be a minimum of 100 percent greater than the ampere rating of the corresponding phase bus, where the panel is indicated to be provided with an “oversize-neutral” on the drawings.

2.04 TERMINAL CABINETS

A. Terminal cabinets shall be fabricated of code gauge sheet steel, size as indicated on the drawing, complete with hinged doors and the number of 2-way screw terminals required for termination of all conductors. The door to terminal cabinets shall be continuously hinged on one side and be the same size as the cabinet so as to allow maximum termination space within the cabinet. Terminal cabinets shall have 3/4" plywood backing finished in black insulating varnish.

B. All terminal cabinets shall be finished with one coat of zinc chromate and a cost or primer sealer after a thorough cleaning. Prime coated terminal cabinets shall be painted to match surroundings after installation.

C. Terminal cabinets shall have flush locks and keys.

D. Terminals for signal systems cabinets to be Cannon Type "SS" or equal unless indicated otherwise.

E. Provide engraved nameplate on each cabinet indicating its designation and system (i.e., "Life Safety System - Panel 2LS").

PART 3 - EXECUTION

3.01 MOUNTING

A. Flush mounted panelboards and terminal cabinets shall be securely fastened to at least two studs or structural members. Trim shall be flush with finished surface.

B. Surface mounted panelboards and terminal cabinets shall be secured to walls by means of preformed steel channels securely fastened to at least two studs or structural members.

C. Panelboards shall be installed to insure the top circuit protective device (including top compartment control devices) are not more than 6'-6" above finish floor in front of the panel and the bottom device is a minimum of 12" above the floor. Manufacturer shall specifically indicate on shop drawing submittals each panel where these conditions can not be met.

3.02 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Provide a red and white bakelite nameplate with 1/2" high letters in each 277/480 volt panel fastened to face of dead-front plate, to read:
"WARNING 480 VOLTS AUTHORIZED PERSONNEL ONLY".

B. Identification plates and numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind shall not be used.

C. Panelboard identification plates shall also identify as to where panelboard source is located.

END OF SECTION
121007/270032

SECTION 16250
AUTOMATIC TRANSFER SWITCH

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets for all switches, relays, controllers, power supplies, cabinets, etc.

B. Submit detailed shop drawings including dimensioned plans, elevations, details, schematic and point-to-point wiring diagrams and descriptive literature for all component parts and cabinets.

PART 2 - PRODUCTS

2.01 Provide automatic transfer switch system with number of poles, amperage, voltage and withstand ratings as shown on the plans. The system shall be the product of one manufacturer. The system shall be U.L. listed to the latest requirements of U.L. Std. #1008 and rated for all classes of loads, 100% tungsten filament lamp loads as manufactured by ASCO, Russell, or Zenith.

2.02 Electrical operation shall be accomplished by a momentarily energized operating single solenoid mechanism which receives power from the source to which the load is being transferred. The total operating transfer time shall not exceed one-sixth of a second. Mechanical locking in each position shall be provided without the use of springs, gear mechanisms or motor operators.

1. Operation shall be inherently double-throw where all contacts move simultaneously and with no programmed delay in a mid position. Electrical spacings shall not be less than those listed in Table 15.1 of U.L. Std. #1008. An overload or short circuit shall not cause the switch to go to a neutral position. Main contact structures not originally manufactured for transfer switch service shall not be used.

2. A U.L. listed manual operating handle shall be provided for maintenance purposes.

3. Switches shall be four pole for switched neutrals with fully rated neutral transfer contacts.

2.03 CONTROL PANEL

A separately mounted logic panel with solid state sensing and timing functions, shall provide the following operational characteristics:

1. Time delay on momentary dips in normal source (0.5-6.0 seconds), set at 1.0 seconds.

2. Time delay on transfer to emergency for controlled loading of generator (0-5 minutes), set at 0 minutes.

3. Time delay on retransfer to normal (0-30 minutes), set at 15 minutes.

4. Toggle switch to manually bypass time delay on retransfer.

5. Time delay on engine shutdown after retransfer to normal (0-5 minutes), set at 5 minutes.

6. Close differential voltage sensing of all normal source phases (pick-up 85-100% of nominal and drop out 75-98% of pick-up), set at 85% drop out and 95% pickup.

7. Independent voltage (85-100% pick-up) and frequency (90-100% pick- up) sensing of the emergency source to prevent premature transfer, set at 90% voltage and 95% frequency.

8. Test switch (momentary type).

9. 10 amp engine starting contacts (1-N.C. & 1-N.O.).

10. Pilot lights to indicate switch position (white on normal and yellow on emergency).

11. Auxiliary contacts (1-closed on "N" and 1-closed on "E") rated 10 amps, 480 VAC.

12. All time delay and sensing functions shall be readily field adjustable over the ranges indicated and operate without drift over minus 4 degrees F to 158 degrees F. The logic panel shall be provided with a protective cover and isolation plug in wiring harness between control panel and main transfer panel.

13. Automatic engine generator exerciser to provide adjustable 30 minute to 60 minute duration generator start-run and stop sequence, one time per week or one time every two weeks. Exercising sequence shall be field selectable with or without load connection. The exerciser shall provide automatic separate control of the engine generator load bank.

2.04 The automatic transfer switch system shall be supplied in an enclosure with a barrier between the compartments. The complete system shall be factory assembled, wired and tested prior to shipment. Entire assembly shall be constructed for front access only.

2.05 Pilot lights shall indicate availability of normal and emergency power sources and automatic transfer switch position. A prominent and detailed instruction plate shall be furnished.

2.06 Electrical and Mechanical Performance: The system must comply with U.L. Std. #1008 (including compliances with the 1 1/2 and 3 cycle withstand current ratings), and NEMA Std. ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified independent laboratory test data:

1. Temperature Rise: Measurements shall be made after the overload and endurance test.

2. Withstand: U.L. listed to withstand the magnitude of fault current available.

3. Dielectric: Tested after the withstand test at 1960 VAC r.m.s. minimum.

4. Voltage Surge: Control panel voltage surge withstand test per IEEE Std. 472-1974 and voltage impulse withstand test per ICS-1-109.

PART 3 - EXECUTION

3.01 The manufacturer shall certify that the complete unit meets or exceeds the seismic requirements of the California Administrative Code Titles 21 and 24.

3.02 Certification: The manufacturer shall provide a notarized letter certifying compliance with all the requirements of this specification. The certification shall identify, by serial number(s), the equipment involved.

END OF SECTION
120711/270032

SECTION 16425
SWITCHBOARDS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide nameplate engraving schedule.

B. Submit engineered settings for each adjustable circuit breaker device, showing the correct time and current settings to provide the coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. The information shall be submitted in tabular form and on time current log-log graph paper.

C. Factory Tests: Switchgear tests - ANSI C37.20. Certified copies of design tests, production tests, and conformance tests of the switchgear shall be submitted and review comments shall be received before delivery of equipment to the project site. In lieu of the above tests, a report of these tests previously performed on identical units of each rating will be acceptable.

1.03 APPLICABLE STANDARDS

The switchgear equipment shall be designed, tested and assembled of ANSI, IEEE, and NEMA and U.L.

1.04 EQUIPMENT QUALIFICATION

The manufacturer of the switchboard shall have a complete technical field service division capable of providing parts and service through a 24-hour, toll-free nationwide dispatch system.

PART 2 - PRODUCTS

2.01 BUSSING

A. Horizontal and vertical busses shall be full length in each equipment section. Buses shall have a minimum withstand rating equal to the available fault current indicated on drawings, but in no case shall the rating be less than 65,000 amperes symmetrical or less than the maximum available short circuit current as provided by the serving utility company.

B. Provide interconnected full capacity neutral bus in each section with the same ratings and construction as the phase busses.

C. Provide interconnected ground bus in each section.

D. Provide space and all hardware and mounting attachments for future devices as indicated on the drawings.

E. Main horizontal bussing shall be full capacity in all switchboard sections.

F. Vertical buss may be tapered, to not less than one third the ampacity rating of the main horizontal buss; but in no case shall the vertical buss be of less capacity than the sum of the frame size ampacities of overcurrent devices mounted in the respective sections including any indicated spares and spaces.

G. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 on temperature rise Bus shall be copper with silver plated bus joints or extruded aluminum with tin plated bus joints. The through bus shall have provisions for the addition of future sections. The through bus supports, connections and joints are to be bolted with grade 5 hex head bolts and Belleville washers to minimize maintenance requirements.

2.02 CIRCUIT BREAKERS

A. General:

1. Circuit protective devices as indicated on the drawings. All devices shall have an interrupting capacity not less than the maximum available fault current at the circuit breaker as indicated on the drawings, but in no case shall the interrupting capacity be less than the maximum available short circuit current as provided by the serving utility company or 65,000 ampere symmetrical for 208/120 volt devices. Provide padlock-off devices on each device. Breakers shall provide time overcurrent and instantaneous circuit protection.

2. Circuit breakers shall employ a quick make-quick break, trip free operating system on each phase, with common trip. Breakers shall comply with U.L. 489 and NEMA AB1 latest revisions.

3. Provide conductor lugs on circuit breakers to accept conductor sizes shown on drawings.

B. Performance requirements for the main circuit breaker in the main switchboard.

1. Circuit breaker shall be a true two-step stored energy, insulated case type employing current sensors and static electronic automatic trip system. Current carrying components shall be completely isolated from the static trip units. The trip unit shall be independent of external power sources. Circuit breaker shall be U.L. listed for reverse power connection. Circuit breaker shall be rated for 100% continuous loading. Square D "SE" series, Westinghouse "SYSTEM POW-R" Series, General Electric "POWER-BREAK" Series, or Siemons "SPB" series.

2. Breaker solid state trip control functions shall provide the following field adjustable features;

   a. Adjustable ampere setting to vary the continuous current carrying capacity, minimum range of 80% thru 100% of full load trip rating.

   b. Adjustable long-time delay setting to vary the time the breaker will trip under sustained overload conditions. Minimum of three settings, "minimum - intermediate - maximum".

   c. Adjustable short-time pickup to vary the level of high current the breaker can carry for short periods of time, minimum range of 2 times thru 6 times of ampere setting.

   d. Adjustable short-time delay to vary the time of the short-time pickup. Minimum of three settings "minimum-intermediate-maximum".

   e. Short time "I2t" switch to allow a current-squared multiplied by time ramp function in the short-time system. Two position setting "in-out".

   f. Adjustable instantaneous pickup to vary the breaker ampere setting for immediate (instantaneous) interruption of severe overloads (short circuits). Adjustable minimum range of 2.0 times thru 9 times of circuit breaker ampere sensor rating. (Note: Where the coordination study requires a higher instantaneous setting, change the specified adjustable instantaneous trip to fixed instantaneous trip at 15 times the breaker ampere sensor setting).

   g. Integral ground-fault interrupter with adjustable pick-up and delay.

   h. Individual fault trip indicators shall provide local indication on the breaker for overload and short circuit (and ground fault where applicable) conditions.

C. Performance requirements for feeder circuit breakers in the main switchboard with a frame size of 400 amperes.

1. Solid state trip breakers shall conform to the requirements described for solid state breakers with a frame size of 600 amps or larger except, only the following field adjustments are required:

a. Ampere setting adjustable minimum range of 80% thru 100% of full load trip rating.

b. Short time pickup adjustable minimum range of 2 times thru 8 times of the ampere setting.

c. Fixed or field adjustable instantaneous trip.

D. Circuit breakers in the main switchboard with a frame size of 225 amps or less shall be molded case thermal-magnetic with AIC ratings as herein specified.

E. Circuit breakers and switchboards shall be products of the same manufacturer.

2.03 MAIN SWITCHBOARD

A. Switchboard shall be floor-mounted, dead-front, dead-rear type, front and rear aligned, self-supporting, consisting of one or more vertical sections with group mounted non-drawout circuit protective devices, instrumentation and control wiring as indicated on the drawings and as specified herein.

B. Switchboards shall be General Electric AV-line, Westinghouse or Square D.

C. Switchboard shall be designed, built and tested in accordance with applicable portion of the latest editions of NEMA PB-2, Underwriters Laboratories No. UL-891 and the National Electrical Code.

D. Switchboard sections shall be floor standing self supporting, of the universal frame type using dieformed, 12-gauge steel members bolted and welded together. Provide removable side and rear plates with formed edges all around. Provide ventilation openings required to maintain minimum operating temperature. Provide removable steel cover plates for all usable device spaces. Provide lifting means and provisions for moving by means of rollers or skids to installation location. Bolt individual sections together to form a single rigid switchboard assembly. Provide full height, hinged, vertical wireway metal covers, on each vertical wireway, of each distribution section of the switchboard, containing group mounted feeder protective devices.

E. Switchboard shall include, but not be limited to, the following:

1. Fully bussed underground pullsection.

2. Metering facilities as required by the serving utility.

3. Current transformer space.

4. Main disconnect.

5. Feeder protective devices.

6. Bussing.

2.04 CONTROL WIRING

A. Terminal blocks with barriered terminals shall be provided for all control wiring terminator points. Control wiring shall be run in horizontal and vertical, isolated, internal metal wireways and shall be carried across hinges in laced bundles. Wire terminators shall be crimp-on type spade terminal

B. Secondary control wiring shall be minimum of 14 AWG stranded copper type SIS 600 volt insulation.

C. Control circuits shall have circuit number tags at each termination or break in the wire to match circuit numbers on terminal strips and control wiring diagrams.

2.05 WEATHERPROOF SWITCHBOARDS

A. Switchboards indicated as weatherproof (W.P.) or outdoor shall be NEMA 3R, non walk-in, tamper resistant construction. Provide full height hinged doors with provisions for padlocking the doors in the closed position.

B. Provide a 250 watt sealed, resistance type, anti-condensation heater in each switchboard section. Heaters shall be controlled automatically by Thermostats and Humidistats. An overcurrent protective device shall be provided to supply switchboard buss voltage to the heaters, all prewired by the Manufacturer to fused terminals.

C. Switchboard finish shall be elecrostatically applied finish paint over iron oxide primer, 600 hour salt spray test equivalent to ASTM-B-117. Finish color shall be manufacturers standard color, all per ASTM-B-117 600 hour salt spray test equivalent. Provide a 3MIL minimum thickness, undercoating on the bottom six inches of the weather protective housing, inside surfaces.

PART 3 - EXECUTION

3.01 Install switchboards in accordance with manufacturer's written instructions and applicable portions of NECA's "Standards of Installations" for switchboards and motor control centers.

3.02 Switchboards shall be secured to structure in accordance with the Structural Engineer's requirements. Switchboard anchoring shall be designed for a 1.0 gravity lateral acceleration of the equipment.

3.03 TESTING (ADDITIONAL REQUIREMENTS)

Protective device coordination check; adjustable settings shall be set and tested after the equipment installation is complete, for proper operation at set pickup and/or drop-out points, by an independent test laboratory. Testing shall comply with the equipment manufacturers recommendations. Submit three copies of all test results to Architect. Correct any deficiencies and retest.

3.04 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Provide a red and white bakelite nameplate with 1/2" high letters in each 277/480 volt panel fastened to face of dead-front plate, to read: "WARNING 480 VOLTS, AUTHORIZED PERSONNEL ONLY".

B. Manufacturer shall stencil the equipment name on each device and equipment section to correspond to the identification of the drawing.

C. Devices mounted in equipment controlling protective devices shall be provided with nameplates indicating device controlled or monitored.

END OF SECTION
120711/270032

SECTION 16480
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for, and incidental to, performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

PART 2 - PRODUCTS

2.01 INDIVIDUAL STARTERS

A. Manual Motor Starters:

1. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the larger type requiring a special box and cover designed to accept the particular unit.

2. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 h.p., shall be the compact toggle type. Manual starters for all single phase motors, 1 to 5 h.p., and all three phase motors up to 5 h.p. shall be the heavy duty type.

3. Where manual motor starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet, and engraved nameplate to indicate function of pilot light.

4. Motor starters as manufactured by the following:

Manufacturer	Single Phase 1 h.p. and Below	Others
Arrow Hart	Type RL	Type LL
General Electric	CR 101	Class CR 1062
I.T.E.	Class C10, C11 or C12	Class C20

Square D Company	Class 2510, Type A	Class 2510, Type B & C
Westinghouse	Type MS	Type A100
Allen Bradley	Equal	Equal

B. Individual Magnetic Motor Starters:

1. Three phase magnetic motor starters NEMA size 1 and larger controlling three phase motors 5 horsepower and larger shall provide integral motor single phasing protection. The starter shall automatically "open", turn off electrical power to the connected motor in the event of the loss of one or more circuit phases, lock out and require manual resetting of the single phase protection to restart the magnetic motor starter. Provide single phase annunciator. provide adjustable time delay, minimum range 0-3 seconds for initiating single phase shut down.

2. Magnetic motor starters shall be A.C. line voltage, across-the-line units in NEMA Type I enclosure, unless other types of enclosures are indicated.

3. All starters located outside of a building whether or not indicated shall be W.P. (weatherproof), and all starters noted W.P. shall be furnished in NEMA type 4 cast or stainless steel enclosures.

4. Starters shall be horsepower rated for the motor controlled, and shall be equipped with properly sized overload elements. Every pole shall be with overload element.

5. Verify the exact motor current and voltage characteristics with the supplier of the motor before installation of a starter.

6. Each starter shall be equipped with "Hand-Off-Auto" switch or stop-start pushbutton as required.

7. Coils shall be designed to operate on voltage indicated on control diagrams and have built-in-under the voltage release for coil circuit to drop motor starter off the line when the line voltage drops below normal operating voltage.

8. The coil control circuit shall be independently fused, sized to protect coil.

9. Starters to be equipped with running pilot light indication with a "Push-to-Test" feature.

10. Magnetic starters shall have a minimum of two auxiliary contacts. Additional auxiliary contacts shall be provided as required to comply with the requirements of the wiring diagrams on the Electrical, Mechanical and Plumbing drawings and the description of the function in the Mechanical and Plumbing Sections of the Specifications.

11. Minimum starter size shall be NEMA size I unless indicated otherwise.

12. Magnetic motor starters as manufactured by the following:

Manufacturer	Type
General Electric	Class CR 106
I.T.E.	Class A20
Square D Co.	Class 8536
Westinghouse	Type A200 (Size 4 Max.) or Class II-200 (Sizes 5 thru 8) Allen Bradley Equal

2.02 INDIVIDUAL COMBINATION MOTOR STARTERS

A. Combination starter shall incorporate fused disconnect switch and individual magnetic motor starter in a common enclosure. Combination starters shall be mounted in general purpose enclosures unless otherwise indicated on the plans. Provide oversized enclosures where required to accommodate the components and/or wiring indicated. Starters shall comply with NEMA standards, size and horsepower as indicated on drawings General Electric, Square D, Westinghouse or I.T.E.

B. The disconnect handle used on combination starters shall control the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

C. Each starter shall be equipped with an integral control circuit transformer with secondary voltage or as indicated.

D. All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.

E. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

2.03 MOTOR CONTROL INTERLOCKS AND CONTROL DEVICES

A. Refer to mechanical and plumbing drawings and specifications and provide all control devices including timeswitches, relays and interconnection of starters as required.

B. Whether shown on mechanical and plumbing drawings or control center schedules or not, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, each motor starter to be equipped with a "Hand-Off-Auto" selector switch in starter cover. Other starters equipped with a "Start-Stop" pushbutton station in starter cover.

C. Provide low voltage, 60Hz control power transformer(s), VA as required for HVAC and plumbing controls.

2.04 FUSES

A. Fuses shall be dual element, current limiting type, U.L. Class RK-1 unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each motor control center.

B. Verify the full load amperes of all motors for which fuses are to be provided. Size fuses for the motor full load amps according to the recommendations of the fuse manufacturer.

PART 3 - EXECUTION

3.01 IDENTIFICATION

A. Provide a red and white bakelite nameplate with 1/2" high letters on each 277/480 volt panel fastened to face of dead-front plate, to read: "WARNING 480 VOLTS, KEEP OUT, AUTHORIZED PERSONNEL ONLY".

B. Manufacturer shall stencil the panel number or letter on each device and equipment section to correspond to identification on the drawing.

C. Identification plates and numbers shall be attached with screws or twist lock fasteners. Adhesive attachment of any kind shall not be used.

END OF SECTION
120711/270032

SECTION 16500
LIGHTING FIXTURES

PART 1 - GENERAL

1.01 GENERAL

A. Provide light fixtures complete including lamps, ballasts, lamp sockets, housings, ceiling trim rings for special ceilings, brackets, diffusers/lenses and outlet boxes.

B. The catalog numbers included in the description of the various types of lighting fixtures shall be basically considered to establish the type or class of the fixture with a particular manufacturer only. The fixture length, number of lamps, component materials, accessories, mounting type and all other features required to fulfill the total description of the fixture based on all drawing and specification information shall be complied with regardless of whether or not the catalog number specifically includes these features. If any conflict exists between the catalog number and the description, the Contractor shall either resolve the conflict with the Architect prior to submittal of his bid or furnish the fixture to meet the intent as later interpreted by the Architect without change in contract price.

C. Lighting fixtures shall be of types as indicated in fixture schedule on the drawings.

D. Include an allowance of $300.00 for the material cost of any lighting fixture where outlet is shown on drawings without a fixture type designation. Include all labor and transportation costs in base bid.

E. All fixtures of one type shall be of one manufacturer and of identical finish and appearance, unless indicated otherwise on drawings.

F. All fixtures shall be installed per manufacturer's requirements.

1.02 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

1.03 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit certification letter from manufacturers of lamps and ballasts stating the specific lamp and ballast combination comply with manufacturers approval for the combined use, shown on the drawings.

B. If requested by the Architect, provide a sample of any fixture proposed as a substitution for a specified fixture. Sample fixture shall be complete with lamps, cord and plug for 120 volt operation. Fixture shall be delivered to the Engineer's office for review and shall be picked up within ten (10) working days after review comments have been received; any samples left over this time will be discarded by the Engineer. Decision of Engineer regarding acceptability of any fixture is final.

C. Provide complete manufacturers catalog data information for each light fixture, ballast and lamp.

PART 2 - PRODUCTS

2.01 FLUORESCENT BALLASTS

A. General:

1. Fluorescent fixtures shall be equipped with UL, ANSI ETL approved C.B.M. certified high power factor (90% minimum) ballasts. Class "A" or better sound rating. Fluorescent fixtures shall be designed to accommodate rapid start lamps, except where specified otherwise. Ballasts shall have Class "P" protection. Fluorescent ballasts shall be full light output rated with specified lamps.

2. Ballasts shall comply with FCC Part 18 and NEMA limits as to EMI or RFI and not interfere with normal electrical or electronic data processing equipment

3. Ballast open circuit voltage and lamp operating voltage shall comply with requirements of the manufacturer of the specified lamps.

4. Ballasts shall be for use specifically with rapid start fluorescent lamps only. Ballasts rated for use with instant start fluorescent lamps or other non-rapid start fluorescent lamps are not acceptable.

5. Ballasts shall be suitable for use with automatic occupancy sensing type switching "on-off" control systems with multiple "on-off" cycles per hour, on a 24 hour a day basis, without loss of performance in ballast and/or lamp operating characteristics.

6. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and U.L. listed.

B. Solid State Electronic

1. Except where indicated otherwise, fluorescent ballasts shall be rapid-start integrated circuit electronic type for both straight and "U" lamps, both T12 and T8 series lamps, as manufactured by MagneTek Triad-Utrad Ballastar series, Advance Mark V, Motorola or equal.

2. Ballast manufacturer shall have been producing electronic ballasts for a minimum of five years.

3. Ballast shall operate lamps at frequency of 20 to 35 KHZ without visually detectable flicker and shall deliver lamp manufacturers normal rated lamp life.

4. Ballast shall be surge and transient protected to 6000 volts, provide soft/stable start of rapid start lamps and maintain cathode heat during operation. Maximum total harmonic distortion created on the line side of the ballast shall not exceed 25%.

5. The ballast shall provide an isolated output to the lamps. Ballast case shall be positively grounded to the light fixture metal housing.

6. The ballast shall incorporate transient surge protection to prevent damage to the ballast due to line side transients complying with ANSI/IEEE C62.41, Category A.

7. The ballast lamp current crest factor shall be less than 1.6.

8. The ballast factor shall be a minimum of 87.

9. T8 rapid Start Lamps

Lamp Wattage	Maximum Line Input Watts
Two - 32W	62
One - 32W	39

2.02 Ballasts for HID and fluorescent fixtures shall be high power factor, with lowest sound rating available. Ballasts which are judged by the Architect to be excessively noisy to be removed and replaced.

2.03 Light fixtures shown connected to both normal power and emergency power branch circuits, shall be furnished with separate lamp ballasts for the normal and emergency power circuits. A factory label shall be secured to the wireway which states "Caution - Emergency and normal branch circuits contained within this fixture".

2.04 HIGH INTENSITY DISCHARGE (HID) BALLASTS

A. Metal halide fixtures shall be supplied with encased and potted constant wattage 90% minimum power factor ballasts and shall have best available sound rating for type and lamp size.

B. High pressure sodium ballasts shall be encased and potted, high power factor, constant wattage auto transformer types.

2.05 LAMPS

A. Lamps shall be new, of wattage indicated and shall be as manufactured by General Electric, Philips or Osram/Sylvania. Each fixture or lighting outlet shall be supplied with the proper lamp.

B. General purpose incandescent lamps shall be inside frosted, reduced wattage/energy saver, medium base for 200 watts and smaller.

C. Par lamps shall be Halogen, unless otherwise specified in fixture schedule.

D. Fluorescent lamps shall have the following characteristics:

	Lamp Type	Watts	Initial Lumens	Life (Hours)
1.	F32T8	32	2950	20,000
2.	CFT9W/G23	9	600	10,000
3.	CFT13W/G23	13	825	10,000
4.	CFQ13W/G24q	13	860	10,000
5.	CFQ18W/G24q	18	1250	10,000
6.	CFQ26W/G24q	26	1800	10,000
7.	FM18W/GX24q	32	1120	10,000
8.	FM26W/GX24q		1610	10,000
9.	FM32W/GX24q		2200	10,000

10. Other types as noted on drawings.
11. Color rendering index (CRI) shall be of 80 or above, unless noted otherwise.
12. All compact fluorescent lamps shall be four pin, unless noted otherwise.
13. Color temperature shall be 3500°K, unless noted otherwise.

E. High pressure sodium lamps installed on the exterior shall be clear unless noted otherwise. Lamps shall be rated for a minimum of 24,000 hours of life. Lamps shall be manufactured for universal burn and open or enclosed fixtures. Lamps shall have the following minimum characteristics:

Lamp Wattage	Initial Lumen Output
35	2250
50	4000
70	6400
100	9500
150	16,000
250	30,000
400	50,000
1,000	140,000

F. Halogen MR16 lamps shall be 50 watt unless noted otherwise, 3000°K color temperature, rated life of 5,000 hours and distribution as indicated.

2.06 LIGHT FIXTURES

A. Lighting fixtures shall have all parts and fittings necessary to complete and properly install the fixture. All fixtures shall be equipped with lamps of size and type specified.

B. Fixtures shall be wired from outlet boxes supplied with fixture to socket with #14 AWG Underwriters' Type "AF" or "CF" fixture wire.

C. Surface and/or wall mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing, but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.

D. Where fixture color is indicated to be selected by the Architect, provide two color chip samples for review.

E. Recessed fixtures where noted to have attached junction box shall have a junction box permanently attached to the plaster ring so that it is accessible when the fixture is removed. Connection between fixture and pull box to have flexible conduit and 2#14 AWG "AF" wires. The flexible conduit to be sufficient length so that when the fixture is dropped, the pullbox is readily accessible.

F. Recessed fixtures must all have Underwriters' Laboratory approval for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Finish trim shall not be installed until finish painting of the adjacent surface is completed.

G. The fixture to bear Underwriters' label of approval for the wattage indicated.

H. Light fixtures installed outdoors in damp or wet locations shall be U.L. labeled for said location and shall be sealed and gasketed to prevent light leaks, insect and dust accumulation and water entry.

2.07 LENS AND DIFFUSERS

A. Acrylic diffusers and lenses shall be formed from a sheet of 100% acrylic having a minimum thickness of 0.125" and shall be of sufficient thickness and or proper construction and camber to prevent the diffusers from having any noticeable sag over the entire normal life of the installation. Diffusers shall be formed from cast sheet by a vacuum and/or pressure technique. Acrylic lenses shall be manufactured by either injection molding or by extrusion.

PART 3 - EXECUTION

3.01 LIGHT FIXTURE INSTALLATION

A. It is the Contractor's responsibility to verify actual ceiling construction type as defined on the architectural drawings and furnish all lighting fixtures with the correct mounting devices and proper operating voltage whether or not such variations are indicated by fixture catalog number. The Contractor shall verify depth of all recessed lighting fixtures with architectural drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the Architect prior to ordering of the fixtures.

B. Lighting fixtures installed in ceiling grids, suspended lay-in "T-Bar" and concealed spline ceilings.

1. Provide two seismic clips at opposite ends of each recessed light fixture connected to the ceiling grid main runners and the light fixture.

2. Each light fixture weighing 50 pounds or less and where the ceiling grid system is "heavy duty" type, shall be suspended directly from the ceiling grid or suspended independent of the ceiling grid support system. Each light fixture weighing more than 50 pounds or where the ceiling grid system is not a "heavy duty" type, shall be supported independent of the ceiling grid support system.

3. Each light fixture required to be supported directly from the ceiling grid system shall be additionally connected with a minimum of two independent slack safety support wires. One wire at each opposite diagonal fixture corner. Each 4ft. x 4ft. light fixture shall be supported in the same manner, except provide a minimum of four independent slack safety wires, one at each fixture corner.

4. Each light fixtures required to be supported independent of the ceiling grid system shall be supported with a minimum of four taut independent support wires, one wire at each fixture corner.

5. The support wires for light fixture support shall be 12 gauge steel (minimum). The wires including their building and light fixture attachments shall provide support capacity of not less than four times the weight of the light fixture assembly. Provide additional light fixture support wires and building anchors to meet these requirements, as part of the contract. The support wires shall be anchored to the building structural elements above the ceiling.

C. Light fixtures surface mounted to a suspended "tee" ceiling shall be installed with a one and one-half inch steel channel or angle which spans across and above the main runners. Each channel or angle member shall be provided with a minimum of two threaded studs for attaching to the fixture housing through the lay-in tile. Two channel or angle members shall be installed for each four foot fixture. Install the channels or angles within six inches of each end of the light fixture to span a minimum of two ceiling grid main runners. Provide two seismic clips connecting the main runners to each channel or angle. Provide support wires connecting to the channels or angles in lieu of connecting to the light fixtures. Bolt the light fixtures to the threaded studs on the channels or angles.

D. Suspended fixtures weighing in excess of 50 pounds shall be supported independently of the fixture outlet box. Provide "air craft" hanger cable (minimum 12 gauge) for suspended fixtures route cable concealed or in pendant where possible. Each cable and attachments shall support four times the weight of the fixture assembly. Securely attach the cable to the building structure.

E. On acoustical tile ceilings, fixture outlets shall be accurately located in the center, at the intersection of the four corners or at the center of the joints of two tiles.

F. Surface mounted fixtures installed on drywall or plaster ceilings and weighing less than 50 pounds may be supported from outlet box. Provide structural supports above drywall or plaster ceilings for installation of fixtures weighing more than 50 pounds and secure fixture to structural supports. The use of toggle bolts is prohibited.

3.02 RECESSED LIGHTING FIXTURES

Lighting fixtures recessed in ceiling or wall which has a fire resistive rating of 1 hour or more shall be enclosed in a box which has a fire rating equal to that of the ceiling or wall. The space from the fixture to the enclosure to be a minimum of 3".

3.03 LAMPS

Fluorescent and H.I.D. lamps shall be operated (aged) for 100 continuous hours without interruption, prior to occupancy of the building by the District.

3.04 LENS AND DIFFUSERS

A. Lens and diffusers shall be completely cleaned of all dust, dirt and fingerprints after light fixtures, ceilings, painting, lamps, etc. have been completed yet prior to occupancy of the facility by the District.

3.05 BALLASTS

A. Ballasts remote from the lighting fixture, mounted as shown on the drawings and designed for remote operation. Additional wiring and conduit shall be provided whether shown on the drawing or not, between lighting fixture and remote ballasts with required quantity of "THHN" wire to operate said fixture(s).

B. Provide proper type and quantity of conductors with conduit system for proper operation of dimming system, whether or not shown on drawings.

3.06 FLUORESCENT LIGHT FIXTURE TANDEM WIRING CONNECTIONS

A. The tandem wiring harness shall be the product of the respective lighting fixture manufacturer.

B. The tandem connection shall provide pre-assembled wiring harness connecting two fluorescent laps in adjacent lighting fixtures with a master lamp ballast, remote adjacent fixture slave lamp.

C. The wiring harness shall contain the wiring in flexible steel conduit or enclosed metal raceway/jacket for installation in an air plenum.

END OF SECTION
120711/270032

SECTION 16620
STANDBY POWER

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: Labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein.

   1. Examine all other sections for work related to those other sections and required to be included as work under this section.

   2. General provisions and requirements for electrical work.

B. Furnishing and installation of an emergency continuous standby diesel engine driven generator with all accessories and other appurtenant work and materials required for a complete installation.

C. All system ratings shall be based on the continuous standby rating at the altitude of the generator installation site. The generator set shall be built, tested and shipped by the manufacturer of the unit so there is one source of supply and responsibility as manufactured by Kohler to match the existing operational and maintenance systems within the District.

D. The standby power system shall conform to all requirements of South Coast Air Quality Management District (SCAQMD) for standby generators. The Generator Manufacturer shall utilize the best available control technology per SCAQMD regulations.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. The supplier of the standby engine-generator system shall be the factory authorized distributor and shall have full service and parts capability on a 24-hour basis. The supplier shall instruct the involved contractors on the proper method of installing the engine generator set and related equipment.

B. Submit scale drawings, showing overall dimensions and other dimensions required for proper installation of equipment. Identify clearly each item on drawings to show piece of equipment it represents. Indicate corrosion resisting treatment and finish.

C. Submit documentation that the system is approved under a fleet permit with SCAQMD.

D. Diagrams shall be schematic and point-to-point using standard symbols and with components arranged in logical sequence, so that system operation can be checked easily. Where special symbols are used or where function of components is not obvious, include suitable legend or functional guide. Number all terminals for external wiring

connections on diagrams. A composite control wiring diagram shall be provided showing the integrated control and load connections of the following:

1. Engine generator and control panel.
2. Engine generator remote annunciator panel.
3. Automatic transfer switch.
4. Battery charger.
5. Special interlocks noted on drawings.

E. Submit prototype, certified test reports for engine generator unit of identical size, type and construction showing conformance with performance requirements outlined in the contract documents. Plus the following additional tests:

1. Maximum power level.
2. Maximum motor starting capacity.
3. Fuel consumption.
4. Engine/alternator cooling air flow (heat rejection).
5. Transient response and steady state governing.
6. Alternator temperature rise.
7. Single step load pickup.
8. Verification of harmonic distortion in the wave form.
9. Three phase short circuit test for mechanical electrical strength.
10. Seismic shock tests based on actual time history records of known seismic shocks and California Seismic Zone 4.

F. Operating Manuals:

1. Provide three (3) bound copies of operating manuals for electrical equipment.
2. Provide catalog cuts, functional description of operation, wiring diagrams, operating and maintenance instructions, parts lists and other data useful and necessary for complete maintenance and operation of equipment.
3. Deliver operating manuals to the District.

G. The supplier shall provide documentation of maintaining local 24-hour parts and factory-trained service personnel within a 200 mile radius of the project site with the shop drawings.

H. Manufacturer shall have printed literature and brochures on the complete unit describing the standard series specified.

I. A Certification shall be supplied with the unit verifying torsional vibration compatibility of the rotating element of the prime mover and generator for the intended use of the energy converter.

J. After the installation is complete and prior to testing the supplier shall stipulate in writing that the entire unit complies with NFPA 110 and will perform as indicated.

PART 2 - PRODUCTS

2.01 ENGINE

A. The engine shall be diesel drive, four cycle, water cooled type with radiator cooling turbo-charged operating speed of 1800 RPM. Engine speed shall be governed by a Barber Colman electronic governor with electric activator, or equal by Woodward Governor Company. A unit mounted, 24 volt, 45 ampere battery charging alternator and solid state regulator shall be provided. Engine shall be rated for continuous standby duty and shall include the horsepower required to operate the engine radiator cooling fan, cooling water pump, battery charging alternator, lubricating oil pump, filters, silencers and other engine driven accessories at generator synchronous speed.

B. The engine lubrication system shall be pressure type with engine driven lubrication oil pump and replaceable element, full flow oil filter. A breather pipe suitable for adding engine lubricating oil while the engine is running shall be provided. Provide lubricating oil per manufacturer's recommendations.

C. The engine throttle control system shall provide a minimum discrete engine speed adjustment of equal to or less than one-quarter (1/4) hertz, measured at the generator output.

D. All openings for fuel lines, air, exhaust, conduits etc. shall be capped or plugged prior to shipment.

2.02 ALTERNATOR

A. The alternator shall be a revolving field, broad range, 4 pole, brushless, designed for minimum reactance, low voltage waveform distortion and maximum efficiency. The rotor amortissuer windings shall improve the AC waveform, reduce field heating with single phase or unbalanced loads and act as a stabilizer for paralleling. The rotor shall be dynamically balanced, connected and aligned to the engine by a semi-flexible disc coupling. The three phase alternator shall be twelve lead reconnectable. The insulation shall be Class B per NEMA MG1-1.65. Temperature rise 80° centigrade per NEMA MG1-22.40. Insulation shall be vacuum impregnated for improved protection and cooling.

B. The exciter shall be brushless, 3 phase, full wave rectified, with silicon diodes mounted on common rotor shaft and sized for maximum motor starting. Provide transient voltage surge suppressors to protect the diodes.

C. The voltage regulator shall be solid state including silicon controlled rectifiers with phase controlled sensing circuit. The system shall feature automatic voltage reduction if the load demand exceeds the engine capacity to eliminate engine stalling due to an occasional engine misfire or temporary overload such as motor starting and shall prevent overheating or blowing of fuses if the load circuit due to saturation of magnetic components when the voltage remains constant at reduced frequency. The voltage reference shall be a temperature compensated zener diode.

D. The alternators shall be designed to accommodate the "SCR" type loads indicated.

2.03 ENGINE-GENERATOR CONTROLS AND INSTRUMENTATION

A. Main power output molded-case circuit breaker mounted in Nema I enclosure inside the generator weather protective housing. A signal light shall be provided to indicate breaker is in the "off" or tripped position.

B. AC meters shall be not less than 2.5" analog or digital; digits shall be not less than .5" high, 2.5% accuracy.

1. Battery charge rate ammeter.

2. Output voltmeter with phase selector switch.

3. Output ammeter with phase selector switch.

4. Frequency meter.

C. Gauges

1. Oil pressure to indicate lubricating oil pressure.

2. Engine temperature.

3. Battery charging meter to indicate satisfactory performance of battery charger.

4. Hour meter to indicate actual total running time.

5. Other gauges as recommended by the manufacturer for proper maintenance.

D. Three position control selector switch "Stop-Remote-Run" when the switch is in the "off" position a red pilot light shall activate with a nameplate "Generator is not in auto".

E. Voltage adjusting rheostat, plus or minus 5% rated voltage and voltage regulator.

F. Manual reset exciter circuit breaker.

G. Remote start-stop terminals.

H. Cranking controls

1. A complete cranking cycle shall consist of an automatic crank period of approximately 15 seconds duration followed by a rest period of approximately 15 seconds duration. Upon starting and running of the prime mover, further cranking shall cease. Two means of cranking termination shall be utilized so that one will act as backup to the other to prevent inadvertent starter engagement.

2. The duration of the cranking cycle shall be 75 seconds after which the crank/rest cycle shall be terminated with alarm indication and manual reset.

3. The cranking cycle shall be capable of being initiated by any of the following:

   a. Manual start initiation.

   b. Loss of normal power at automatic transfer switch. Prime mover shall start upon closing of remote contacts and shall stop, after appropriate time delays, when switch or contacts are opened.

   c. A clock exerciser located in an automatic transfer switch or in the control panel.

   d. A manually operated (test) switch located in the automatic transfer switch that shall simulate a loss of power and cause automatic starting and running until this test means is reset to cause the engine circuit to duplicate its functions the same as when commercial power is restored after a true commercial power failure.

I. Controls to shut down and lock out the prime mover under the following conditions: failing to start after specified cranking time, overspeed, low lubricating-oil pressure, high engine temperature, or operation of remote manual stop station.

J. Battery-powered individual alarm indication to annunciate visually at the control panel the occurrence of any of the following conditions:

1. Over crank.

2. Low water temperature (less than 70 degrees F.).

3. High engine temperature prealarm.

4. High engine temperature.

5. Low lube oil pressure prealarm.

6. Low lube oil pressure.

7. Overspeed.

8. Low fuel in tank (less than 2 hours run time at rated full load).

9. Generator supplying load.

10. Control switch not in automatic position.

11. Battery charger malfunction.

12. Low voltage in battery.

13. Provide lamp test switch(es).

14. Provide common audible alarm signal which sounds during any of items 1 - 12 above.

L. All wiring for connection to the control panel, instrumentation, and sensors shall be harnessed or flexibly enclosed, shall be securely mounted on the prime mover to prevent chafing and vibration damage, and shall terminate at the control panel in an enclosed box or panel.

M. All controls shall be identified as to function with engraved nameplates or engraved control panel. Nameplates shall be fastened with bolts, nuts and lock washers.

N. Engine and generator control panel(s) shall be shock mounted over the rear end of the alternator.

2.04 UNIT PERFORMANCE

A. Frequency Regulation: Isochronous no-load to rated load.

B. Voltage Regulation: Shall be within plus or minus 2% of rated voltage from no-load to full rated load.

C. Recovery to steady-state operation after application of full rated load shall occur within 4 to 10 seconds.

D. Steady State Operation: The frequency variation shall not exceed plus or minus 0.15 Hertz and voltage variation plus or minus 1% of their mean value for constant loads from no load to full rated load.

E. Total Harmonic Distortion: Attenuation shall exceed requirements for data processing equipment, standard AM radio, television and marine radio-telephone equipment. Telephone influence factor shall be less than 50 per NEMA MG1-22.43.

F. Waveform Deviation Factor shall be less than 0.06 line-to-line and line- to-neutral per NEMA MG1-22.42.

G. RMS Voltage Dip: The sustained RMS voltage dip shall be less than 10% of rated voltage when full 3 phase load and rated power factor is applied to the alternator.

2.05 ENGINE GENERATOR REMOTE ALARM ANNUNCIATOR PANEL

A. Battery-powered remote mounted alarm annunciator panel in a NEMA 1 flush mounted enclosure, shall include visual indicators for each of the following with appropriate sensors installed in generator, fuel, and transfer systems.

1. Generator running.
2. Emergency power system supplying load.
3. Overcrank: Electric plant failed to start.
4. Low lube oil pressure prealarm.
5. Low lube oil pressure.
6. High engine temperature prealarm.
7. High engine temperature.
8. Low water jacket temperature.
9. Overspeed: Excessive RPM of electric plant.
10. Low fuel supply.
11. Generator not in automatic mode.
12. Low voltage in battery.
13. Normal utility power supplying load.
14. Normal battery voltage.
15. High battery voltage.
16. Low battery electrolyte.

B. An audible signal will sound with visual signals, for items 3 thru 11 above. A switch will be incorporated to silence the audible alarm until the alarm condition is corrected. The audible alarm then sounds until the switch is moved to the "normal" position.

C. Provide lamp test switch.

2.06 FUEL

A. Diesel with flexible fuel connections, and engine mounted dual parallel, in line Dahl Fuel Filter/Water Separator with valving for replacing individual filters while engine is running.

B. Flexible, bronze, fuel line connectors minimum 12 inch in length for supply and return fuel line connections.

2.07 COOLING

A. The engine shall have an engine driven centrifugal type water circulating pump with bypass, for circulating thermostat controlled water through the engine cooling system.

B. Radiator Cooling: A unit-mounted radiator and pusher type fan shall be provided for full load continuous standby operation in an ambient 24 hour temperature of 110 degrees Fahrenheit. Provide a fan shroud and protective guard. Provide radiator drain petcock and pressure relief filler cap, and 50% permanent solution anti-freeze protection.

C. Radiator shall be provided with duct flanges. Provide diverter duct to direct cooling air discharge upward.

D. The pusher radiator fan shall be sized to provide proper cooling air flow to overcome the static back pressure of the supply and exhaust cooling air ducts and louvers associated with the engine generator installation.

2.08 ACCESSORIES

A. Batteries: Starting batteries shall be lead acid type. Batteries shall provide sufficient capacity to provide the equivalent of six (6) 60-second long engine cranking operations with a 60 second rest period between cranking operations at 77 degrees F. with a cold engine and final battery voltage of 1.75 volts per cell at 77 degrees F. Specific gravity of fully charged battery shall not exceed 1.220 at 77 degrees F. Provide insulated stranded copper conductors to connect batteries to generator electric starting motors(s) sized to insure a full load voltage drop of not more then 5%. Mount batteries inside the generator set weatherproof housing.

B. Battery Charger: Completely solid state. DC output shall be voltage regulated and current limited so as not to require a cranking disconnect relay. The charger shall include: full wave output, silicon semiconductors, automatic equalize mode, surge suppression, individual potentiometer adjustments for boost and float voltage, DC output voltmeter and ammeter, AC & DC fuse, input and output terminals, DC output completely isolated from AC input, and shall be capable of charging batteries within a 12 hour period, which have been discharged to zero volts. Input voltage shall be as indicated on the drawings. Mount the charger inside the generator set weatherproof housing.

C. Engine Muffler: Critical grade exhaust silencer with companion flanges, raincap, and seamless stainless steel flexible exhaust tubing, 18" minimum length. Provide approximately 8 inch length of rigid schedule 40 black iron pipe between the exhaust manifold and the flexible tubing. Sweep elbows a minimum radius of three times the exhaust pipe diameter shall be used for exhaust pipe bends. Provide safety guards on exposed exhaust manifolds.

D. The water jacket engine preheater shall provide positive water circulation, thermostatically controlled to keep the water temperature at not less than 90 degrees F. Provide cut-off relay to disconnect power to the heater while the prime mover is running.

E. The generator shall be completely housed in a NEMA 3R weather-protective enclosure. The generator set is to be mounted on a skid, have at least 4 hinged, removable doors and rear hinged control panel door. Silencer shall be side inlet type, mounted on top of housing and terminate with rain cap. Engine exhaust going through housing shall be provided with a suitable rain shield to prevent water from entering the housing. Provide locking hasps on all doors.

F. Radiator, engine and alternator shall be mounted on a twin steel beam base. Base shall be suitable for lifting, hoisting, or skidding of the entire unit into installation position.

G. Engine combustion air intake silencers to limit the air intake noise to less than the engine exhaust silencer noise level.

H. Replaceable dry element heavy duty intake combustion air filters.

I. Remote manual stop station shall be break-glass type, flush-mounted, compatible with generator control circuits, engraved to indicate function. ASCO #124204 series, or equal with "EMERGENCY GENERATOR" nameplate attached to wall above switch.

2.09 FINISH

Engine generator set shall have a manufacturer's standard finish paint color. Housing shall have a rust inhibitor prime coat and finish paint coat manufacturer's standard color.

2.10 FUEL TANK

A. The fuel day tank for the generator shall be of the self-contained skid mount type. Tanks shall be completely housed within the generator weather protective enclosure. Tank finish and color to match generator finish and color.

B. The fuel tank holding capacity shall be of sufficient capacity to operate the genset under full load for 24 hours. Provide fuel filler neck with locking removable cap.

C. The maximum height addition to the generator set caused by the skid mount tank shall be 24 inches.

D. Tank unit shall have rupture basin with accidental spillage detection alarm contacts. Rupture basin capacity shall be sized at a minimum of 115% of fuel tank capacity. Rupture basin shall have 1/2 inch petlock valve at the bottom of the basin to drain contents into portable container.

E. Tank shall be provided with two fuel level float switches, low level engine shut down and low level pre-alarm shut down. Provide level "sight" gauge.

2.11 LOAD BANKS

A. Each generator set shall have a resistive load bank which will operate only under exercising function of the generator. The total KW rating of the load resistors shall be not less than 50 percent of the full load KW rating of the generator to which it is connected, or larger as required by engine generator manufacturer to maintain by unit warranty.

B. Load bank shall be housed in a NEMA 3R weather protective enclosure, mounted integrally to the engine on the front of the radiator, and cooled by the air floor across the radiator. The load bank's load chamber shall have the physical dimensions coordinated with the radiator's duct flange. The radiator fan's cooling capacity shall be increased as necessary to prevent excessive static pressure build up caused by the load bank.

C. Resistors shall be constructed of high temperature alloy capable of continuous operation at 1920 degrees F. with a melting point of 2750 degrees F. and designed to operate at an average of 750 degrees F. The resistors shall be assembled in a three phase array with the phase-to-phase resistor current balanced within 2% and an overall KW tolerance within 5% of its nominal rating.

D. A circuit breaker shall be provided in the engine generator supplying the load bank, sized at 125% of the full load current of the load bank. Provide fuse protection for each individual load bank section.

E. Provide automatic electric contactors as required to activate load bank in the exercising mode. Provide all control interlocks with the automatic transfer switch as required to provide the following functions:

1. Transfer switch exercising timeclock starts generator and brings load bank on-line.

2. Exercising function operates for pre-selected period of time with load bank connected at 100% of load bank capacity.

3. At end of exercise period, load bank shall be automatically taken off-line.

4. If utility power outage occurs during the exercise period, the load bank shall immediately be de-energized before the emergency load automatic transfer switches change position; generator shall continues to run during the disconnect of the load bank.

F. Load bank system shall be as manufactured by Load Technology, Inc., La Mirada, California, AVTRON, Simplex or equal.

2.12 ENGINE EXHAUST PARTICULATE EMISSIONS REDUCTION (PER)

A. The PER shall be a self contained, passive, self-regenerating, continuously self-cleaning (regenerating) particulate filter, with internal precious metal catalysts in conjunction with the particulate filters. Connect the PER “in-line” with engine combustion air exhaust discharge system. PER high temperature 304 stainless steel housing, supports and fittings. The PER filter system, supports, and housing shall withstand and operate correctly with the exhaust flow pulsations, pressures, physical characteristics and thermal conditions of the engine exhaust system. The PER shall be specially designed and manufactured for stationary, internal combustion engine operation and for 2-stroke or 4-stroke engines as applicable.

B. The PER shall reduce environmentally harmful products of ENGINE combustion present in the engine combustion air exhaust. The PER shall not cause an increase in any other engine exhaust toxic contaminants:

1. Diesel particulates reduction (without increasing $N0^2$ content) not less than ..... 80-percent reduction

2. Carbon Monoxide (CO)
   not less than.....70-percent reduction

3. Total Hydro Carbons (THC)
   not less than.....70 percent reduction

C. The PER shall be tested, approved and certified to comply with Federal - EPA, State and Local air quantity management districts and applicable AHJ, by the engine generator manufacturer, for safe correct operation of the proposed engine/PER combination and by the PER manufacturer for AHJ compliance and engine compatibility. The PER shall be listed and approved by and with each AHJ.

D. A microprocessor - based, data logger and alarm, with data logger and sensors installed to record PER temperature and engine exhaust back pressure, shall detect if engine combustion exhaust back pressure and/or PER operating temperatures comply with and/or exceeds engine and PER manufacturer's recommendations. The alarm status shall also be reported on the engine generator remote annunciator panel (EGAP) and the engine generator internal control panel.

E. Provide a permanent sign on the engine generator fuel input port and each related fuel storage tank, minimum 1/4" high block letters:

   "Warning this engine is equipped with an engine exhaust particulate combination filter/catalyzer. Diesel fuel for this unit <u>shall be</u> Ultra Low Sulfer Diesel fuel (ULSD), maximum of 15 PPM sulfer content or less, as measured by weight. Damage to the equipment and failure to operate may occur if the correct ULSD fuel is not used!"

F. PER systems requiring the addition of additives to the engine post production fuel supply are not acceptable.

G. Standby Emergency Unit Operation with Particulate PER Filter

   1. The particulate emissions shall not exceed AHJ requirements, but in no case shall particulate emissions exceed the following:

      a. The engine combustion air exhaust (discharge) shall not exceed particulate emissions (PM) of 0.15 grams/Bhp-HR (engine brake horse power each hour)at all engine generator load factors.

PART 3 - EXECUTION

3.01 GENERATOR INSTALLATION

A. Generator engine shall have a crankcase drain pipe that is at least 8" from the floor, equipped with a readily accessible positive locking shut-off valve. All units shall have a removable full length drip pan under the engine.

B. Provide expansion type or cast in place type anchor bolts to anchor generator to equipment slab. Installation shall comply with seismic requirements of California Code of Regulations Title 21 and Title 24.

3.02 ENGINE-GENERATOR TESTS

A. Before delivery to the site, the set shall be given a preliminary operation and load test. The test shall be performed by a certified testing laboratory. The tests shall include full load test with a load bank of adequate capacity and shall assure performance of all specified function to the satisfaction of the Architect. Upon completion of the preliminary tests, the unit, complete with equipment, shall be delivered and installed at site by the Contractor. Provide four copies of complete test records. A copy shall be framed and mounted in the unit by the Contractor. All factory load tests must be run at 80% lagging power factor.

B. Upon completion of the installation work, including the electrical connections, and grounding of equipment and neutral, the Contractor shall provide all necessary facilities, instruments and equipment, including full capacity load bank required for the load tests, and arrange for final test runs. Field tests to be run at unity power factor with Contractor provided unity power factor load bank, and fuel:

1. With prime mover in a "cold start" condition and emergency load at normal operating level, initiate a normal power failure by opening all switches or breakers supplying the normal power to the building or facility. Test load shall be actual building emergency load.

2. Observe and record the time delay on start.

3. Observe and record the cranking time until the prime mover starts and runs.

4. Observe and record the time required to come up to operating speed.

5. Record voltage, frequency overshoot.

6. Observe and record time required to achieve steady-state condition with all switches transferred to the emergency position.

7. Record voltage, frequency and amperes.

8. Record prime mover oil pressure, water temperature and battery charge rate at 5-minute intervals for the first 15 minutes, and at 15-minute intervals thereafter.

9. Continue load test with building load for two hours observing and recording load changes and the resultant effect on voltage and frequency.

10. Return normal power to the facility, record the time delay on retransfer to normal (set at 5 minutes), and the time delay on prime mover cooldown period and shutdown (set at 5 minutes).

11. Immediately begin a two-hour, full-load test. Utilize a load bank of sufficient size to provide a load equal to 100 percent of the system rating. Unity power factor is acceptable for on-site testing, provided that rated load tests at rated power factory have been performed by the manufacturer of the engine-generator set prior to

shipment. The full-load test shall be initiated immediately after the cooling time by any method that will start the prime mover and, immediately upon reaching rated rpm, pick up 100 percent of rated load.

12. Record the data listed in items 2 thru 8 above at first load acceptance and every 15 minutes thereafter until the completion of the two-hour test period.

13. Utilize any method recommended by the manufacturer or prevent the prime mover from running. Put the control switch into "run" to cause the prime mover to crank. Observe and record the complete crank rest cycle.

14. Test all safe-ties as recommended by the manufacturer.

3.03 Before acceptance of set, the Contractor shall conduct an instructional training session with the Owner's maintenance forces in the operation and maintenance of this equipment. The session shall be conducted by factory-trained personnel. Four complete written instructions manuals, operating schedules, parts, lists, blueprints, wiring diagrams, maintenance and repair manuals, engine and generator specifications including actual performance curves shall be submitted to the Architect before final approval.

Perform tests as specified and as requested by the Architect to prove installation is in accordance with contract requirements. Perform tests in presence of the IOR, all test equipment, facilities, and technical personnel required to perform tests.

3.04 The generator factory trained service personnel shall perform two field inspections and service maintenance visits, 4 hours each visit excluding travel time, at six and eleven calendar months after the generator testing is complete. The manufacturers standard recommended maintenance procedures shall be performed as part of the contract requirements. A letter certifying the work has been completed and shall be sent to the District after each visit.

END OF SECTION
120711/270032

SECTION 16720
INTEGRATED FIRE ALARM /SECURITY SYSTEM

PART 1 - GENERAL

1.01 SCOPE & RELATED DOCUMENTS

A. The work covered by this section of the specifications include the furnishing of all labor, equipment, materials and performance of all operations associated with the installation of the Fire/Security Alarm Systems as outlined. All items required to complete the installation whether detailed here in the specification or on the drawings shall be included in this contract.

B. The requirements of the conditions of the Contract, Supplementary Conditions, and General Requirements apply to the work specified in this section.

C. Related work in other sections or divisions:

1. Waterflow switches.

2. Sprinkler valve supervisory switches.

3. HVAC Systems Controls.

4. Elevator monitor/control panel.

5. Electrical (Section 16000).

D. The entire installation, including materials and equipment shall meet or exceed the minimum standards and requirements of the following:

1. Underwriters Laboratory Inc.

2. 2010 Building Standards Administrative Code, Part 1, Title 24 C.C.R.

3. 2010 California Building Code (CBC), Part 2, Title 24 (2008 IBC Volumes 1-3 and 2009 California Amendments).

4. 2010 California Electrical Code (CEC), Part 3, Title 24 C.C.R. (2008 NEC and 2009 California Amendments).

5. 2010 California Fire Code (CFC), Part 9, Title 24 C.C.R. (2008 UFC and 2009 California Amendments).

6. 2010 California Mechanical Code (CMC), Part 3, Title 24 C.C.R. (2008 UMC and 2009 Amendments).

7. 2010 California Referenced Standards Code, Part 12, Title 24, C.C.R. Title 19, C.C.R. Public Safety, State Fire Marshall Regulations.

8. 2002 NFPA 72, with California Amendments.

9. Manufacturers Specifications.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. The plans for this project have already been approved by DSA-FLS. The Contractor shall prepare eight (8) sets of blue-line drawings, eight (8) sets of submittal booklets, for submittal to the Architect for approval.

B. The following shall be included on all drawings:

1. Building floor plan of each building drawn to 1/8" scale minimum. Building floor plan shall show location of all devices, conduit and interconnecting wires. Device symbols shall be the same as on the original bid set of drawings. Show all fire rated corridors, occupancy separations and area separation walls. Show all Room Identification Numbers/Use.

2. Site plan showing all buildings, conduit and interconnecting wires.

3. Complete symbol legend (same symbols as bid set), showing all symbols, wire, manufacturer, model number, back-box, mounting height and CSFM Listing Number.

4. Typical mounting height details.

5. Voltage drop using point to point or OHMS Law calculations. Voltage drop shall not exceed 10% per circuit.

6. Battery calculations with batteries used:

   a. Normal - 100% for applicable equipment and devices for a period of 24 Hours.

   b. Alarm - 100% for applicable equipment and devices for a period of 5 Minutes.

7. Codes as used in the design of this project.

8. DSA Application Number and District File Number.

9. Classification per building. Ex: Manual, Automatic, etc.

10. Typical fire penetration detail showing methods and codes used.

11. Wiring riser diagram including but not limited to, devices, wiring, zoning, EOL'S, etc.

12. Sequence of operations schedule.

13. General notes pertaining to this project.

C. The following shall be included in the submittal book:

1. Cover Sheet: Project Name, Project Location, Architect/Engineer of record, System Supplier/System Installer with C-10 License Number, UL Listing Number with Expiration Dates.

2. Table of Contents: Page numbers of all specification sheets and CSFM Listing Numbers.

3. Specification Sheets for each piece of equipment.

4. CSFM Listing Sheets.

1.03 EQUIPMENT QUALIFICATION

A. The specification is based upon equipment as manufactured by EDWARDS Systems Technology (EST) or District approved equal. The equipment specified shall communicate with the EXISTING Fireworks Central Monitoring System at the District School Police Headquarters (EDWARDS EST Fireworks was provided under separate contract and is not part of this contract). The EDWARDS EST-3 control panel shall communicate with the EXISTING Fireworks via District's LAN network. Coordinate with District's IT department for configuring LAN network to communicate with EDWARDS Fireworks. The system supplied shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based Fire Alarm and Security Detectors, Devices and Modules as described in this specification. It shall be complete with all-necessary hardware, software and memory specifically tailored for this installation.

B. All equipment shall conform to all applicable codes and ordinances, and shall be listed by Underwriters Laboratories and the California State Fire Marshall.

C. Equipment suppliers, installation and service for the equipment specified can be found at https://est.edwardsutcfs.com/EST_Dist_Search.cfm.

D. Should Contractor elect to submit a different system than specified, Contractor is to, at his/her sole expense, within 30 days of contract award provide and install a complete mock-up of the system at a school site selected by the District for review and approval by the District as a part of the substitution request process. Said mock up shall demonstrate to the sole satisfaction of the District complete compatibility, bi directional communication and control compatibility between the proposed fire/security system and the existing FireWorks Central Monitoring System.

E. EWARDS. EST-3 or Mock-up of District approved equal system, as installed and operational, to perform per specifications herein, shall be fully integrated, whereby the fire alarm system shall not be overridden by any other system including the security systems. Fire alarm shall always have priority over security system. To the extent permitted by all applicable codes, other than fire alarm system having priority in the event of a

simultaneous alarm, fault, failure, and/or defect, fire alarm system shall not override security system.

F. Contractor is responsible for engineering and Division of the State Architect approval associated the proposed system; and fees borne there from. Fire alarm and security systems shall be separately wired and there shall be two separate data loops, one for each system.

1.04 QUALIFICATION OF BIDDERS

A. To qualify as an acceptable bidder, whether the bid is submitted to the Owner, his agent, a general contractor or a sub-contractor, the system bidder or contractor shall be a qualified U.L. Listed Fire Alarm contractor (at time of bid) and shall hold a valid C-10 License issued by the Contractors State License Board of California. The system bidder or installing contractor shall herein be referred to as the Contractor. The Contractor shall also hold a State of California Consumer Affairs License - Bureau of Collection and Investigative Services. The Contractor shall also have on staff, a minimum of Three NICET Certified Technologists (at time of bid). This is to insure that licensed installers familiar with this type of installation will be used on this project. The Contractor shall be the factory authorized distributor (at time of bid), for the brand of equipment being installed. The Contractor shall have been in the business of supplying, installing and servicing Addressable Fire Alarm Systems for the past ten (10) years, in the State of California. The Contractor shall be able to refer to at least twenty (20) projects of this nature rendering satisfactory service with contact persons, phone numbers, and addresses. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall maintain an inventory of all major components in stock at all times. The Contractor's Office shall be located within 50 miles of the job-site. This will insure an adequate service response, in a timely matter. The Contractor shall maintain on staff for the duration of the project a minimum of two EST-3 and Fire Works Certified Installers. Contractors named in 1.03C above, will be able to satisfy warranties already in place, when adding onto the Fire Works Central Monitoring System Program.

B. The responsibility of the installing Contractor is to provide all drawings, submittals, wire, devices, equipment, installation to conduit system furnished and installed under Section 16000, programming, final test out and certification. All specialty Fire Alarm Back-boxes for the conduit system installation provided under Section 16000, shall be provided under this section. Terminal cabinets, pull boxes, etc. shall be furnished and installed under section 16000.

PART 2 - SYSTEM LAYOUT

2.01 SYSTEM DESCRIPTION

A. The Fire/Security Alarm System as outlined on the drawings, shall be a Life Safety, Security System as manufactured by EDWARDS. It shall be complete with all necessary hardware, software and memory specifically tailored for this project.

B. Provide a new Network System, Remote Panels, Remote Annunciators, Printers, Devices, etc. in accordance with specifications and drawings. Counts for fire alarm devices to be in accordance with contract drawings. Counts for security system devices shall be as determined by the Contractor bidding these systems unless otherwise shown on the drawings. Criteria for security system shall b e : each perimeter room with windows shall have motion detectors. Each perimeter room with exterior doors shall have either door detectors or room motion detectors. Interior or exterior rooms with skylights which are accessible from the roof shall have motion detectors.

C. All equipment needed for a complete operable system, (whether specifically indicated or not) shall be included in this section. It shall be the Installing Contractors responsibility for a COMPLETE AND OPERABLE SYSTEM upon completion of this project. Systems shall be independently wired and shall be a dual loop system. A separate panel shall be provided for the security system adjacent and interconnected with the Fire Alarm Control Panel and/or Annunciator Panel as appropriate. At no time shall the fire alarm system be overridden by the security system nor shall any faults in the security system shall not disarm the fire alarm system.

2.02 AUTOMATIC ALARM OPERATIONS

A. The fire alarm system operation subsequent to the alarm initiation via pull station, smoke detector, heat detector, sprinkler flow switch, etc., shall be as follows:

1. All audible alarm indicating devices shall sound the Temporal Signal Code in synchronization with each other, until silenced at the control panel or at the remote annunciator.

2. All visual alarm indicating devices shall flash per NFPA requirements in synchronization with each other, until reset at the control panel or at the remote annunciator.

3. Alarm audible devices and alarm visual devices shall operate on the same circuit.

4. The alarm signals shall be inhibited from being silenced for a period of at least one (1) minute after commencing operation. This rate is to be field programmable for actual AHJ requirements.

5. Display type and location of alarm per point on the Main Control Panel LCD display.

6. Display type and location of alarm per point on Remote LCD Annunciator.

7. List on printer the time, date, type and user defined message for each event printed.

8. Graphically display on the Fire Works Station, school diagram showing whole school, with Graphic scrolling thru system prompts, down to point of alarm activation.

9. Subsequent alarms are to report to the Main Control Panel and Fire Works, shall indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.

10. Shut down all associated air handlers in Alarm Zone.

11. De-energize door holders to release fire doors in Alarm Zone.

12. Recall elevators as required.

B. The security alarm system operation subsequent to the alarm initiation via motion detector, door contact, tamper switch, etc., shall be as follows:

1. Individual device in alarm shall display on partition keypad, in which zone device is located.

2. Display type and location of alarm per point on the Main Control Panel.

3. Display type and location of alarm per point on Remote LCD Annunciator.

4. List on printer the time, date, type, and user defined message for each event printed.

5. Graphically display on the Fire Works Station, school diagram showing whole school, with graphic scrolling thru system prompts, down to point of alarm activation.

6. Subsequent alarms are to report to the Keypad, Control Panel, and Fire Works and indicate to the operator that a subsequent alarm is present, and also indicate the number of subsequent alarms.

2.03 AUTOMATIC SUPERVISORY OPERATION

A. All data, initiating, indicating and supervisory lines shall be constantly monitored for integrity. Indicate opens, shorts, grounds, at Main Control Panel, Remote Annunciator and Fire Works Station.

2.04 OPERATION

A. During the normal state, the NORMAL LED (green) shall flash. The first line of the LCD shall display the time in (HH:MM:SS) as well as the number of active points (AP) and the number of disabled points (DP) in the system.

B. When the control panel goes into alarm condition, the NORMAL LED (green) extinguishes and the ALARM LED (red) shall light, the buzzer pulsates and the LCD indicates the time, the number of messages waiting, the type of alarm, the point ID number of device, and the time that the alarm occurred. The second line is dedicated to the user-specified message.

C. To silence the panel buzzer, the operator shall press the LOCAL SILENCE button and the buzzer will silence.

D. To silence the audible devices, the operator shall press the ALARM SILENCE button. A new alarm shall cause the audibles to resound.

E. During the TROUBLE condition, the amber TROUBLE LED shall light, the NORMAL LED shall go out, and the buzzer shall pulsate. The display shall indicate the point ID number of the device, the time the event occurred and up to a 40-character custom user description.

F. During the MONITOR or SUPERVISORY condition, the appropriate LED shall light, the NORMAL LED shall go out, and the buzzer shall pulsate. The display shall indicate the point ID number of the device, the time the event occurred and up to a 40-character custom user description.

PART 3 - MATERIALS

3.01 MAIN or REMOTE CONTROL PANEL EST-3 W/CAB7/CAB14/CAB21

A. Control Panel construction shall be modular with solid state, micro - processor based electronics. It shall display only those primary controls and displays essential to operation during an alarm condition.

B. A local audible device shall sound during Alarm, Trouble, Monitor or Supervisory conditions. This audible device shall sound differently at each condition, to distinguish one condition from another without having to view the panel.

C. Primary Keys, LED's, LCD Display

1. The following primary controls shall be visible through a front access panel:

a. 8 Line by 21 Character LCD display
b. Individual System ALARM LED and Switch
c. Individual SUPERVISORY LED and Switch
d. Individual TROUBLE LED and Switch
e. Individual MONITOR LED and Switch
f. Individual RESET LED and Switch
g. Individual ALARM SILENCE LED and Switch
h. Individual PANEL SILENCE LED and Switch
i. Individual DRILL LED and Switch
j. Individual LED'S For Power, Test, CPU Fail, Ground Fault, Disable
k. NEXT/BACK Switch Per Condition

D. The Master Controller shall be capable of supporting up to 64 supervised system nodes per single line network without any change in hardware. Each controller shall contain a RS-232 Printer/Programming Port for programming locally via an IBM PC.

E. Each controller shall support up to 10 Intelligent Loop Cards (SDCs). Each card shall support (125) Intelligent Sensors and (125) Intelligent Modules. Each sensor shall respond to a panel poll for information with an analog representation of measured fire related phenomena (smoke density, particles of combustion, temperature). Such response proves end to end sensor response including the operation of the sensor

electronics. Systems which only monitor the presence of a conventional detector in an addressable base shall not be acceptable.

F. The Master Controller shall have the following additional features without any changes in hardware or firmware:

1. Auto Programming and Electronic Addressing of Field Devices.
2. Logic Statements.
3. Time Controls.
4. Sequences.
5. Actions.
6. Analog Value Reporting of all analog sensors and traditional zones.
7. Maintenance Reporting by Intelligent Sensor.
8. Sensitivity Setting by Sensor (Within UL Limits).
9. Sensitivity Setting changed by time (Day/Night Mode).
10. Alarm Verification by point or zone. (0-60 Seconds).
11. Print a history of Sensors Activating the Verification Cycle.
12. On demand system condition printouts (status).
13. Enabling and Disabling of any system device or function.
14. Ground Fault Detection by Panel, by Signature Data Circuit, and by Device Module.
15. Normal and Silent One Man Test.
16. Windows Based Programming.
17. Network Response Time Under Three (3) Seconds.
18. Loop Response Time Under 750 Milliseconds.
19. Device Mapping Feature for As-Builts.
20. Up to 1750 History Events
21. Remote Systems Diagnostic via Phone Line

3.02 REMOTE ANNUNCIATOR - 3- LCDANN

A. Remote Annunciator to accommodate all buildings for the Fire/Security/Access Alarm System. Annunciator zoning shall have the following displays as a minimum:

1. Point ID number of each device.

2. Custom annunciation of each device.

3. Common Controls Features.

.

B. The remote annunciator shall contain the following:

1. Eight (8) Line by 21 Character LCD Display.

2. Individual System ALARM LED and Switch.

3. Individual SUPERVISORY LED and Switch.

4. Individual TROUBLE LED and Switch.

5. Individual MONITOR LED and Switch.

6. Individual RESET LED and Switch.

7. Individual ALARM LED and Switch.

8. Individual TROUBLE LED and Switch.

9. Individual DRILL LED and Switch.

10. Individual LED'S For Power, Test, CPU Fail, Ground Fault, Disable.

3.03 KEYPADS – KPDISP

A. Provide keypads at each building, as indicated on drawings.

1. Keypads to be backlit 128 x 64 dot matrix LCD Display.

2. Units to support bilingual operation.

3. Keypad shall be electronic addressing. Jumpers or dip switch addressing shall not be considered equivalent. Each Keypad shall support up to 200 users, with unique PIN numbers.

3.04 PRINTER - PT-1S

A. Provide printer for the life safety system..

B. The event and status printer shall be a 9 pin, impact, dot matrix printer with a minimum print speed of 232 characters per second. Printer parameters shall be set up with a menu drive program in the printer. The printer shall be capable of serial or parallel communications protocol.

C. The communications speed for RS-232 communications protocol shall be adjustable from 300 - 9600 Baud. The serial cable shall be supervised.

D. The printer shall list the time, date, type and user defined message for each event printed.

SIGNATURE SERIES DEVICES - GENERAL

1. Each remote device shall have a microprocessor with non-volatile memory to support its function and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, number of alarms and troubles, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.

2. Dependent on its functionality, each device shall be capable of monitoring up to 32 diagnostic codes. This data shall be stored at the device and available for system maintenance.

3. Each device shall be capable of performing its intended function dependent of the control panel, to lower loop data traffic. Each device shall immediately alert the loop controller of a status change to achieve a loop response time of less than 750ms.

4. Each device shall be capable of electronic addressing, either automatically or application program designed, to support physical/electrical mapping and supervision by location. Setting a device's address by physical means shall not be necessary. Each device shall be individually annunciated at the Main Control Panel and Remote Annunciator.

3.05 ANALOG PULL STATIONS - SIGA-278

A. Provide pull stations as indicated on the drawings.

B. Pull station shall be double action with terminals for field wiring. Pull station shall be constructed of Red Lexan with White Letters, Key resettable with break glass rod.

C. Station shall be equipped with a STI 1100 Protective Cover w/horn, if indicated on drawings.

D. For flush mounting applications - Use 4S 2-1/8-inch box with ½-inch Single Gang Ring. (Furnished and Installed under Section 16000).

E. For surface mounting applications - Use 276B-RSB Backbox with STI-3100 Conduit Spacer. (Furnished under this section, Installed under Section 16000).

3.06 ANALOG SMOKE DETECTORS - SIGA-IPHS W/SIGA-SB BASE

A. Provide Intelligent Multi-Sensor Detector where indicated on the drawings.

B. Units shall incorporate three (3) sensing technologies. It shall process and analyze information from each technology (ion/photo/heat) separately using dynamic filters, then apply a sophisticated algorithm for optimum detection accuracy. If alternate equipment is proposed, contractor shall install additional devices as required, to accomplish ALL of the above operations. ALL additional costs shall be borne by contractor.

C. Each sensing element self-compensates for changes in the detectors installed environment to maintain the sensitivity setting and prevent unwanted alarms. The detector reports when it cannot compensate any further.

D. Units shall incorporate twin status LED's. Flashing green shows normal; flashing red shows alarm state; steady red and steady green show alarm state in stand alone mode, visible from any direction.

E. Units shall incorporate a stand-alone operation mode. The detector makes decisions and inputs an alarm even if the loop controller fails. The detector reverts to an intelligent "conventional" detector when polling interrogation stops.

F. Units shall mount to the SIGA-SB, SIGA-RB or SIGA-IB bases as required.

G. Base shall mount to a 4S 2-1/8-inch box with 3-0 ½-inch ring (Furnished and Installed under Section 16000).

3.07 DUCT SMOKE DETECTORS - SIGA-SD (SUPER DUCT W/INTELLIGENT SENSOR)

A. Provide Duct Smoke Detectors where indicated on the drawings.

B. Duct Housing shall be constructed of a plastic housing. Units shall incorporate the SIGA-PS sensor, base as required and sampling tubes as required for duct width.

C. Each air-handling unit shall be controlled from the built in relay, for shut down of that particular unit.

D. Duct Housings, Detectors, and Sampling Tubes are to be supplied by this section.

E. Duct Housings and Sampling Tubes are to be installed as part of the conduit system in Section 16000. Section 16000 Contractor to provide and install weatherproof housings for above, if applicable to this project.

3.08 HEAT DETECTORS - SIGA-HFS or SIGA-HRS W/SIGA-SB BASE

A. Provide Heat Sensors where indicated on the drawings.

B. Detectors shall gather analog information from their fixed temperature and/or rate-of-rise heat sensing elements and convert it into digital signals. The detectors on board microprocessor measures and analyzes these signals. It compares the information to

historical readings and time patterns to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.

C. Units shall incorporate twin status LED's. Flashing green shows normal; flashing red shows alarm state; steady red and steady green show alarm state in stand alone mode, visible from any direction.

D. Units shall mount to the SIGA-SB, SIGA-RB or SIGA-IB bases as required.

E. Base shall mount to a 4S 2-1/8-inch box with 3-0 Ring (Furnished and Installed under Section 16000).

3.09 ATTIC HEAT DETECTORS - 284B-PL W/SIGA-CT1

A. Provide Heat Detectors where indicated on the drawings.

B. Units shall incorporate single pole, normally open contacts, and SIGA-CT1 Monitor Module.

C. Fixed Temperature Rating shall be 194 Degrees Fahrenheit.

D. Units shall mount to a 4S 2-1/8-inch box with 3-0 Ring (Furnished and Installed under Section 16000).

E. Monitor modules shall mount to a 4-S 2-1/8-inch box with one (1) Gang Ring (Furnished and Installed under Section 16000).

3.10 STROBES – GENESIS G1RF-VM (Wall)

A. Provide Strobes as indicated on the drawings.

B. Strobes shall be Multi Candela rated 15cd, 30cd, 75cd or 110cd. Strobes shall be capable of being on same circuit as audibles, be synchronized and flash per NFPA requirements. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc. All additional costs to be borne by contractor. Strobes shall be listed for indoor applications. Units shall be rated for 24VDC polarized operation.

C. For flush mount applications - Use 4S 2-1/8" boxes with one (1) Gang Ring. (Furnished and Installed under Section 16000).

D. For surface mount applications - Use One (1) Gang Wiremold Box V5748 (Furnished and installed under Section 16000).

3.11 STROBES – GENESIS GCF-VM (Ceiling)

A. Provide Strobes as indicated on the drawings.

B. Strobes shall be Multi Candela rated 15cd, 30cd, 75cd or 95cd. Strobes shall be capable of being on same circuit as audibles, be synchronized and flash per NFPA requirements. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc. All additional costs to be borne by contractor.

Strobes shall be listed for indoor applications. Units shall be rated for 24VDC polarized operation.

C. For flush mount applications - Use 4S 2-1/8" boxes with 4-S Extensions Ring (Furnished and Installed under Section 16000).

D. For surface mount applications - Use Wiremold Box V5753 (Furnished and installed under Section 16000).

3.12 HORNS - 757-1A-T

A. Provide Horns as indicated on the drawings.

B. Horns shall be rated at 94dBA - low and 98dBA - high. Units shall incorporate a high and low setting position. Units shall be rated for 24VDC polarized operation. Units shall have screw terminals for input/output wiring, be red in color and be suitable for indoor or outdoor applications. Units shall be capable of being installed on the same circuit as visual devices and shall sound the Temporal Code in synchronization with all units. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc. All additional costs to be borne by contractor.

C. For flush mount applications indoor - Use 4S 2-1/8-inch boxes with two (2) Gang Ring (Furnished and Installed under Section 16000).

D. For surface mount applications indoor - Use 757A-SB Back-box (Furnished under this section, Installed under Section 16000).

E. For surface mount applications outdoor - Use 757A-WB Back-box (Furnished under this section, Installed under Section 16000).

3.13 HORN/STROBES – G1RF-HDVM (Wall)

A. Provide Horn/Strobes as indicated on the drawings.

B. HORN/(Strobes) to be rated at 92.5dBA - low and 97.6BA - high. Units shall incorporate a high and low horn setting position. (Horn)/STROBE to be Multi Candela Rated at 15cd, 30cd, 75cd or 110cd. Units shall have screw terminals for input/output wiring and be suitable for indoor applications. Units shall be capable of being installed on the same indicating circuit. Units shall sound the Temporal Code in synchronization and strobes shall flash in synchronization per NFPA requirements. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc. All additional costs to be borne by contractor. Units to rated for 24VDC polarized operation.

C. For flush mount applications - Use 4S 2-1/8-inch boxes with one (1) Gang Ring (Furnished and Installed under Section 16000).

D. For surface mount applications - Use Wiremold Box V5748 (Furnished under this section, Installed under Section 16000).

3.14 HORN/STROBES – GCF-VM (Ceiling)

A. Provide Horn/Strobes as indicated on the drawings.

B. HORN/(Strobes) to be rated at 92.4dBA - low and 96.6BA - high. Units shall incorporate a high and low horn setting position. (Horn)/STROBE to be Multi Candela Rated at 15cd, 30cd, 75cd or 95cd. Units shall have screw terminals for input/output wiring and be suitable for indoor applications. Units shall be capable of being installed on the same indicating circuit. Units shall sound the Temporal Code in synchronization and strobes shall flash in synchronization per NFPA requirements. Units not capable of this feature shall install separate audible and visual circuits, conductors, synchronization modules, etc. All additional costs to be borne by contractor. Units to rated for 24VDC polarized operation.

C. For flush mount applications - Use 4S 2-1/8-inch boxes with four (4) S Extension Ring (Furnished and Installed under Section 16000).

D. For surface mount applications - Use Wiremold Box V5753 (Furnished under this section, Installed under Section 16000).

3.15 MODULES - SIGA-CC1S/SIGA-CT1/SIGA-CT2/SIGA-CR/SIGA-MM1/SIGA-WTM

A. Provide modules as indicated on the drawings.

B. Units shall permanently store serial number, type of device, and job number. Each module shall be capable of having its own personality code. Use respected module for particular application. Modules shall use electronic addressing. Use of switches to set address will be prohibited.

C. Module for flush or surface mountings - Use 4S 2-1/8-inch Boxes One or two (2) Gang Ring as required, (Furnished and Installed under Section 16000).

3.16 SECURITY MODULE – SIGA-SEC2

A. Provide modules as indicated on the drawings.

B. The Dual Input Module shall provide two (2) input circuits, each capable of a minimum of six (6) personalities, each with a distinct operation.

3.17 SECURITY MOTION DETECTORS – SIGA-MDS

A. Provide motion detectors as indicated on the drawings. Where detectors are not shown on the drawings, provide motion and door detectors per the criteria listed above. All wiring shall be in conduit.

B. The passive infrared motion detector shall utilize adaptive signal processing with gliding focus mirror optics to analyze the size, speed and shape to determine the alarm threshold.

C. The unit shall be configurable for up to seven different curtain patterns has a range of up to 34 ft. and a 90-degree field of view.

3.18 DOOR DETECTORS – SIGA-SEC 2

A. Door detectors (for any and all exterior doors in rooms without exterior windows or skylights) shall be as manufactured or supplied by EDWARDS ES-3.

3.19 OTHER EQUIPMENT

A. Provide all other materials equipment and parts as required for a complete first class operating fire alarm and integrated security system.

PART 4 - EXECUTION

4.01 INSTALLATION

A. Wiring shall be installed in conduit as specified under the electrical section of the specification (Section 16000).

B. The sum of the cross-sectional areas of individual conductors shall not exceed 40% of the interior cross sectional area of the conduit. Minimum conduit size shall be 3/4 inch trade size.

C. Wiring shall be identified at terminal and junction locations to prevent unintentional interference with the circuits during testing and servicing.

D. Junction, pull and terminal boxes/cabinets shall be labeled. Labels shall be permanently affixed to covers/doors. Labeling to be Furnished and Installed under Section 16000.

E. Wiring color code shall be consistent throughout the system and shall allow for easy identification of initiating, indicating and auxiliary control circuits.

F. Wiring at building terminal cabinets shall be terminated to screw barrier strips, with circuits identified.

G. Wiring in control, terminal and junction cabinets shall be neatly arranged and bundled.

H. Wiring shall test free of earth grounds or shorts between conductors.

I. The contractor shall be responsible and assure the use of adequate numbers of skilled workmen, who are thoroughly trained and experienced, and completely familiar with the specified equipment and code requirements.

J. The contractor shall be responsible for assuring that conduit size, wire type and color coding meets the specification, manufacturers and code requirements.

4.02 SYSTEM VERIFICATION

A. Upon completion of the installation, the fire alarm contractor shall place into operation and test all operational features, functions, and devices. Test shall be conducted with District personnel present. Each device shall be tested from central monitoring station and at each device location. Upon completion of the installation, the fire alarm contractor shall place into operation and test all operational features, functions, and devices. Each and every security and fire alarm device shall be field tested in the presence of the

District Representative. Any device which fails to adequately communicate with the FACP, FAAP and/or FireWorks or District approved equal Central Monitoring System shall be replaced at no cost to the District.

B. Upon completion of testing, and after the system has been in operation for a minimum of five (5) days without failure, the fire alarm contractor shall schedule with the Authority Having Jurisdiction (DSA INSPECTOR), Architect and Engineer, a demonstration and field acceptance test.

C. Field acceptance and approval of the fire alarm system shall be evidenced in writing by the Authority Having Jurisdiction.

D. Prior to scheduling field acceptance, the fire alarm system contractor shall certify in writing, and record the method of testing, the results of all tests and certify that the system has been in operation a minimum of five (5) days.

E. All testing shall be conducted in accordance with NFPA-72, contract documents, manufacturer's instructions and per the requirements of the Authority Having Jurisdiction.

4.03 GUARANTEE AND SERVICE

A. Fire alarm system contractor shall provide written guarantees for all fire alarm equipment and devices used on this project for a period of THREE (3) YEARS from the date of final acceptance.

B. During the guarantee period the contractor shall repair or replace any defective material at no additional cost to the Owner.

4.04 IN SERVICE TRAINING

A. The fire alarm contractor shall provide factory trained representatives to demonstrate the operation of the fire alarm system to the Owner's personnel. The representative shall have a thorough knowledge of the equipment and operation of the system. The contractor shall provide two (2) 4-hour in-service training sessions which shall be videotaped by the Contractor, and a VHS videotape and DVD compact disk turned over to the District for future use.

B. The fire alarm contractor shall provide to the Authority Having Jurisdiction a demonstration of system operation. Sessions shall consist of one (1) 4-hour in-service training.

4.05 OPERATION MAINTENANCE MANUALS

A. The fire alarm contractor shall provide to the Engineer, three (3) weeks after the field acceptance test, two (2) sets of operating/maintenance manuals and one (1) set of as-built drawings.

B. As-built drawings shall indicate the location of all devices, appliances, coding, zoning, wiring sequences, wiring methods, color coding, identification, labeling and connections

of the components of the fire alarm system as installed. The as-builts shall include a mapping sequence as generated by the Fire Alarm Control Panel and connected computer. Systems not capable of this feature shall generate TRUE Device mapping sequences as-builts on Auto Cad 14. These as-builts shall show the physical layout of all addressable devices as they were actually installed on the loop.

END OF SECTION
120711/270032

SECTION 16745

TELEPHONE SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit block wiring diagrams of the system.

C. Submit FCC registration number of system proposed.

1.03 EQUIPMENT QUALIFICATION

A. The specification is based on proprietary equipment of manufacturers who have been approved by the District and the manufacturers herein named shall be considered as meeting the requirements of this specification. For all items which are identified by part number and manufacturer the Performance specifications which are published in the most recent manufacturer's data sheets available at the time of bidding this project shall be applicable to the present work as though fully written out herein.

B. All equipment shall conform to all local applicable codes and ordinances, and shall be listed by Underwriters Laboratories.

C. The system shall be approved for direct interconnection to the utility services under part 68 of FCC rules and regulations.

D. The system shall be manufactured by Siemens or equal by Nortel complete with voice mail system and shall integrate with the public address (PA), intercom, clock and class/program change systems. The PBX shall have the capability for future Voice Over IP (VOIP) functionality. Intercom phones shall not be VOIP digital instruments.

1.04 QUALIFICATIONS

A. To qualify as an acceptable bidder, whether the bid is submitted to the District, his agent, a general contractor or a sub-contractor, the system bidder shall be the factory authorized distributor for the brand of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least five years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.

B. Installation Certification

1. Work and material for cables, cable terminations and related components shall be performed by installers certified for commercial installations. The installer shall be certified by the respective product manufacturers.

2. The manufacturers of the indicated work and material, shall provide an installer education/training and certification program for the supplied products.

3. The installers performing the Contract work for the indicated products, shall have attended and successfully completed each of the respective manufacturer's installation training education programs for the specified products.

4. Six copies (6) of the manufacturer's certifications for each installer performing the work shall be submitted to the Architect. The submittal shall be approved by the Architect prior to initiating any related contract work.

5. Contract material installed and work performed by installers not complying with these requirements shall be removed. Removal of work and material not in compliance with these requirements shall done at the CONTRACTOR'S expense without any additional cost to the contract and without any additional contract completion date extensions. New material and work required to replace the non-complying removed work and material shall be provided at the CONTRACTOR'S expense, without any additional cost to the contract and without any additional contract completion due date extensions.

PART 2 - PRODUCTS

2.01 MATERIALS

Comply with pertinent provisions of Section 16050 and 16760.

2.02 TELEPHONE EQUIPMENT FUNCTIONS

In addition to all other features of the telephone system, the telephone system shall provide all the following functions and features:

A. Two-way telephonic communication between any two telephones in the system or any combination of telephones in the system.

B. One-way communication between any telephone and the campus paging system as indicated in Section 16760.

C. Two-way communications between the public utility company's central office lines and each telephone in the system.

D. All telephones in the system shall be directly connected to a dedicated station port on the central telephone equipment.

E. Each port on the system shall be capable of becoming either a station or a trunk. The system equipment shall provide adequate ports and station cards to accommodate 125% of the stations indicated on the drawings. The system equipment shall provide adequate ports and trunk cards to accommodate a minimum of sixteen (16) incoming central office trunk lines. The system equipment shall provide tie lines to the paging system per Section 16760.

F. A standby battery supply and battery charger shall be included to preserve memory and programming upon loss of normal operating power.

G. PBX and PA systems shall be interconnected to provide paging access capability from any designated intercommunication telephone. This is usually accomplished with dedicated CO ports from the PBX interfaced into the intercom, public address and class/program change signaling system for transparent functionally and full access from any PBX telephone into the Public Address System, but shall be PIN protected within the PA system.

2.03 CABLING

A. Cable run in conduits below grade shall be approved by the manufacturer for that purpose.

B. Cable serving each telephone station shall be a 4-twisted pair of #24 AWG solid copper conductors with overall PVC jacket. Cable shall be EIA/TIA Category 6.

2.04 TELEPHONES

A. The system installation shall be provided with a modular UL Category 6 RJ-type connector at each telephone/ telecommunications outlet in the system.

B. At each telephone/telecommunications outlet indicated to be at a mounting height of +18", provide an eight-foot long portable Category 6 cord and RJ-type connector at each end, plus a desk-mounted telephone instrument.

C. Where plans indicate a wall-mounted telephone/telecommunications outlet, provide nominal 6-inch long portable Category 6 cord and RJ-type connector at each end, plus a wall-mounted telephone instrument bolted directly over the outlet.

D. The attendant console shall contain an LCD readout with the necessary information to process calls in an efficient and orderly manner.

E. Desk mounted telephones in private offices shall be capable to function as speaker phones, have fixed and programmable keys and have public line switches and an LCD readout.

G. Desk mounted telephones not in private offices shall be capable to function as a speaker phone.

2.05 Telephone Instrument Types (all instruments furnished and installed by District unless otherwise directed by District).

A. Attendant Console Type T1 (Main Office 1 – Location)

Desktop unit. Upper portion of console shall contain a 40-character alphanumeric LCD, major/minor alarm indicators, and trunk group status lamps. Lower portion shall contain a keyboard assembly that allow attendant to process various types of calls and access special features. Hearing-aid-compatible handset. Keys shall be powered from the main switching system power supply and require a cable not larger than 4-pair. DSS adjunct, if provided; may require external power.

B. Telephone Type T2 (Principal/Vice Principal/Assistant Principal Offices)

Desktop unit. Up to 24 buttons with flexible functionality that can be answered from the set, including inside stations and a variety of outside trunks. LCD display minimum of 2 lines x 40 characters and soft keys, line select keys, speed call keys, speaker assembly, microphone, speaker on/off key, microphone on/off key, speaker volume control and ringer volume control.

C. Telephone Type T3 (Not Used)

Desktop unit. Lines can be any variety of internal or external lines. Hold key, transfer/conference redial key, program/save key, speaker on/off key, microphone/mute key, speaker/microphone assembly, speaker volume control, ringer volume control and ring control.

D. Telephone Type T4 (Classrooms and Library Reception Desks)

Desktop unit. 2500 or equal, single-line, fully modular. Hearing-aid-compatible handset, touch tone, ringer tone switch, ringer volume control, redial key, and call/hold key.

E. Telephone Type T5 (Cafeteria/Auditorium/Computer Rooms/Faculty Lounge)

Wall unit. 2554 or equal, Hearing-aid-compatible handset, touch tone, ringer tone switch, ringer volume control, redial key, and call/hold key.

F. Telephone Type T6

Desktop unit. Type T6 (same as T4 above). Single-line phone on an independent line, separate from the telecommunications system. Provide independent line telephones at Nurse Office, Cafeteria, and/or as determined during design.

Color: All phone sets shall be black.

2.05 Supplying contractor shall coordinate all necessary service requests with the local utility and act as the agent for the District. Request for removal of any equipment and facilities must be arranged with the District and performed in an organized, timely manner. Cutover date of systems must be coordinated with the District and utility so that there is a minimum disruption of the day-to-day operation.

2.06 System shall include necessary transient protection and lightning protection on the AC power feed, all station lines leaving or entering each building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground. A description of this protection shall be delivered to the District.

PART 3 - EXECUTION

3.01 MATERIALS

Comply with pertinent provisions of Section 16050.

3.02 WIRING DESIGNATION AND TERMINAL CABINET MAKE UP

A. All connections throughout the system shall be made by spring tension clip "punch block" Siemen type 5210 terminals. All conductors in terminal cabinets shall be carefully formed, harnessed and dressed per industry standards.

B. All wiring for complete communications system shall be new wire. Multi-pair cables may be used between buildings. The wiring shall be intact with no cuts in the protective outer jacket.

C. The installing vendor shall provide all cabling from building terminal cabinets to each outlet shown on the plans. Provide underground cabling between central equipment and each terminal cabinet as required to serve all outlets shown plus 25% spare pairs.

D. All wiring leaving and enter a building, shall be properly protected with in-line fuses, for protection from lightning and static electrical discharge.

3.03 PROGRAMMING

A. All programming shall be specified by the District. All classroom telephones shall initially be programmed as staff stations, with the capability of being changed at the direction of the District to administrative telephones.

B. Contractor shall provide the District with a disk containing all programming.

3.04 The Contractor shall provide four (4) copies of the complete as-built drawings and service manuals. The drawings and manuals shall include the following:

1. Identification of all components and cable runs in the system. The identification numbers must match those used in construction.

2. Service manuals and schematic diagrams of all active components used in the system.

3. A complete manual must be assembled and organized to permit easy reference and cross-checking and to facilitate future servicing.

4. A complete block diagram.

5. All information shall be printed or typewritten.

3.05 The Installing Contractor shall provide a minimum of two eight-hour periods to instruct district personnel in proper operation of all systems. The first instructional period shall be held prior to final acceptance of the systems. The second instructional period shall be within a period of one year after final acceptance of the systems, upon request of the District.

END OF SECTION
120711/270032

SECTION 16760
INTEGRATED COMMUNICATION SYSTEM

PART 1- GENERAL

1.01 SCOPE OF WORK:

A. All applicable portions of Section 16000 shall apply to this section as though written herein completely.

B. The work under this section includes all labor, materials, equipment, and accessories required to furnish and install a complete Integrated Communication System as indicated on the drawings and as specified herein. The System shall contain the following Subsystems: Telephone Interface, Intercommunication, Master Clock, Emergency and Zone Paging, Sound Reinforcement, Intrusion Alarm, Network Media Management and Television Signal Distribution Systems.

1.02 RELATED WORK:

Document affecting work of this section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and sections of Divisions 1 and sixteen (16) of these specifications.

A. The work described by this part includes the furnishing of all materials, equipment, supplies, labor and the performing of all operations necessary for the installation of complete and operating systems.

B. All conduits, outlet boxes, back boxes, junction boxes, terminal cabinets, backboards, wiring, cables, equipment, devices, etc., shall be furnished and installed complete under this section. Conduit and junction box sizes shall be determined by the Installing Communications Contractor for the particular wire and cable fills required for the systems installed (conduit sizes shall comply with the National Electrical Code). The entire responsibility of the system, including the installation, operation, function, testing and maintenance for one (1) year after final acceptance under this section shall be the responsibility of the communications contractor.

C. The Installing Communications Contractor shall furnish and install all equipment, cables, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system so that the system shall perform the functions listed herein in compliance with all specified requirements.

1.03 GENERAL REQUIREMENTS

A. The Installing Communications Contractor shall hold a valid State of California C-10 License, shall have completed at least twenty (20) projects of equal scope, shall have been in business of furnishing and installing communication systems of this type for at least five years, and capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

B. The Installing Communications Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work. Such as Alarm Company and Agent licenses.

C. The Installing Communications Contractor shall be a factory authorized distributor and warrantee station for the brand of equipment specified and shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Installing Communication Contractor shall maintain a spare set of all major parts for the system at all times. All circuit boards, amplifiers and control sub systems shall be 100% backed up with stock at contractor's shop.

1.04 QUALITY ASSURANCE:

A. In order to match the District's Standard, establish quality and standards of performance the specified equipment for the communication systems is that of Rauland Borg Corporation. All mechanical, electrical and general information set forth on the respective data sheets for each specified item shall be considered to be part of these specifications and binding herein. Any proposed equal item offered shall be substantiated fully to prove equality. A list of at least six jobs of the identical equipment that has been in service for at least three years must be submitted with telephone numbers and addresses. The Architect reserves the right to require a complete sample of any proposed equal item and may, if necessary, request a sample tested by an independent testing laboratory to prove equality. The decision of the Architect regarding equality of proposed equal items will be final.

B. It is the intent of these specifications to establish a standard of quality for labor and material to be installed. The Base Bid shall include materials as specified <u>without exception.</u> For any proposed substitution, complete descriptive, technical and cost comparison data and test reports shall be submitted for review during the bidding period. The Contractor shall reimburse the Architect for any additional engineering charges and shall pay all charges of other trades resulting from substitutions. Proposed substitutions shall be listed on the bid form, stating the reasons for substitution and the amount to be deducted from the bid if the substitution is allowed. Final approval of the alternate system shall be determined at the time of job completion. Failure to provide the "precise functional equivalent" shall result in the removal of the alternate system and installation of the specified system at the contractor's expense.

C. If a substitution item is given final acceptance by the Owner, the contractor shall pay all costs (including travel, lodging, meals, computers, etc.) required to provide factory certification, equal to that of a Factory Authorized Distributor of the substituted item, for two (2) selected Owners representatives. This training shall occur at the primary factory of the substituted item in question and shall allow the selected Owners representatives to provide any and all Factory/Manufacturer approved repairs, services, software upgrades, etc. without affecting any available or applicable Manufacturer Warranties.

D. All of the Electronic Systems Equipment shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of all major equipment, which certifies that the Installing Communication

Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

E. All communication systems supplied shall be listed by Underwriter's Laboratories under UL Standard 1459. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

F. The material in this section will be covered by the Rauland **five (5) year** material warranty policy.

1.05 SUBMITTAL AND MANUALS

A. Comply with all requirements of the General Conditions, Supplementary Conditions and applicable sections of Divisions 1 and 16 of these specifications.

B. Additional requirements of this section are:

1. Within thirty-five (35) calendar days after the date of award of the Contract, the Contractor shall submit to the Architect for review, eight (8) copies of a complete submission.

2. The submission shall consist of five major sections with each section separated with index tabs. Each page in the submission shall be numbered chronologically and shall be summarized in the index.

3. The first section shall be the "Index" which shall include the project title and address, name of the firm submitting the proposal and name of the Architect.

4. The second section shall include a copy of the Installing Communication Contractors valid C-10 California State Contractors License, letters of factory authorization and guaranteed service, list of twenty (20) projects of equal scope and list of proposed instrumentation to be used by the Contractor.

5. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished next to all of the specified equipment's features and functions as stated in the specifications and data sheets.

6. The fourth section shall contain an original factory data sheet for every piece of equipment in the specifications.

7. The fifth section shall contain a wiring designation schedule for each circuit leaving each piece of equipment and drawings showing system wiring plans.

C. The Contractor shall provide two copies of an "Operating and Servicing Manual" for the system. The manuals shall be bound in flexible binders. All data shall be printed material or typewritten. Each manual shall include the following: Instructions necessary for the

proper operation and servicing of the system; complete as-built installation drawings of the system; a wiring destination schedule for each circuit leaving for each piece of equipment; a schematic diagram of major components with all transistor and IC complements and replacement number.

PART 2 - PRODUCTS

2.01 ICS SYSTEM REQUIREMENTS

A. The system shall provide the state of the art in technology for all paging and intercom communications, secondary clock corrections, and bell schedules. The system shall be easy to learn and operate. All standard system programming shall be user friendly to allow the system administrator the ability to easily program system features. The system shall be a Rauland Telecenter VI.

B. This system shall be interfaced with a telephone system furnished by others and some of the features and functions that are described here are done though the telephone system. The instruments in the classrooms and administrative areas are part of the telephone system and only interfaced to the ICS system.

C. Provide complete and satisfactorily operating Integrated Intercom/Communications System as described herein, using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers standard design and construction, in accordance with published product information. Coordinate the features of all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

D. Features offered by this system shall be implemented and controlled by software programs that can be changed and expanded as customer needs evolve.

E. The system shall allow system monitoring and administration from a local Windows 95/98 PC or remote Windows 95/98 PC via a modem.

F. The system shall be an electronic system consisting of one or two amplified intercom channels, (classroom) speakers, digital readout for display, and solid state logic and sensing.

G. Ability to provide multiple zone program distribution which is not interrupted by intercom communications.

H. The system shall lend itself to expansion by simple addition of modules.

I. The central switching system shall provide for switching of the intercom talk path to a telephone mode, during the course of a call.

J. The system shall be equipped with voice prompting to identify the calling station and respective call priority.

K. This system is to be interfaced with the site telephone system, which is specified elsewhere and furnished by the owner as per the specifications.

L. Two-way communication between any telephone and any room speaker.

M. Room speakers and call switches shall be programmable and may be assigned any three, four or five digit number. Any room number may be reassigned at any time, and it shall not be dependent on wiring or circuit numbers.

N. Sixteen (16) separate paging zones shall be provided; each location shall be programmed in software to belong to any combination of software zones.

O. Each dialing administrative telephone in the system shall be programmable for the following options:

1. Allow zone paging.
2. Allow All-Page announcements.
3. Allow Executive Override.
4. Allow Emergency paging.
5. Allow activation of Time Zone tones.
6. Set the priority level and target display of "normal" calls.
7. Set the priority level and target display of "emergency" calls.
8. Assignment of architectural number.
9. Class of Service.
10. Assignment of associated speaker to paging zone.
11. Automatic Call-Back-Busy.
12. Call Forward-No Answer.
13. Call Forward-Busy.

P. Amplified two-way voice communication shall be available from any dial phone in the system, through any speaker in the system. This shall allow hands-free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when speaker monitoring is active.

2.02 EQUIPMENT AND MATERIALS

A. CENTRAL CONTROLLER UNIT

The Integrated Electronic Communications Network shall have the following capabilities:

1. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator / classroom communication capabilities.

2. Facilities for centralized attendant answering.

3. The system shall provide Personal Identification Numbers for selected administrators. By dialing their PIN at any system telephone, the administrator shall have access to

the same intercom/paging capabilities assigned to their office telephone, regardless of the restrictions on the phone they are currently using.

4. Provide multiple attendant positions for answering intercom calls.

5. Facilities for the central control unit to store information and give reports on features, system activity, etc. upon request either on site or remotely.

6. Facilities for automatically sounding a warning tone signal over any loudspeaker selected for two-way communications to alert the station attendant (classroom teacher) to the call and prevent unauthorized monitoring.

7. Facilities for access to any single loudspeaker unit, zone loudspeaker unit, or all loudspeaker units. The warning tone signal shall sound as soon as the station is selected and shall be automatically repeated at regular intervals for the duration of the call if the voice circuit is not activated.

8. Direct Dialing, two-way amplified voice intercom between all locations equipped with administrative telephones and staff station speakers without the use of a press-to-talk or talk-listen switch.

9. The Central Controller Unit shall provide an RS-232 port for the connection of on-site or off-site diagnostics by distributor or factory-trained personnel.

10. This port shall be usable for the programming and saving of all programmed data for each system with the utilization of an on-site or off-site computer.

11. This port shall provide the capability of logging of various activities within the system.

12. Facilities for executive override permitting an assigned telephone to "override" on-going intercom conversation(s) in the system.

13. Facilities for the instantaneous distribution of emergency announcements simultaneously, by a single button access, to all locations equipped with speakers.

14. Emergency announcements originating from any assigned administrative telephone shall have priority over all regular system functions.

15. Facilities for the distribution of alarm signals to all areas equipped with speakers by single button access.

16. Up to nine (9) separate distinct alarm signals shall be provided. Each of the distinct alarm signals can be activated by a designated single button.

17. Capability for assigning speaker locations to any one or more of the sixteen (16) zones for zone paging, up to sixteen (16) zones for program distribution, eight (8) zones for class change “bells”, and up to eight (8) security zones. All of these zones may be configured to be independent of the other zones.

18. Facilities for the origination of both “normal” and “emergency” calls from any staff location.

19. It shall be possible to review all calls stored in memory in the order received.

20. Facilities for answering calls registered in the digital read-out display merely by pressing a single response button. This capability shall not prevent other calls from being placed or answered by dialing their numbers.

21. Facilities to cancel all staff station originated calls from any administrative telephone.

22. Facilities for assigning or changing classroom numbers by architectural or any desired numbering system; either three-digit, four-digit, or five-digit numbers may be assigned.

23. Facilities for multiple loudspeaker or telephone conversations to take place and not prevent announcements, educational, or music programs from being distributed to other areas of the building.

24. Facilities to automatically send incoming calls to an alternate phone or if they remain unanswered for a predetermined amount of time.

25. A facility to notify a user that the intercom path called earlier is now available. If a busy signal is obtained, user shall dial callback feature code and hang up. System shall automatically call back user when intercom path is available and complete an intercom call to speaker.

26. Facilities for universal wiring for all data network, telephones, intercom speakers, and call switches using category five (5) cable. Systems requiring a custom cable plant dedicated to just the intercom system will not be acceptable.

27. Facilities to provide automatic emergency instructions to be broadcast to the entire school when an alarm is tripped. The emergency instructions are preprogrammed and require no user intervention.

28. Facilities for single button access to allow page announcements into speaker zones without interrupting others performing simultaneous functions.

29. Facilities to page one or more area-wide pocket pagers when a call is placed of a specific call priority or all call priorities. The pocket pager will display the calling room number and a numeric call priority.

30. Facilities to automatically alter a call switch’s class of service by time of day and day of week as directed by the owner.

31. It shall be possible to initiate Class of Service changes either manually or automatically on a per station basis using internal clock set.

32. A minimum of four independent program memory sets shall be provided. Choice of time of service change and active memory set selected shall be completely programmable.

33. Class of Service Changes shall be programmable by time of day and day of week.

34. A minimum of sixty-four (64) unique classes of service shall be available.

35. Capability for assigning speaker locations to any one or more of the zones for zone paging or time signal reception; this assignment to be a programmable function.

36. Time signal tones shall be generated on a manual or automatic basis.

37. Emergency tones shall be distributed from designated Administrative Telephones.

38. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count.

B. ADMINISTRATIVE TELEPHONE (if shown)

Administrative Telephones indicated on the drawings shall provide functions as scheduled below:

1. One (1) button dialing of most commonly dialed number or numbers.

2. Facilities for multiple operations simultaneously without interference with an established pattern of priorities for all administrator/classroom communication capabilities.

3. Complete station software assignment including class of service, speed call numbers, and any other features assigned without any wiring changes being required.

4. Facilities to permit the distribution throughout the facility of emergency announcements, all-page announcements, zone-page announcements, and emergency/evacuation alert if authorized through class of service.

5. Facilities to enable use of features without the use of "hook switching".

6. Facilities for two (2) line, forty-eight (48) character LCD module to display room number dialed, room station call, program distribution, and paging zones.

7. Facilities for receiving staff station and/or emergency calls with single button response.

8. Provide saved number redial function.

C. EMERGENCY/NORMAL CALL SWITCH (if shown)

Emergency/Normal Call Switches indicated on the drawings shall provide functions as scheduled below:

1. Provide one (1) “Emergency” call switch that shall activate a distinctive “EMER” level call from a single button activation. Button shall be clearly marked “EMER” and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the “Emergency” call will provide a flashing call assurance LED confirming that the call has been placed in the system.

2. Provide one (1) “Normal” call switch that shall activate a distinctive “NORM” level call from a single button activation. Button shall be clearly marked “NORM” and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. In accordance with the Americans with Disabilities Act (ADA), the “Normal” call will provide a steady call assurance LED confirming that the call has been placed in the system.

D. NORMAL CALL SWITCH (if shown)

Normal Call Switches indicated on the drawings shall provide functions as scheduled below:

1. Provide one (1) “Normal” call switch that shall activate a distinctive “NORM” level call from a single button activation. Button shall be clearly marked “NORM” and shall route call to any one or more Administrative Telephones and/or Displays for quick and easy response from an Administrative Telephone. Ability to upgrade the “NORM” call to an “EMER” call by pressing the button a second time. In accordance with the Americans with Disabilities Act (ADA), the call will provide a steady call assurance LED (which will be upgraded to flashing for “emergency” calls) confirming that the call has been placed in the system.

E. PROGRAM DISTRIBUTION SYSTEM

1. The system shall provide facilities to distribute program material (i.e. cassette tape, CD, radio broadcasts) in the following manner:

   a. The media operator shall cue remotely located music source or select radio station.

   b. The media operator shall then "direct select" room(s) or areas to send the program via a switchpanel OR The media operator shall dial from an Administrative Telephone to select the room(s) or areas to distribute program

   c. Both means of switch panel and dial-up program distribution shall be accessible from the system.

2. Power amplifiers shall meet all specifications exactly as specified herein, including power capacity and count, provide a minimum of ½ watt power to all intercom speaker locations plus 15 watts power to all horn type speaker locations.

F. TIME PROGRAMMING

The master time controller shall provide the following functions:

1. Non-volatile memory capacity for storing 550 events and up to 100 Calendar dates for schedule changes.

2. Ability to review, edit and delete events via a Windows 95/98 PC running the configuration program.

3. Review events from any entered time of day.

4. Events shall be programmable to any or all of eight (8) zone circuits. Selection of any of (8) schedules to allow flexibility due to seasonal changes or special events.

5. Fully automatic Calendar execution.

6. User programmable Automatic Daylight Savings Time Change.

7. Programmable Music-on-Class-Change. This feature shall be programmable from 1 to 3600 seconds (60 minutes).

8. Separate bell-tone selection and separate bell duration for each event.

9. Latched operation of zones to control lighting or other devices.

10. Interface with most types of secondary slave clocks whether synchronous wired or electronic.

11. User-programmable custom slave clock correction. Output relays rated at 5 amperes shall be provided on all zone circuits as necessary.

12. Lithium battery will provide not less than 5 years battery back up for timekeeping function.

G. CLASSROOM SECURITY AND SUPERVISION INTERFACE

1. The classroom controller shall offer easy interface to a security transducer-like motion detector or door switches.

2. All field wiring shall be individually supervised for opens or shorts to each call station and security devices.

3. No other wiring or equipment shall be needed to secure a classroom.

4. Arming and disarming functions shall be performed by dial-up via the Administrative Telephone(s).

5. Easy interface shall be provided to the main security system.

6. Any systems not providing inherent security functions in the classrooms shall not be acceptable.

H. DATA LOGGING

1. System wide events. The System Log shall contain all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

2. Schedule parameters. Shows for each day-of-the-week the times-of-day when system configuration modes change.

3. System logging. The System Log Dump report shall list all events that occurred in the system for which event logging has been enabled to diagnose or document system usage.

4. System shall be self-monitoring. System shall include a background process dedicated to self-monitoring.

I. TELECENTER SYSTEM RACK EQUIPMENT

To fulfill the above requirements, the following control equipment shall be provided:

1. Rauland Microprocessor based central switching assembly with auto modem. Equip system for number of stations required plus one station line group card but no less than 20%.

2. Power amplifiers - Power and number of amplifiers shall be as required by load plus 50% reserve.

3. All equipment shall be mounted in a Rauland equipment racks.

4. Furnish a Sola or equal 1.3KVA UPS system.

5. Provide switchbank to control pushbutton changes of master clock schedules four (4) and emergency tone transmission eight (8).

J. ACCESSORY EQUIPMENT:

1. Classroom loudspeakers - Interior flush mounted wall or ceiling shall be Rauland USO188 mounted in Rauland ACC1004 baffle and ACC1100 back box. Use ACC1102 back box for surface installations.

2. Exterior flush ceiling or wall loudspeaker shall be Quam C10PAOT10 weatherproof mounted on Rauland ACC1012 baffle and ACC1105 back box. Use vandal-proof hardware.

3. Exterior long throw surface mounted horn loudspeaker shall be Rauland 3703. Provide Vandal-proof cage to protect horn. Submit drawing for approval prior to installation.

K. CABLE:

1. Loudspeaker cable shall be West Penn 290/425.

2. Microphone cable shall be West Penn 291.

3. All cable installed in underground conduit shall be West Penn AQC type.

2.03 TELEVISION SIGNAL DISTRIBUTION

A. The Contractor shall furnish all materials, equipment, labor and services required for the installation of a complete TV signal distribution system.

B. All work shall be performed under the supervision of a company accredited by the basic equipment manufacturer and such accreditation must be presented.

C. All basic electronic equipment (not including cable) specified herein shall be produced by a single manufacturer of established reputation and experience who shall have produced similar apparatus for at least three or more years and who shall be able to refer to similar installations rendering satisfactory service.

D. SYSTEM FUNCTIONS AND CAPABILITIES:

1. The system shall provide for the reception of TV signals provided by a CATV drop to the equipment rack by the owner and signals from VCR's and VDP's.

2. The distribution system shall furnish signals to TV outlets shown on plans.

3. The distribution system shall be installed so that additional channels may be added to the installed system.

4. The system shall pass all channels without noticeable degradation of intelligence of color fidelity.

5. The system shall be suitable for the proper connection of standard EIA TV receivers.

6. The system shall deliver a minimum of 10dbmV signal strength to each receiver on every TV channel in the system; this condition shall be met when every outlet is connected to a lead. Zero dbmV equals 1,000 microvolts across 75ohms.

7. The system as installed shall be rated and capable of continuous 24-hour operation.

8. The system shall be designed to accept, process, and distribute a simultaneous sub-channel inserted at any outlet in the system automatically.

E. EQUIPMENT SPECIFICATIONS:

1. In order to establish quality and standards of performance of equipment required by the Owner, the specified equipment for the distribution system is that of Blonder - Tongue.

2. Amplifier shall be Bida 550-50 or RMDA550-50 if rack mounted with filters and return amp modules as required.

3. Provide return equipment - DSV separator - ESHP/T8 to unused cable channel converter – AM60op4. Furnish rack for portable equipment with all necessary processors and hardware.

4. Modulators shall be AM-60-550.

5. Provide all necessary HE-12/MICM modulators, Middle Atlantic Custom rack-mounts and hardware for a complete and operable system. All devices are to be rack mounted.

6. Room taps shall be V-3889 with isolation as required.

7. Provide each tap location with a Peerless WSP414 backplate to be installed by the Electrical Contractor.

8. Terminators shall be BTFTP and splitters CRS-2 or four (4) as required. Trunk cable shall be Westpenn 821 for runs of 500' or less, JA500 for over 500'. Drop cable shall be Westpenn 842.

10. Equipment racks shall be Middle Atlantic WRK44 with doors front and back and all necessary side panels and blanks. Furnish a rack mounted 13-inch Panasonic color monitor and a video switcher with inputs for each source device specified.

11. Furnish a complete Rauland Avator media management software system.

F. ACCEPTANCE TEST:

1. The installer shall, upon completion of the system, orient all antennas, adjust all controls, etc., to provide a system operating at maximum capability.

2. The installer shall, after the system is installed and adjusted, notify the Owner to arrange for an acceptance test at a mutually convenient time.

3. The installer shall prove that reception quality at an outlet by the District (or authorized representative) is equal to or better than reception normally available in the area and that signal strength is as specified.

4. Submit block diagram and shop drawing of equipment.

PART - EXECUTION

3.01 INSTALLATION

A. The wiring of the system shall be executed in accordance with the drawings and the equipment manufacturer's wiring diagrams. Should any variations in these requirements occur, the contractor shall notify the Architect before making any changes. It shall be the responsibility of the factory authorized distributor of the specified equipment to install the equipment and guarantee the system to operate as per plans and specifications.

B. Furnish all conductors, equipment plugs, terminal strips, etc., And labor to install a complete and operable system.

C. The cables within the rack or cabinets shall be carefully cabled and laced with No. 12 Cord waxed linen lacing twine or ty-raps. All cables shall be numbered for identification.

D. Splices of conductors in underground pull boxes is not permitted.

E. The labor employed by the contractor shall be regularly employed in the installation and repair of communication systems and shall be acceptable to the owner and architect to engage in the installation and service of this system.

F. The contractor shall thoroughly clean all equipment and materials. All exposed parts of the equipment, cabinets, and other equipment shall be left in a clean condition, unblemished and free of all dirt, dust, smudges, spots, fingerprints, etc., The contractor shall remove all debris and rubbish occasioned by the electronic systems work from the site. The contractor shall thoroughly clean all buildings of any dirt, debris, rubbish, marks, etc., Caused by the performance of this work.

G. The contractor shall provide not less than eight (8) hours for instruction of personnel in the operation and maintenance of the systems. This instruction time shall be divided as directed by the District.

3.02 WARRANTY

A. The entire system shall be warranted free of mechanical or electrical defects for a period of one (1) year after final acceptance of the installation. Any material showing mechanical or electrical defects shall be replaced promptly at no expense to the purchaser.

B. The contractor shall maintain a competent service organization and shall, if requested, submit a service maintenance agreement to the owner after the end of the guarantee period.

C. A typewritten notice shall be posted at the equipment rack which shall indicate the firm, address and telephone number to call when service is necessary. The notice shall be

mounted in a neatly finished metal frame with a clear plastic window and securely attached to the inside of the door.

3.03 TESTING

A. Provide all instruments for testing and demonstrating in the presence of the owner's inspector that the frequency response is as stated in the factory data sheets. Check all circuits and wiring to verify they are free of shorts and grounds. Perform all tests stated in each separate system specification.

B. The owner reserves the right to make independent tests of all equipment furnished to determine whether or not the equipment complies with the requirements specified herein and to accept or reject any or all of the equipment on the basis of the results thereby obtained.

END OF SECTION
120711/270032

SECTION 16761
CLOCK SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances tools, equipment, facilities transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit product data sheets and descriptive literature for all component parts.

B. Submit block wiring diagram of the clock system. Showing head end equipment, terminal cabinets, remote power supplies, and typical clock for each zone.

1.03 EQUIPMENT QUALIFICATION

A. The specification is based on the equipment of manufacturers who have been approved by the District and the manufacturers herein named shall be considered as meeting the requirements of this specification. For all items which are identified by part number and manufacturer the Performance specifications which are published in the most recent manufacturer's data sheets available at the time of bidding this project shall be applicable to the present work as though fully written out herein.

B. All equipment shall conform to all local applicable codes and ordinances, and shall be listed by Underwriters Laboratories.

1.04 QUALIFICATIONS

A. To qualify as an acceptable bidder, whether the bid is submitted to the District, his agent, a general contractor or a sub-contractor, the system bidder or contractor shall be qualified sound contractor and shall hold a valid C61 License issued by the Contractors State License Board of California. The system bidder or Contractor shall hereinafter be referred to as the Contractor. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work. The Contractor shall be the factory authorized distributor for the brand of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least five years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment.

1.05 GENERAL REQUIREMENTS AND SCOPE

A. Furnish and install a complete new GPS wireless clock system using Primex Wireless Inc. GPS wireless system or equal by Sapling. All bids shall be based on the equipment as specified herein. The specifying authority must approve any alternate system.

B. Section includes Transmission Systems GPS Receiver, Primary Transmitter, Satellite Transmitter.

1. Clocks:

Analog
Digital

1.06 RELATED SECTIONS

A. Division 16 – Electrical (120 volt grounded outlet required for transmitter).

1.07 REFERENCES

A. This Technical Specification and Associated Drawings, Primex Wireless GPS Satellite Time System User Manual.

1.08 DEFINITIONS

A. GPS: Global Positioning System, a worldwide system that employs 24 satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits Universal Coordinated Time, the world's most accurate and reliable time.

1.09 SYSTEM DESCRIPTION

A. GPS wireless clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

B. The system shall provide wireless time using GPS and be synchronized to UTC. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Saving Time

C. Analog Clocks shall be synchronized to within 10 milliseconds 6 times per day, and the system shall have an internal oscillator that maintains plus or minus one second per day between synchronization, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

D. The system shall include an internal clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating time.

E. The system shall incorporate a “fail-safe” design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal Operation without the need to reset the system or any component thereof.

F. Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

G. The system must operate in accordance with a “Radio Station Authorization”, Form FCC 601 – LM, granted by the Federal Communications Commission (FCC). This license will be issued to and held by the end user.

1.10 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of manufacturer’s latest model.

B. The end user will hold a license, known as a “Radio Station Authorization” granted by the FCC.

1. This license grants the end user protected use for wireless transmission at the designated frequency.

2. This license will designate a unique “call sign” for each end user.

C. Transmitter and receiver shall comply with Part 90 of FCC rules as follows:

1. This device may not cause harmful interference, and

2. This device must accept interference received, including interference that may cause undesired operation.

3. Transmitter frequency shall be governed by FCC Part 90.35.

4. Transmitter output power shall be governed by FCC Part 90 257 (b)

D. System shall be installed in compliance with local and state authorities having jurisdiction.

E. Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment. Furnish the license or a copy of the application for the license, to the Owner/End User prior to operating the equipment. The original license must be delivered to the Owner/End User.

F. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed.

G. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

H. Floor plans indicating the location of system transmitter(s), approved by manufacturer, will be submitted to owner prior to installation.

1.11 QUALITY ASSURANCE

A. Permits: Obtain operating license for the transmitter from the FCC.

1. Qualifications:

a. Manufacturer: Company specializing in manufacturing commercial time system products with a minimum of thirty (30) continuous years of documented experience including four (4) years experience producing GPS wireless time systems.

b. Installer: Company with documented experience in the installation of commercial time systems.

2. Prior to installation, a site survey must be performed to determine proper transmitter placement.

1.12 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.13 PROJECT SITE CONDITIONS

Clocks shall not be installed until painting and other finish work in each room is complete.

Coordinate installation of GPS receiver for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

1.14 SYSTEM STARTUP

At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all clocks are functioning.

1.15 WARRANTY

Manufacturer will provide a 1 year warranty on GPS receiver, transmitter, and satellite transmitter. All other components will have a 1-year warranty.

Part 2 - PRODUCTS

2.01 MANUFACTURER

A. GPS wireless clock system shall be manufactured by Primex Wireless, Inc., N3211 County Road H, Lake Geneva WI 53147 (800) 537-0464 FAX (262) 248-0061 www.primexwireless.com or equal by Sapling.

2.02 SEQUENCE OF OPERATION

A. Transmitter Operation: When power is first applied to the transmitter, it checks for and displays the software version. It then checks the position of the switches and stores their position in memory. The transmitter looks for the GPS time signal. Once the transmitter has received the GPS time, it sets its internal clock to that time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock every time it receives valid time data from the GPS.

B. Analog Clock Operation:

1. Apply power or insert batteries. Follow set up procedures detailed in manufacturer's instructions.

2. After initial setup, the clock will shut off the receiver. Six times each day, the microprocessor will activate the receiver and starting with the stored channel, it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.

3. If the clock has not decoded a valid time signal for a pre-determined number of days, it will go to a step mode. Non signal reception can be caused by low battery voltage. If this occurs, replace the batteries.

2.03 EQUIPMENT

A. General: The clock system shall include a transmitter, a roof or window mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. The GPS Receiver shall be a complete GPS receiver including antenna in a waterproof case, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure.

C. The GPS Receiver cable must be plenum rated where required by local code.

D. Transmitter: Primex Wireless Model 14400, consisting of wireless transmitter with GPS receiver, a surge suppressor/battery backup, and a mounting shelf. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.

1. Transmission:

    a. Frequency Range: 72.100 to 72.400 MHz.

    b. Transmission Power: 1 watt (30dBm) maximum

    c. Radio technology: Narrowband FM

    d. Number of channels: 16

    e. Channel bandwidth: 20 kHz maximum

    f. Transition mode: one-way communication

    g. Data rate: 2 KBps

    h. Operating range: 32 degree F to 158 degrees F (0 degrees C. to 70 degrees C).

2. Transmitter:

    a. Transmitter output power: +26 to +30 dBm

    b. Frequency deviation: +/- 4 kHz

    c. Transmitter power requirements: 120 VAC 60 Hz

    d. Internal power requirements: 5 VDC

    e. Carrier frequency stability: +/- 20 ppm

3. Transmitter shall have 16 selectable channels to assure interference-free reception.

4. Transmitter shall have the following switches:

    a. Time zone adjustment switches for all time zones in the world. Includes: Eastern, Central, Mountain, Pacific, Alaska, and Hawaii.

    b. Daylight Saving Time bypass switch.

    c. 12-hour or 24-hour display.

5. Transmitter housing shall be black metal case, 16-3/4 inches (424.4mm) by 12 inches (304.8mm) by 1-7/8 inches (46.4mm) in size.

6. Antenna shall be 46 inches (1168mm) high, commercial type, mounted on top center of transmitter housing. Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.

7. Transmitter housing shall incorporate a display which shall include the following:

    a. Time readout

    b. AM and PM indicator if 12-hour time display is set

    c. Day and date readout

    d. Indicator for daylight savings or standard time

    e. LED which shall flash red in event of reception problem

    f. GPS reception indicator

8. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.

9. Power supply (included):

    Input: 120 volt AC 50/60 Hz, 0.4 amps.
    Output: 9 volt DC, 1.5 amps.

E. Surge Protector/Battery Backup (included).

    Input: 120 volt AC 60 Hz +/- 1 Hz.
    Output: 120 volt AC, 500VA, 300 watts
    Surge Energy Rating: 365 joules

F. Additional Equipment

1. Wireless Receiver Switches: Switches shall receive time packets from the Primary Transmitter and relay the synchronized time to the Satellite Transmitter connected to it. The unit shall include the following:

    a. Antenna mounted on top of the switch housing, 11-1/2 inches (292mm) long.

        Power Supply:
        Input 120 VAC 50/60 Hz, 0.4 amps
        Output: 9 volt DC, 1.5 amps RS 232 data cable, 5 feet (1.5mm) long

    b. Daylight Savings Time bypass switch

    c. Dimensions: 4-1/4 inches (108mm) long, 5/-3/4 inches (146mm) wide, 1-1/4 inches (31.75mm) deep.

    d. Weight: 12 ounces (.34kg)

    e. Operating Range: 32 degrees F to 158 degrees F (0 to 70 degrees C)

2. Satellite Transmitters Primex Wireless Model 14401: Satellite Transmitters shall receive the signal from the Wireless Receiver Switches and transmit the signal to the devices in its vicinity, which are out of the range from the Master Transmitter. The unit shall include the following:

   Antenna mounted on top of the housing, 46 inches (1168mm) long.

   Wireless Receiver Switch.

   Power Supply Input: 120
   VAC, 50/60 Hz, 0.4 amps
   Output: 9 volt DC, 1.5 amps.

   6 foot (1.83m) cord

   Surge Suppressor/Battery Backup

   Mounting Shelf

   Transmission Power: 1 watt maximum

   72 MHz frequency.

3. Traditional analog clocks (battery): Analog clocks shall be wall mounted. Clocks shall have polycarbonate frame and polycarbonate lens. Face shall be white. Hour and minute hands shall be black.

   a. 9 inch (228.6mm) diameter analog clock: Primex Wireless Model 14280

   b. 12-1/2 inch (317.5mm) diameter analog clock: Primex Wireless Model 14155

   c. 16 inch (406.4mm) diameter analog clock: Primex Wireless Model 14163

   d. 24 inch (610mm) diameter analog clock: Primex Wireless Model 14346

4. Additional colors, finishes, and dial faces are available from manufacturer.

   a. Analog clocks shall be battery-operated,

   b. Analog clocks shall be capable of automatically adjusting for Daylight Saving Time. An on-off switch located on the transmitter shall disable this function If desired.

   c. Time shall be automatically updated from the transmitter 6 times per day.

   d. Analog clocks shall remember the time during changing of batteries.

e. Nine (9) inch (228.6mm) and 12.5 inch (317.5mm) analog clocks shall have a tamper proof/theft resistant clock lock mounting slots.

5. Analog clock receivers shall be as follows:

   a. Receiver sensitivity: >-110 dBm

   b. Receiver power: 24 VAC or 120 VAC (see model #)

   c. Antenna type: internal

   d. Antenna gain: -7 dBd

   If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded. If signal transmission is not restored after 96 hours, the second hand will “five step” as a visual indicator that the signal has been lost. Should the clocks lose power and signal, the clocks will not function.

6. Cable Connection Sealant: Radio Shack Coaxial Cable Connector Sealant 278-1645, or approved electrical grade silicone sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

B. Verify that 120 volt electrical outlet is located within 6 feet (1.83m) of location of transmitter and the outlet is operational and properly grounded.

3.02 INSTALLATION

A. Provide all equipment necessary for a complete and operable system.

B. Transmitter:

   Locate transmitter where indicated, a minimum of 2 to 3 feet (.6 to 1 meter) above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls. Transmitter(s) will be placed at locations indicated below:

   1. Attach receiver to transmitter using cable.

   2. Connect antenna to transmitter, using care not to strip threads.

   3. Connect power supply to the transmitter. Set the channel number on the display to correspond to the FCC license.

4. Plug power supply into electrical outlet.

C. Analog clocks shall perform the following operations with each clock:

1. Set clock to correct time in accordance with manufacturer's instructions.

2. Observe analog clock until valid signals are received and analog clock adjusts itself to correct time.

3. Install the analog clock on the wall in the indicated location, plumb, level and tight against the wall. If using 12-1/2 inch (317.5mm) clock, attach using clock-lock hanging method and suitable fasteners as approved by clock manufacturer.

3.03 ADJUSTING

A. Prior to final acceptance, inspect each clock, adjust as required, and replace parts which are found defective.

3.04 CLEANING

A. Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by clock manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.05 DEMONSTRATION

A. Provide training to Owner's representative on setting and adjusting clocks, replacing batteries and routine maintenance.

3.06 PROTECTION

A. Protect finished installation until final acceptance of the project.

3.07 TESTING

A. All devices must be tested at their operational location under normal operational conditions to assure reception of signal.

END OF SECTION
120711/270032

SECTION 16762
DATA SYSTEM

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes all labor, materials, equipment and accessories required to furnish and install a complete Data Cabling System as indicated on the drawings and as specified herein.

1.2 APPLICABLE DOCUMENTS

A. The system design described in this document and depicted in the attached drawing package is derived in part from recommendations made in industry standard documents. The list of documents below are incorporated by reference:

1. This Technical Specification

2. ANSI/EIA/TIA-568-B series of standards
   ANSI/EIA/TIA-568-B-1 Commercial Building Telecommunications Cabling Standard – April 2001.
   ANSI/EIA/TIA-568-B-2 Commercial Building Telecommunications Cabling Standard - April 2001
   ANSI/EIA/TIA-568-B-3 Optical Fiber Cabling Components Standard – April 2000

3. ANSI/EIA/TIA-568 Commercial Building Wiring Standard - July 1991, and Standards Proposal No. 2840-A, Proposed Revision of EIA/TIA-568 Commercial Building Cabling Standard (published as TIA/EIA-568-A)

4. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair
   Cables - November, 1991

5. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for
   Unshielded Twisted-Pair Connecting Hardware - January, 1994

6. TIA/EIA-TSB-75 Telecommunications Systems Bulletin, Additional Transmission Specifications for
   Unshielded Twisted-Pair consolidation points and cabling - January, 1997

7. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces - October 1990

8. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February 1993

9. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications August, 1994

10. Building Industries Consulting Services, International (BICSI)Telecommunications Distribution Methods Manual (TDMM) - 1996

11. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) -1997

B. If a conflict exists between applicable documents then the order in the list above shall dictate order of precedence in resolving conflicts. This order of precedence shall be maintained unless lesser order document has been adopted as code by local, state or federal entity, and is therefore enforceable as law by local, state or federal inspection agency.

C. If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. It is important to note, that all documents listed above are believed to be the most current releases of the standards at the time of this writing, however, the vendor is totally responsible for determining and adhering to the most recent cable standards when developing the proposal for installation.

D. Contractors bidding on District projects shall have as a minimum, the following qualifications:

1. Contractor must be a CommScope/Systimax Value Added Reseller (VAR). Bidder must include a current certificate of authorization with bid response. Site certifications are not allowed.

2. Contractor must also be a Cisco Gold, Silver, or Premier partner. Bidder must submit a current certificate of partnership with bid response.

3. Must have a current and in good standing, California C-10 contractors license.

4. Must have completed at least 10 projects of equal size and scope for public entities within the past 3 years.

PART 2 - PRODUCTS

2.1 ASSOCIATED REFERENCES

A. This document describes a system to be installed in accordance with recognizedtelecommunications industry cabling standards. Although the intent of the standard is to provide an application independent cable system, one or more of the following documents, describing specific network types and topologies, may be pertinent to the overall operation of the system and should be considered associated reference materials.

1. ISO/IEC 8802-3 (IEEE 802.3)

2. ISO/IEC 8802-5 (IEEE 802.5)

3. ANSI ANSI X3T9.5 Fiber Distributed Data Interface (FDDI) Physical Medium Dependent (PMD)

4. ANSI ANSI X3T9.5 Twisted Pair Physical Medium Dependent (TP-PMD)

2.2 CABLING SYSTEM

All components of the copper horizontal system and entire fiber optic cabling system shall be of the same manufacturer or manufacturer partnered system in order to provide one single product component and cabling system performance warranty direct from a single point of contact to the San Bernardino City Unified School District. The factory warranties must include a product component warranty and a system performance warranty to the Category 6 standard and revision in force at the time the system is installed. The factory warranty period shall be not less than 25 years.

The San Bernardino City Unified School District has established CommScope/Systimax, as the standard for the network structured cabling plant to eliminate additional training time and costs as well as reduce spare parts costs and database information, NO SUBSTITUTIONS WILL BE ALLOWED.

2.3 CABLE TYPES

A. New Construction and New IDF/MDF. The new planned cable system shall utilize the following cable types for horizontal distribution. Each cable shall meet or exceed the mechanical and electrical performance characteristics listed below.

1. Horizontal Distribution Cable--Unshielded Twisted Pair Cable: construction shall be 24 AWG, 4-pair, Category 6 Enhanced, with a bandwidth of not less than 350mhz.

2. 50/125 multi-mode optical fiber cable with dual bandwidth minimums of 850nm and 1300nm at 500mhz. Optical fiber cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/Km @ 1300 nm.

B. For additional cabling in an existing IDF/MDF. To ensure proper specification adherence please contact IT. The planned cable system added to current category 5e systems shall completely utilize all available Cat 5e patch panel terminations. Any additional patch panels installed will be category 6 horizontal cable drops that terminate into the new category 6 patch panel. Cables and drops added to existing network systems should continue with the existing MDF/IDF numbering pattern.

1. Horizontal Distribution Cable--Unshielded Twisted Pair Cable: construction shall be 24 AWG, 4-pair, Category 5 Enhanced or Category 6 Enhanced (as defined above,) with a bandwidth of not less than 350mhz.

2. 50/125 multi-mode optical fiber cable with dual bandwidth minimums of 850nm and 1300nm at 500mhz. Optical fiber cable shall provide a maximum attenuation of 3.5 dB/km @ 850 nm and 1.5 dB/Km @ 1300 nm.

When new data cabling is specified for a room or office location at any District site, and there is existing data cabling in the room or office location then designated site personnel and designated IT personnel must approve the exact placement for each new data jack, the removal of any existing data jacks, the terminations into existing patch panels for each new data jack, and the data connection to any existing electronics equipment such as switches or hubs. Additionally, if new data jacks are required in a room or office location with no existing data jacks, but the new data jacks will be terminated into an existing IDF or MDF then designated IT personnel must approve all connections into existing equipment and any new patch panel and cabinet installations at that IDF. Furthermore, any new equipment required to support the new data cabling must be calculated and incorporated into the cost of the new cabling. This standard should be followed exactly, and any deviation needs to be approved by IT management prior to implementation of the deviation.

2.4 COPPER SYSTEM

A. JACKS AND PATCH PANELS

1. Eight-wire, eight-position modular jacks shall be used for all telecommunications outlets. Each jack shall be fed by a separate four pair cable sheath. All four (4) pair shall be wired to the jack using TIA/EIA-568-B wiring scheme. The jacks shall employ PC board mounted (110 or IDC) contacts for termination of the wire.

2. The jacks shall be matched to the Category rating of the attached horizontal distribution cable which will all be enhanced Category 6 compliant or better.

3. Patch panels supporting Category 6 enhanced cabling shall be 24 or 48 ports as needed. Panels shall be factory assembled with eight-wire, eight-position modular jacks that employ PC board mounted (110 or IDC) contacts for termination of the wire. Panels shall be wired to the TIA/EIA-568-B wiring scheme.

B. TELECOMMUNICATIONS OUTLET PLATE

1. The outlet shall be configured so that the interconnect couplings are at an acute angle to, or parallel with, the wall surface.

2. The outlet plate shall be affixed to an in-wall or surface mount box with two screws, which match the color of the outlet plate, or a previously installed floor mount device.

3. To meet district standards faceplates shall be two port, four port, six port or duplex mounting straps as required in any floor box or surface raceway application.

C. OUTLET INSTALLATION

1. All outlets shall be installed in the following manner:

   a. Wall mount boxes shall be attached to (box eliminators, 4”X4” boxes, old work boxes) provided by the (contractor providing raceway and boxes).

   b. Wall mount boxes shall be installed with the center of the plate at(15” IAW ADA requirements or match existing) above finished floor (AFF). The faceplates shall be installed in a horizontal or vertical orientation.

   c. Any unused faceplate positions shall be covered/filled with a blank insert made of the same or compatible material as the faceplate and shall be molded in the same color. Blank spaces shall be incorporated between populated positions on the faceplate.

   d. Cables shall be coiled in the in-wall or surface-mount boxes. In hollow wall installations where box-eliminators are used, excess wire can be stored in the wall.

   e. No more than 12” of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack for these situations shall be neatly coiled in the ceiling above drop location. The amount of cable slack in the ceiling is not to exceed 4 feet per horizontal run. Enough slack must be provided, however, for at least one jack re-termination at the outlet plate.

D. HORIZONTAL DISTRIBUTION CABLE

1. Horizontal distribution cables shall be installed from the MDF and IDF to the designated locations in the Work Area Information Outlet (IO). Horizontal distribution cables shall be manufactured in compliance with the mechanical and electrical specifications detailed in the TIA/EIA-568-B document, as applicable. Cables not supported under the current revision of the standard shall be of recent design and manufacture and be capable of supporting the application (e.g., broadband coaxial, baseband coaxial).

2. All cables shall be furnished by the contractor in full, factory packaged reels or pull boxes. The packages shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by the Owner, the contractor shall provide manufacturer’s proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for replacement of the entire reel. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.

E. HORIZONTAL DISTRIBUTION CABLE SHALL BE INSTALLED AND TERMINATED AS BELOW

1. 100 O Unshielded Twisted Pair—Jacks/Patch Panels

2. Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568B document, manufacturers' recommendations and/or best industry practices.

3. Pair untwist at the termination shall not exceed one-half an inch.

4. Bend radius of the cable in the termination area and at any point along the distribution path shall not exceed four (4) times the outside diameter of the cable.

5. The cable jacket shall be maintained as close as possible to the termination point.

6. All modular jacks shall be oriented with the locking tab slot towards the floor.

7. Voice jacks shall be located in the top or top left position of each faceplate. In instances where there is more than one voice jack per faceplate, then the second shall occupy the top right or second position, continuing top to bottom or left to right. Voice jacks in horizontally oriented faceplates shall occupy the left-most position. Modem jacks shall be considered the last voice jack in the sequence.

8. Data jacks that are in surface metal/plastic raceway (Panduit/Wiremold) shall be mounted in the proper termination plate compatible with manufacturer of the raceway to ensure that the District receives a professional end installation. These termination plates and trim are to be provided by the electrical contractor installing the raceway and power outlets to ensure that all outlets and trim will match. The mounting straps shall be provided by the data contractor.

9. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type. Conduit sizing shall be a minimum of 3/4 inch conduit for each outlet with no more than two outlets fed by one 1" homerun. If two outlets are fed by one homerun the conduit shall be 1" to the IDF or MDF and ¾ inch to the end box. For conduits feeding a multiple outlet surface raceway the sizing shall be as follows: 1" for raceways 6' long and under, 1 ¼" for raceways 6' to 18' long and multiple conduits to meet this pattern for lengths greater than 18'. These specifications shall take precedence over conduit routing shown on the plans that deviate from this method. The data contractor shall bring any discrepancies to the attention of the owner before bid time.

10. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.

11. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose.

12. Maximum pulling tension shall not exceed 25 pounds for a single cable or for a cable bundle.

13. When not installed in conduit, (per the plans and electrical specifications requirements), all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels, nor shall they be attached to ceiling grid wires. Horizontal distribution cables shall be bundled in groups not greater than 48 cables. Bundles shall be supported by cable tray, conduit, trapezes, or multiple support strap made by Erico, Caddy part # CAT21 and CAT32. Saddle supports are not allowed. Plenum rated cable is to be installed in plenum rated areas and non-plenum cable to be installed in non-plenum areas.

14. The cable system shall not be attached to the fire sprinkler system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes or other control devices.

15. Cables shall not be attached to ceiling grid or lighting support wires. Where light support style wires for drop cable legs are required, the contractor shall install clips to support the cabling.

16. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

17. Cables shall be identified by a computer generated, permanent, self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.

F. IDF/MDF Data Labeling.

1. Data Patch Panel Labels at each IDF/MDF shall be labeled with 2 lines of information. The top line should indicate the drop number and the second line shall indicate the building and room number of the drop. The drop numbers shall be numbered consecutively beginning at one (1) through and including the total number of drops connected to all IDF/MDF patch panels. If a particular installation is an addition to an existing IDF/MDF, the newly added drops and patch panels shall continue the number sequence from the last number of the previous patch panel.

   a. Example Line 1: Two (2) 48-port patch panels newly installed will be numbered one (1) through 96. Later, when a 48-port patch panel is installed, the number sequence on the newly installed patch panel shall begin at 97 and continue.

   b. Example Line 2: Under drops 1 through 8 the label says B5, under drops 9 through 15 the label says Lib6. This indicates that drops 1 through 8 are located in the B building room 5, while drops 9 through 15 are located in the Library building, room 6.

G. Drop Plate Labeling.

1. Each data drop plate shall list the following 2 items.

   a. IDF/MDF name or number and the location of that IDF/MDF, ie “IDF-3 B-2” for IDF 3 in room B-2.

   b. Each data drop port shall list the drop number that corresponds with their drop number as listed at the IDF/MDF patch panel. Example: 4 data drop ports should be numbered like d-110, d-111, d-112, and d113.

2.5 FIBER OPTIC SYSTEM

A. FIBER OPTIC CONNNECTORS

1. Fiber optic connectors shall be SC-style.

2. Connectors shall incorporate zircona ceramic ferrules. The same type shall be used throughout the installation.

3. All connectors provided by Contractor shall be of same manufacturer and termination method throughout this contract.

4. Fiber optic connectors shall be rated for a mean loss not greater than 0.3 dB per mated pair.

B. OPTICAL FIBER COUPLERS

1. Multimode optical fibers shall be terminated with (duplex SC -style) connectors and attached to (duplex SC, duplex SC to duplex SC) feed-through couplers.

2. Single-mode optical fibers shall be terminated with (duplex SC) connectors and attached to (duplex SC) feed-through couplers.

3. All fiber optic terminations shall be installed in boxes with bend limiting provisions for fiber slack storage.

C. FIBER TERMINATION PANELS

1. Fiber termination panels shall be capable of handling a minimum of 24 fiber optic connectors with the appropriate number of connector panels and couplers. All unused locations shall be filled with blank panels.

2. Fiber termination panels shall be 19” rack mountable.

3. Fiber termination panels shall be hinged to provide complete access to connectors and slack storage from the front.

4. Fiber termination panels shall be complete with 12 SC-style interconnect couplers.

5. Fiber termination panels shall be equipped with cable strain relief brackets.

6. Fiber termination panels shall provide ample storage and handling for up to 36” of slack per fiber strand.

7. Fiber termination panels shall protect both the installed cable and patch cord cable interface when the panel is in the closed position.

8. Fiber termination panels must be of the same manufacturer as the fiber cable and SC connectors, as well as the horizontal cabling system to ensure the owner will not have any coordination problems in the future.

D. FIBER OPTIC CABLE

The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-A Standard specification

1. Optical fiber cables used outside shall be housed in an OSP loose tube, gel-filled, construction jacket configuration. Inside fiber shall be riser or plenum tight buffered.

2. Inside/outside gel-filled construction shall be used if entering a building more than 50 feet outside of EMT or IMC conduit.

3. Use OFNR construction if used as a riser cable.

4. Use Plenum construction if used in an air plenum of any kind.

5. Optical fiber shall be rated a minimum of 100 Mbps.

6. Each optical fiber component shall be surrounded by an individual aramid yarn strength member.

7. The optical fiber cable construction shall meet or exceed the requirements of the EIA/TIA-568-B.3 Standard specification, to achieve 500 MHz-km.

8. Optical fiber cable shall withstand a minimum short term tensile load of 105 pounds without damage to the optical fiber

9. Optical fiber cable shall be able to withstand a minimum bend radius of 45 millimeters (mm) during installation without damage to the optical fiber elements

10. Optical fiber cable shall have a minimum crush resistance of 200 N/cm

11. Optical fiber shall be rated a minimum of 100 Kpsi.

12. Optical fiber cable shall withstand a minimum short-term tensile load of 448 pounds without damage to the optical fiber.

13. Optical fiber cable shall be able to withstand a minimum bend radius of 128 mm during installation without damage to the optical fiber elements.

14. All fiber optic cable shall be installed per industry standards. This includes using a proper break-away swivel and sealing the end of all cables before pulling through any conduit system. 10 feet of slack cable shall be left at each end of the cable run for future maintenance purposes.

15. OSP, loose-tube cables shall be properly prepared and protected per industry standards. All cables shall be properly cleaned. The cable ends shall be terminated through a breakout unit and a 900 micron buffer tube for each fiber strand. Each cable OSP buffer tube shall be labeled for strand counts contained therein. Provide proper break out kits as manufactured by AT&T, Corning, or equal.

16. When distribution style fiber cable is installed, strength members shall be mechanically secured to the outlet box and distribution enclosure.

17. A minimum of 12-inches of slack shall be stored at the drop end and 36-inches shall be stored at the TC termination enclosure.

18. Where 250-micron coated cable is field terminated, breakout kits that build up the fiber to a minimum of 900 microns shall be used.

19. Any splices, fusion only, shall be housed in fiber trays and an enclosure with splice tray organizers.

2.6 BACKBONE CABLING SUBSYSTEM

A. The backbone cable subsystem is comprised of all cable, connecting hardware, pathways and cable management hardware required to form a continuous path from the Telecommunications Entrance Facility (EF) to the Equipment Room, from the ER (MDF) to each TC (IDF), and between TCs (IDFs) on the same floor.

B. BACKBONE CABLE

1. Backbone cables will be installed between the locations described in the scope of work and on the plans. An inner-duct shall be pulled in all backbone conduits along with the fiber-optic cable. This inner-duct shall be left with only a pull rope for future use and shall be of the size and quantity called out in other areas of this specification. All conduits shall be plugged with snug plugs and duct seal after inner-duct installation is completed.

2. All cables shall be furnished by the contractor in full, factory packaged reels. The reels shall be marked with the respective cable part number and lot number by the manufacturer. Upon request by the Owner, the contractor shall provide manufacturers' proof of compliance with the required manufacturing guidelines presented in the aforementioned standards. Each reel shall be visually inspected upon receipt and prior to installation to ensure that no damage was incurred during shipment. Any damaged cable shall be returned to the vendor/manufacturer for

replacement. The cost for replacement cable shall be borne by the contractor. Any residual cable, in lengths greater than 500 feet, shall be delivered to the Owner and the Owner shall decide the disposition of the cable.

C. BACKBONE CABLE INSTALLATION: All backbone cables shall be installed in the following manner:

1. Backbone cables shall be installed separately from horizontal distribution cables.

2. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate inner-ducts within conduits.

3. Where cables are installed in an air return plenum, the cable shall be installed in conduit, or plenum cable shall be installed in a plenum inner-duct to provide protection to the cable

4. Where backbone cables and distribution cables are installed in a cable tray or wire-way, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

5. Backbone fiber cable shall consist of a six (6) strand count unless specified differently on the plans and in the scope of work. These cables shall emanate from the MDF to each IDF. These cables shall be of the same manufacturer of all the other fiber and copper cabling system and terminations. These cables shall be FDDI+ grade per EIA/TIA standards.

6. All backbone conduit shall have (1) 3/4” inner-duct with pull ropes if in a 2” conduit, (2) 1” inner-duct with pull ropes if in a 3” conduit, and (4) 1” inner-duct with proper “Jack-moon” plugs if installed in a 4” conduit. This inner-duct will be for future use in the 2” and 3” conduits and one or as many as necessary will be utilized in the 4” conduit leaving the remainder for future use. All unused inner-duct shall have a rubber snug plug with rope tie off installed and all inner-duct occupied with cable shall have the appropriate cable seal.

D. HORIZONTAL CROSS-CONNECT TERMINATION HARDWARE

1. The backbone side of the horizontal cross-connect, and the main cross connect shall be terminated in the same termination panels as the horizontal cables. The backbone fibers shall be maintained in separate termination panels from the horizontal distribution fiber cables. The backbone termination panels shall be installed in the double swing enclosed rack. Termination details and rack elevations for fiber panel placement shall be provided in the contractor submittals.

2. The contractor shall be required to install, secure and ground the racks. The Contractor shall only be required to install those fiber termination panels to fully terminate all newly installed fiber strands unless otherwise noted. Placement of the enclosures shall be detailed in the contractors working drawings.

3. Each fiber optic cable shall be terminated in the telecommunications closet in a 12, 24, 48, or 72 fiber port rack mounted patch panel enclosure providing protection to the terminated fibers. The enclosures shall provide a strain relief bracket for attaching the optical fiber cable and support slack storage of a minimum of 36” per fiber cable. The enclosure shall provide a minimum of 12 ports for fiber terminations and fully enclose both the hardwired cable and the patch cord terminations when the shelf is closed.

4. Products for this installation shall be furnished in new and factory packaged condition. Each product shall be inspected by the Contractor to ensure completeness and that no damage was incurred during shipping. The contractor shall return to the manufacturer, any product found to be deficient. The cost of the return and replacement product shall be borne by the Contractor.

2.7 RACKS/CABINETS

A. The products supplied shall meet the following specifications:

1. All MDF racks/cabinets shall be an APW or equivalent 7’ open relay rack or a 6’ enclosed cabinet manufactured by APW or equal.

   a. Enclosed rack should be a minimum of 24” wide and 42” deep.

   b. Cabinet must be adequately equipped with self-contained ventilation system such as fans or similar means.

2. A cable trough shall be supplied at the bottom of each open rack to support patch cord routing between racks.

3. Server Racks (minimum one per campus) shall be floor-mounted racks with (2) peripheral shelves, server sliding shelf (150lb capacity), and monitor and keyboard shelf all as manufactured by APW or equal. (More detail in Paragraph 2.12.C)

4. Inter-bay and end-cap cable managers shall be a single piece full height unit supporting front and rear cable routing and attachment.

5. The inter-bay manager shall have integral routing and slack storage loops supporting a 1.5” minimum bend radius.

6. Inter-bay and end-cap management panels shall be supplied with adjustable routing guides.

7. Both inter-bay and end-cap units shall have removable covers secured with 1/4 turn fasteners.

8. Inter-bay and end-cap cable managers shall securely attach to the rear rail of the rack with #12-24 screws.

9. All IDF locations shall be 2', 3' or 4' wall-mount enclosures manufactured by APW or equal. Size of IDF cabinet shall depend on the number of switches, cabling connectivity, and cable management devices for IDF, or as stated on plans and in scope of work. Each cabinet is to provide space for 25% equipment growth. Cabinets shall:

    a. Be a minimum of 24" and a maximum of 30" deep

    b. Be double-swing design and 3-piece construction

    c. Provide in-field door hinge reversing

    d. Shall include louvered sides

    e. Shall include a solid metal door

    f. Shall be mounted on 1" plywood back-board, anchored sufficiently to mount the cabinet.

10. All cabinets shall be keyed alike.

11. All cabinets shall provide a minimum of two cooling fans in the top cover.

B. CABLE MANAGEMENT

1. Horizontal cable management shall be provided in each rack. A minimum of two front wire- management panels shall be provided in each rack. One combination front and rear horizontal wire management shall be provided for each fiber termination box, for each 24 ports of RJ45 panels, and each 24 ports of switches. Cable dressing at all racks/enclosures shall utilize velcro straps. The use of cable ties is not permitted. All cables and their termination on each end shall be labeled per EIA/TIA administration standards. All labeling schemes and label designations shall be reflected on the CAD drawings at the end of the project and in the submittals.

C. RACK MOUNTING AND HARDWARE

1. Vertical wire management shall be supplied for all open racks.

2. A TGMB ground buss shall be provided at the MDF and a TGB ground buss shall be provided at each IDF. All racks shall be grounded to the telecommunications ground bus bar. The buss bars will be installed by an electrical contractor and not part of the scope of work in this specification section.

3. Floor mount open racks shall be securely attached to the concrete floor using 3/8" hardware and a minimum of 3 feet and a maximum of 10 feet away from the most

adjacent wall. The contractor shall install a 12” wide ladder tray system, as manufactured by APW or equal, from the most adjacent wall to the rack. Appropriate wall and rack mounting from the same manufacturer shall be installed as well. These racks should have a minimum of 30” clearance on all sides for access.

4. Rack mount screws (#12-24) not used for installing fiber panels and other hardware shall be bagged and left with the rack upon completion of the installation.

5. Inter-bay and end-cap managers shall be installed to the rear mounting rail of the rack using all available mounting holes.

6. Inner-ducts and cables shall be securely fastened to the cable managers.

7. Cable feeds shall alternate left and right to minimize congestion at the top of the rack.

8. Wall mounted racks shall be installed with a minimum of six 5/16” lag bolts or masonry anchors into structural building members.

2.8 OTHER NETWORK CABLING NOTES

A. Data cabling shall not occupy the same conduits as other low-voltage systems to ensure the data network can be up-graded and expanded in the future without disturbing the other critical communications systems.

B. Each RJ45 workstation outlet shall be provided with one (1) 3’ patch cord for the rack location and one (1) 7’ workstation cord for the future computer. These patch cords shall be of the same manufacturer as the cabling system. Patch cord shall be factory assembled and include snagless color-coded strain relief boot. No field assembled patch cords allowed.

2.9 ACTIVE COMPONENTS

CONTRACTOR MUST BE A CISCO GOLD, SILVER, PREMIER PARTNER. NO SITE CERTIFICATIONS ARE ALLOWED

A. MDF GENERAL REQUIREMENTS “CORE” SWITCHES

1. Will be comprised of the Cisco Catalyst 4500 Series Chassis at Elementary and Middle Schools and the Catalyst 6500 Series chassis at High Schools.

2. A true on-line battery backup UPS system shall be provided for each Core switch installed and shall provide a minimum of 60 minutes run time, and shall include a SNMP module with alert notification software as manufactured by TrippLite or APC.

3. Core-switch will contain modules capable of providing gigabit Ethernet to each of the IDF's it supports.

4. Core-switch will provide one (1) gigabit link for each (96) drops supported by the respective IDF.

5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC style connectors on 50/125 multimode fiber optic zip-cord style cable as manufactured by Systimax. Cords must be the same manufacturer as the cabling system being installed. No field terminated cords are allowed.

6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location as manufactured by Systimaxt.

B. IDF GENERAL REQUIREMENTS "EDGE" SWITCHES

1. Will be comprised of the Cisco Catalyst 3750 Series SMI (Standard Multilayer Image) switch.

2. Each switch at the IDF will be a minimum of twenty-four (24) 10/100Base-TX ports.

3. All IDF switches will be the Enterprise Edition switch.

4. One 1000BaseSX GBIC module will support no more than 96 drops before adding subsequent 1000BaseSX GBIC modules in the IDF for additional gigabit links to the MDF.

5. Contractor to supply and install all required patch cords as needed to fully support all Edge switches newly installed in order to facilitate a fully operational system. Fiber optic patch cords are to be 1 or 2 meters in length as required. The cords are to be Duplex SC style connectors on 50/125 multimode fiber optic zip-cord style cable as manufactured by Systimax. Cords must be the same manufacturer as the cabling system being installed. No field terminated cords are allowed.

6. A 1U (1.75") front wire management panel shall be installed for every 48-ports of electronics with no less than one for each rack location as manufactured by Systimax.

7. A true on-line battery backup UPS system shall be provided for each IDF and shall provide a minimum of 30 minutes run time and shall include an SNMP module with alert notification software as manufactured by TrippLite or APC.

C. SERVER RACKS GENERAL REQUIREMENTS (minimum one per campus)

1. Data contractor will provide one (1) enclosed 7ft server cabinet which will be provided with proper shelving and ventilation (2 fans minimum) to support a minimum of two file servers (see rack specifications section).

2. A true on-line battery backup UPS system shall be provided for each server installed and shall provide a minimum of 60 minutes run time, and shall include an SNMP module with alert notification software, as manufactured by TrippLite or APC.

3. The server rack shall be complete with a server, 104-key key-board, 3-button Logitech mouse, 17" .28 NI SVGA color monitor. The server shall have 512MB of RAM, (6) 18GB SCSI hard-drives (RAID 5), dual Intel 1000Mhz Pentium III processor, 512KB pipeline burst cache, 32X CD-ROM drive, (1) INTEL 100BASETX Dual Port PCI NIC, 3 ½" floppy drive, 8MB AGP video card, and a full size tower for future expansions. The server shall be completely modular as manufactured by Dell or equal.

4. The data contractor or OEM shall provide Network Monitoring (SNMP) software for Windows 2000 as manufacturer by Castlerock or equivalent

5. The data contractor or OEM shall provide a copy of Windows 2000 Server with 200 Client Access licenses on the new server.

6. The data contractor shall configure all switches with IP addresses and user labeling in the SNMP software and fully test the network for proper operation.

7. The data contractor shall provide 24 hours of user training on the network with the customer provided computers. Any training or customer provided computer configuration beyond this shall be outside the contract and negotiated as a service contract.

8. All computer labs on campus shall be autonomous with their own server, SWE 456P rack (or equivalent) with two slide out shelves, hubs and patch panels. The server shall have a 104-key key-board, 3-button Logitech mouse, 17" .28 NI SVGA color monitor. The server shall have 512MB of RAM, (6) 18GB SCSI hard-drives (RAID 5), an Intel 1000Mhz Pentium III processor, 512KB pipeline burst cache, 32X CD-ROM drive, INTEL 100BASETX PCI NIC, 3 ½" floppy drive, 8MB AGP video card, and a full size tower for future expansions and shall be rack mounted. Servers shall be completely modular and manufactured by Dell or other manufacturer as designated by the district.

9. All the servers shall be true servers (not a PC) and shall be completely modular in design with hot-swappable components as manufactured by Dell or manufacturer specified by the district.

D. ROUTER

The Data contractor shall provide a Cisco 3745 router, or superceded product from Cisco, with a minimum of two (2) Fast Ethernet connections and four (4) IMA (Inverse multiplexing over ATM) T1 connections. Contractor shall coordinate the installation of the pre-designated number of T1 lines from the serving utility company and configure the router as needed for a complete and operational WAN connection to the district's network.

PART 3 - EXECUTION

3.1 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified as useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Copper: Each cable shall be tested for continuity on all pairs and/or conductors. Coaxial cables shall be tested for continuity, opens shorts and resistance using a volt/ohm meter (VOM) and installed length using a Time Domain Reflectometer (TDR). Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All Category 6 cables shall be tested to ensure the Category 6 standard performance to 100Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for Maintenance & Operations turn-over documents as well as one CD copy for the owner's use. These data cabling links shall be tested with a Level III cable analyzer utilizing bi-directional swept frequency testing procedures.

C. Continuity: Each pair of installed multi-conductor inter-building phone cable shall be tested using a "green light" test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable retested prior to final acceptance.

D. Length: Category 6 unshielded twisted pair (UTP) data cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the TIA/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

E. Performance Verification: Category 6 unshielded twisted pair (UTP) data cable shall be performance verified using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:

1. Near End Cross-Talk (NEXT)

2. Attenuation

3. Ambient Noise

4. Attenuation to Cross-Talk Ratio (ACR)

5. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

F. Fiber: All fiber terminations shall be visually inspected with a minimum 200 X microscope to ensure that no surface imperfections exist after final polishing. This step is not necessary of factory pre-polished connectors are installed. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source. Cable length and splice attenuation shall be verified and documented using an OTDR.

G. Attenuation:

1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference--two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing.

2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.

3. Single-mode optical fiber attenuation shall be measured at 1310 nm and 1500 nm using a laser light source and power meter. Tests shall be performed at both

wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two meter patch cords shall be used as test references and for the actual test. This test method utilizes a one jumper reference, two jumper test to estimate the actual link loss of the install cable plus two patch cords.

4. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing. *For this application, the length based on cable length measurements marked on the jacket, will be suitable. OTDR testing is to be performed in accordance with 8.2.2, then the actual measured length shall be used. Conversion from metric to US Standard measurement shall use 3.2808 as a constant with the result rounded to the next highest whole number. **The testing for this project is measuring the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors. Subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test.

H. Length and Splice Loss

1. Each cable shall be tested with an Optical Time Domain Reflectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufacturers' recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.

2. OTDR and power meter testing is specifically requested by the Owner.

3. Each strand shall be tested on all outside plant and tight-buffered cables and/or where splices exist.

4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the TIA/EIA-568-B Standard.

3.2 FIRESTOP SYSTEMS

A. A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations(through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE), licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

3.3 GROUNDING AND BONDING

All grounding and bonding work is to be completed by an electrical contactor and not part of this scope of work. This information is placed here for reference only.

A. The facility shall be equipped with a Telecommunications Bonding Backbone (TBB). This backbone shall be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB shall be installed independent of the buildings electrical and building ground and shall be designed in accordance with the recommendations contained in the TIA/EIA-607 Telecommunications Bonding and Grounding Standard.

   1. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding bus bar (TMGB). Each telecommunications closet shall be provided with a telecommunications ground bus bar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility. The intent of this system is to provide a grounding system that is equal in potential to the building electrical ground system. Therefore, ground loop current potential is minimized between telecommunications equipment and the electrical system to which it is attached.

B. Product Specifications

   1. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TC or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack to not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment. The conductor shall be continuous, attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using the appropriate compression connector.

2. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables, and buss-bars shall be identified and labeled in accordance with the System Documentation Section of this specification.

C. Ground System Installation

1. The TBB shall be designed and/or approved by a qualified PE, licensed (actual or reciprocal) in the state that the work is to be performed. The TBB shall adhere to the recommendations of the TIA/EIA-607 standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed C10 electrical contractor.

3.4 SYSTEM DOCUMENTATION

A. The following section describes the installation, administration, testing, and as-built documentation required to be produced and/or maintained by the contractor during the course of the installation. The documentation required will allow the owner to create a TIA/EIA 606 compliant administration system.

B. Cable System Labeling

1. The contractor shall develop and submit for approval a labeling system for this cable installation. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

2. All label printing will be machine generated using indelible ink ribbons or cartridges. Self laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.

C. As-Built Drawings

1. The installation contractor will be provided with (two) set(s) of (D-)size drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner. Contractor shall also redraw the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling

scheme for all items. These CAD drawings shall be on 81/2” x 11” sheets of paper and be turned over to the owner with the O&M manuals.

2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

D. Test Documentation

1. Test documentation shall be provided in a three ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words “Test Results”, the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail test method used and specific settings of the equipment during the test.

2. Scanner tests shall be printed on 8-1/2” x 11”. Hand written test results (attenuation results and green light results) shall be documented on an Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2” x 11” paper for inclusion in test documentation binder.

3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall collocated in the binder.

3.5 WARRANTY AND SERVICES

A. The contractor shall provide a system warranty covering the installed cable system against defects in workmanship, components, and performance, and follow-on support after project completion.

B. Installation Warranty: The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

C. Cable System Warranty:

The contractor shall facilitate a warranty between the manufacturer and the Owner that provides coverage of the installed cabling system to a minimum of 25 years. An extended component warranty shall be provided which warrants functionality of all components used in the system for a minimum of 25 years from the date of acceptance. All fiber cable, copper cable, fiber termination hardware and housings, copper termination hardware and trim shall be of one manufacturer to ensure the owner can establish one relationship for the warranty. A performance warranty in excess of 25 years shall also be provided which warrants the installed 100 MHz horizontal copper (HC to WA) and for both the horizontal and the backbone optical fiber (HC to WA, or cross-connect to cross-connect) portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568-B and/or TIA/EIA 568-A. All fiber and copper cabling, termination components, and ancillary devices shall be of one manufacturer to insure no disputes can arise between different manufacturers if performance problems arise. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project. Certificates of factory training by the manufacturer, or authorized representative, of the cabling system being installed must be made available if requested by the District or District's representative.

3.6 CABLE SYSTEM ACCEPTANCE

A. The Owner's Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the fire-stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

B. Final Inspection:

Upon completion of the project, the Owner's Technical Representative will perform a final inspection of the installed cable system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal and backbone cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the District.

C. Test Verification: Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If significant discrepancies are found, the Contractor will be notified for resolution.

D. System Performance: During the three-week period between final inspection and delivery of the test and as-built documentation, the Owner will activate the cabling system as a validation of operation.

E. Final Acceptance: Completion of the installation and in-progress and final inspections, receipt of the test and as-built documentation, and successful performance of the system for a two-week period will constitute acceptance of the system.

END OF SECTION
120711/270032

SECTION 16771
AUTONOMOUS PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Provide all labor, materials, transportation and equipment to complete the furnishing, installation, assembly, set up and testing of the audio system work as indicated on the drawings and as specified herein. Notwithstanding any detailed information in this Section, provide complete working drawings.

B. Design, engineer and provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of the Work in this Section. Provide engineering of such support by parties licensed to perform work of this type in the project jurisdiction.

C. Systems include, but are not limited to the following major subsystems:

1. The system shall provide for high quality live sound reinforcement and playback of prerecorded sound program. Sound distribution via wall-mounted loudspeakers with related amplifier, switching, and control.

b. Control: Sound control with a rackmountable mixer and associated equipment including microphone and line level devices. Provide routing switcher, two mix positions, tielines, etc.

c. Recording and Playback: Recording and playback facilities shall be provided as shown.

d. Portable equipment: Related equipment and accessories as specified herein.

1.02 RELATED WORK

A. See building plans and specs. for conduit and boxes provided by electrical contractor.

1.03 QUALITY ASSURANCE

A. Company: Work of this Section shall be performed by an Audio Systems Installer who has at least five (5) years direct experience with the devices, equipment and systems of this type and scope specified herein, and who has a fully staffed and equipped maintenance and repair facility, and who is licensed to perform work of this type in the project jurisdiction (C-10).

B. Personnel: Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section. Supervisors shall have at least five (5) years direct experience in similar work. Installation and maintenance personnel shall have at lease three (3) years direct experience in similar work.

C. Coordination: Coordinate the Work of this Section with the Work of all other Sections.

D. Verification: Verify dimensions and conditions at the project site. Submit any conflicts in timely manner for resolution.

E. Project Site Installation and Testing: Install as specified herein. Perform specified adjustment procedures. Provide test equipment and test according to procedures specified herein. Request verification of project site test in timely manner.

F. Verification of Submitted Test Data: Re-test in presence of designated representative(s) of the architect at reasonable mutual convenience. Provide services of the designated supervisor and additional technician familiar with Work of this Section. Provide all test equipment. Provide complete set of latest stamped, actioned submittals of record for reference. Provide complete set of shop and Project Site Test Reports, as applies. Provide a complete set of operation instruction and service manuals for each equipment item for reference.

G. Schedule: Comply with the project schedule. Make all submittals specified herein in a timely manner. Failure to make timely submittals complete as specified herein is considered to be lack of substantial progress of the work of this Section.

H. Temporary Equipment: Provide and operate, without claim for additional cost or time, temporary equipment and/or systems to provide reasonably equivalent function, as determined by the architect, in lieu of the Work of this Section which is incomplete or found not in conformance with the Contract Documents as of seven (7) days prior the completion date. Provide such temporary equipment until Acceptance of the Work of this Section. Thereafter, remove such temporary equipment.

1.04 REGULATORY REQUIREMENTS:

A. Codes and Regulations: Perform all work in strict accordance with all applicable Federal, State, County and City Codes, regulations and ordinances.

1.05 APPLICABLE STANDARDS & AGENCIES:

A. SMPTE Society of Motion Picture and Television Engineers.
B. NAB National Association of Broadcasters.
C. EIA Electrical Industries Association of America.
D. UL Underwriters Laboratories.
E. AES Audio Engineering Society.
F. NEC National Electrical Code.
G. UBC Uniform Building Code.

H.	NFPA	National Fire Protection Association.
I.	EIAJ	Electrical Industries Association of Japan.
J.	IEC	International Electrotechnical Commission.
K.	FCC	Federal Communications Commission.
L.	LA City Lab	City of Los Angeles Electrical Testing Laboratory.
M.	NTC	Network Transmission Committee of the Video Transmission Engineering Advisory Committee.
N.	NCTA	National Cable Television Association.
O.	BTSC	Broadcast Television Stereo Committee.
P.	TASO	Television Allocation Study Organization.

1.06 CONFLICTS:

A. Present any conflicts between codes, regulations, specifications and/or requirements at least thirty (30) days prior to the commencement of the scheduled work.

1.07 SUBMITTALS

A. Shop Drawings: Submit manufacturer's literature completely describing system components, equipment, accessories, and shop drawings illustrating system interconnection, wiring, connectors, patch panels and rack elevations.

B. Submit detailed scale shop drawings showing speaker cluster and method of support.

1.08 OPERATION AND MAINTENANCE DATA

A. Manuals: In addition to the requirements of other Divisions submit two (2) additional sets. Submit in three-post binder or three-ring binder with tabs. Include:

1. Index.
2. Systems operating instructions.
3. Reduced set of system Record Drawings.
4. Key schedule.
5. Maintenance and spare schedules.
6. Shop and Field Test Reports.
7 Equipment manuals. Collage alphabetically by manufacturer. Provide manufacturer's original operation, instruction and service manuals for each equipment. For each set, provide manufacturer's original printed copies only. Photocopies acceptable.

B. Framed Operating and Maintenance Instructions: Provide adjacent to each ensemble of equipment racks. Provide sturdy frame with clear glass or non-scratching plastic cover. Provide permanent, non-fading media. Blueprints shall not be acceptable. Include:

1. Sequence for system start-up and shut-down.
2. System Functional Diagrams.
3. Signal levels and impedances at accessible system signal and test ports.

1.09 GUARANTEE

A. The system specified herein shall carry a complete one-year warranty including parts and labor.

B. Any item and/or components found to be defective, abuse and/or misuse excepted, shall be repaired or replaced at no cost to owner.

C. Service response time shall be no longer than four (4) hours with system repaired in 24 hours.

PART 2 - PRODUCTS

2.01 LOUDSPEAKER ELEMENTS AND RELATED EQUIPMENT

A. Provide two loudspeaker enclosures, each containing one (1) 90°H. x 40°V. horn, one (1) high frequency compression driver and one (1) low frequency transducer with 15-inch diameter.

B. Minimum Performance

1. Frequency Response: +/- 3dB, 40 Hz to 17 kHz

2. Power Handling: 600W Program, 150W RMS

3. Sensitivity: 110dB 1W/1M

4. Nominal impedance: 8 ohms

C. Suitable for flying and furnished with all required support brackets to properly aim the assembly.

D. Internal crossover set per manufacturer's recommendations.

D. Acceptable manufacturers:

1. JBL

2. Electrovoice/Altec

3. Community

2.02 POWER AMPLIFIER - ONE (1) REQUIRED

A. Features

1. Employ solid-state devices throughout and employ positive protection of circuit components.

2. Input connectors: Balanced XLR or barrier strip.

3. Output connectors: Standard 3/4" spacing "5-way" binding posts, or barrier strips.

4. Two channel output.

B. Minimum Performance Per Channel

1. Frequency response: +/- .1 dB from 20 Hz to 20kHz at 1 watt

2. Signal-to-Noise Radio: Better than 100 dB below full rated power from 20 Hz to 20 kHz.

3. THD: .05% at full rated power from 20 hZ to 1 kHz

4. Slew Rate: Greater than 13 volts per microsecond.

5. Damping: Greater than 1,000 from 10 Hz to 400Hz.

6. Power: 300 watts per channel into 8 ohms at 1kHz.

C. Acceptable, Subject to Above

1. Crown MA-1200

2. Equal by JBL, Electrovoice.

2.03 RACK MOUNT MIXER

A. Rack mount eight (8) channel mixer features:

1. Transformer isolated XLR inputs

2. Phantom power

3. Eight (8) position input level switches from 50 dBv to 0 dBv.

4. Dual busses

5. Total harmonic distortion (THD) at +10dB, 20Hz to 20kHz .05%

B. Acceptable, subject to above

1. Intellix 8002 MCB.

2.04 DIGITAL SYSTEM CONTROLLER

A. Features

1. Two (2) balanced inputs (4) balanced outputs.

2. Output limiting
3. Parametric Eq
4. Signal delay
5. Crossover filter/up to 24 dB 1 octave

B. Minimum performance

1. Hum and noise: <-81 dBv
2. Gain: variable, -24 dB to +6dB
3. THD: <.01% @ 1 kHz

C. Acceptable, subject to above

1. Community DSC42.
2. Approved equal

2.05 EQUALIZER/FEEDBACK ELIMINATOR

A. Features:

1. Balanced input and output
2. 30 one-third octave / 14 two-third octave filters 20 Hz - 20 kHz
3. 10 high Q notch filters
4. 66 mHz Motorola 56007 DSP

B. Minimum Performance:

1. Frequency response: 20 Hz through 20 kHz (+/- 1 dB).
2. Noise better than -88 dBv at unity gain
3. THD less than .05% into 600 ohms
4. Filger type R-C Active, single pole pair.

C. Acceptable, subject to above:

1. Shure DRF11 Eq. Two (2) units shall be provided.
2. Approved equal.

2.06 CASSETTE DECK:

A. Features

1. Rack mount
2. Logic transport control
3. Digital meters
4. Pitch control

B. Minimum Performance:

1. Wow and flutter maximum .06%
2. Frequency response 30 Hz - 20 kHz +/- 3 dB
3. Dolby B/C NR
4. S/N 74 dB minimum

C. Acceptable, subject to above:

1. Denon 770R

2.07 CD PLAYER:

A. Features:

1. 5 Disc auto changer
2. Full function remote control

B. Minimum Performance:

1. Frequency response 5 Hz - 20 kHz +/- .2 dB
2. S/N 106 dB IHF A-weighted
3. THD maximum .0025%
4. 352.8 Kitz 18 bit oversampling

C. Acceptable, subject to above:

1. Denon DCM-30

2.08 ASSISTIVE LISTENING SYSTEM

A. Narrow band transmitter

1. 10 channels
2. 500 foot coverage
3. Williams PPA T20

B. Personal receivers with rechargeable batteries

1. Provide quantity equal to 4% of maximum occupancy of the facility.
2. 4 channel selector
3. Williams PPA R19-4

C. Earphones

1. 60% Mini Earbud - Williams EAR013
2. 20% Neckloop - Williams NKL001
3. 20% Stetoclip - Williams EAR 8500-50

D. Remote Antenna

1. Williams ANT005

E. Charger

1. Williams CH6 1269A

2.09 PORTABLE EQUIPMENT

A. Dynamic mics

1. Dynamic element
2. Extremely resistent to above
3. Frequency: 50Hz to 15kHz
4. Cardoid pattern
5. On/Off switch

B. Acceptable, subject to above:

1. Shure SM58-S. Three (3) units shall be provided.

C. Microphone cables

1. Rapco NP-50. Two (2) units shall be provided.

b. Rapco NP-15. Two (2) units shall be provided.

D. Mic stands

1. Soundolier DS-7E Desk Stand. Two (2) units shall be provided.

2. Soundolier TL34-3E Tripod Stand. Two (2) units shall be provided.

2.10 SYSTEM WIRING

A. Loudspeaker Wire

1. Twisted pair jacketed, unshielded cable #14

2. West Penn 226 or equal

B. Mic/line wire

1. Jacketed, shielded twisted pair #20

2. West Penn 292 or equal

2.11 EQUIPMENT RACK

A. UL listed, 16 gauge (minimum) welded steel enclosure designed and constructed to contain the specified equipment and having the following features:

1. Three-piece sectional wall-mounted with hinged sections.

2. Quantity of rack spaces as required for equipment. Outside overall dimensions not exceeding 65”H. x 24”W. x 25”D.

3. Soundolier 320 series or equal by Lowell or Middle Atlantic.

B. Accessories:

1. Locking vented front steel hinged door.

2. Vented side panels at top and bottom.

3. Cable management devices.

4. Solid top.

5. Blank filler panels between amplifiers.

6. Security covers for amplifiers, controller, mixer, equalizer. Cover shall allow unobstructed viewing of settings.

7. Fully enclosed rack mounted storage drawer, 3 rack spaces high with ball bearing slides and non-locking slam latch (cord storage).

8. Fully enclosed rack mounted storage drawer, 4 rack spaces high with ball bearing slides, locking slam latch, and snap together internal partitions (media storage).

2.12 MICROPHONE INPUT JACKS

A. One female XLR mic jack for each outlet shown on plans.

B. Permanently engrave each coverplate with the channel number corresponding to the mixer.

C. Acceptable, subject to above

1. Switchcraft

2.13 Circuit Protection: All active devices shall have integral fuse or circuit breaker protection.

A. All Circuit breakers shall be fully magnetic.

B. Protection devices shall be located to facilitate examination, resetting and/or replacement without the need to disassembly or demount the associated device.

C. Contractor-fabricated items shall be provided with either indicating type circuit breakers or fuses of the clear glass cartridge type, mounted in fuse holders which will indicate a blown or defective fuse.

2.14 Continuous Use: All active circuitry shall be solid-state and shall be rated continuous use. All circuit components shall be operated in full compliance with the manufacturer's recommendations and
shall contain sufficient permanent identification to facilitate replacement.

2.15 Identification: Provide permanent intelligible identification on, or adjacent to, all connectors, receptacles, controls, fuses, circuit breakers, patching jacks, and the like. This identification shall clearly and distinctly indicate the function of the item and shall be numbered or lettered to correspond with the function, circuit and location consistent with field and shop drawings.

2.16 Protective Devices: Identification of fuses and circuit breakers shall indicate protected circuitry, rating of protective device and voltage across open-circuited protected device.

2.17 Panels and Receptacles: Panel surfaces shall be engraved and filled or silk screened with identification, or shall be provided with 1/16 in (min.) thick laminated plastic labels with engraved block characters at least 1/8 inch high fastened to the equipment by stainless steel screws or rivets. Provide white characters on black background unless otherwise noted. Embossed plastic (Dymo) labels shall not be acceptable.

2.18 Finishes: Any item or component of the Work or this Section which is visible shall comply with the following. Finishes noted or scheduled on the Contract Drawings shall take precedence.

A. Where finishes are not noted or otherwise defined in the Contract Documents, submit manufacturer's standard finish samples for selection by the architect.

B. Provide wooden loudspeaker enclosures and baffles painted flat black if not otherwise finished or stained.

C. Unless otherwise noted, receptacle or device plates subject to connection or operating force shall be stainless steel or hard anodized aluminum. Provide plates which general match the appearance of project standard receptacle or device plates in view in the same area. For anodized aluminum, submit samples of standard colors for selection by architect.

D. Operating panels shall be steel, primed, painted with thermosetting epoxy paint, with legends silkscreened in contrasting color, and coasted with clear epoxy thermosetting coating; or aluminum, hard anodized, with legends engraved and filled with contrasting color, all coated with clear epoxy thermosetting coating.

1. All steel surfaces shall be treated with primer equivalent to zinc phosphate and finish painted with baked enamel or painted with the thermosetting epoxy paint.

2. All aluminum surfaces, except those used as operating surfaces, shall be anodized and then painted with a thermosetting epoxy paint.

2.19 Keys: Key all boxes, cabinets, enclosures, panels, controls, doors and related provided for similar usage within a system identically. For each unique key type, provide quantity as specified in other Divisions or quantity of four (4), whichever is greater. Stamp each key with reference designation. Submit schedule of keying.

2.20 PORTABLE ASSISTIVE LISTENING SYSTEM

A. Provide portable assistive listening system by Phonic Ear or equal complete with one (1) PE550T base station with standard antenna, one (1) AT209A wall transformer, four (4) PE350FSR receivers with rechargeable batteries, four (4) AT541-S headsets, one (1) PE 300CS charger with transformer and one (1) AT571 Dynamic Microphone with AT572 25 ft. XLR to XLR cable.

PART 3 - EXECUTION

3.01 GENERAL

A. Perform the Work of the Section in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein.

B. Furnish and install (herein, "provide") all materials, devices, components, and equipment required for complete, operational systems.

3.02 TEST EQUIPMENT

Furnish, store and maintain test equipment at the fabrication shop and the job site for both routine and Acceptance Testing of the Work of this Section. Provide all required test cables, jigs and adapters. Provide at least one (1) each of the following items or approved functional equivalents.

A. Audio Equipment

1. True RMS Audio Digital Volt-Ohm-Millimeter (Fluke 8060A).
2. Acoustic Polarity Tester(BSS Audio Ltd., Phasecheck System AR 130).
3. Low Distortion Audio Frequency Sine Wave Oscillator (HP or Tektronix SG 505).
4. Pink Noise Generator (Ivie IE-20B).
5. Real Time Spectrum Analyzer, One-Third Octave(Ivie IE-30A).
6. Techron TEF Analyzer.

B. Communications and Related

1. Communications equipment.
2. Any other items of equipment or materials required to demonstrate conformance with the Contract Documents.

3.03 WIRE AND CABLE INSTALLATION

A. Provide permanent identification of runs destinations at all raceway terminations.

B. All wire and cable shall be continuous and splice-free for the entire length of run between designated connections or terminations.

C. All Shielded cables shall be insulated. Do not permit shields to contact conduit, raceway, boxes, panels or equipment enclosures.

D. Make splices only at equipment rack.

E. Verify that all raceway has been de-burred and properly joined, coupled, and terminated prior to installation of cables. Verify that all raceway is clear of foreign matter and substances prior to installation of wire or cable.

F. Inspect all conduit bends to verify proper radius. Comply with Code for minimum permissible radius and maximum permissible deformation.

G. Apply a chemically inert lubricant to all wire and cable prior to pulling in conduit. Do not subject wire and cable to tension greater than that recommended by the manufacturer. Use multi-spool rollers where cable is pulled in place around bends. Do not pull reverse bends.

H. Provide a box loop for all wire and cable routed through junction boxes or distribution panels. Provide tool formed thermal expansion loops at cable at manholes, handholes, and at both sides of all fixed-mounted equipment. Cable loops and bends shall not be bent at a radius greater than that recommended by the manufacturer.

I. Secure all wire and cable run vertically for continuous distances greater than thirty (30) feet. Secure robust non-coaxial cables with screw-flange nylon cable ties or similar approved devices appropriate to weight of cable. For all other cables, provide symmetrical conforming non-metallic bushings or woven cable grips appropriate to weight of cable.

3.04 SIGNAL POLARITY CONVENTION

A. Maintain consistent absolute signal polarity at all connectors, patch points and connection points accessible in the system. Where applicable, a positive polarity electrical signal shall yield positive acoustic pressure from the loudspeakers.

B. Audio signal connector convention: AES14-1992 (ANSI S4.48-1992) AES standard for professional audio equipment - Application of connectors, Part 1, XLR-type polarity and gender.

Signal	Connector	Wire
Signal Phase	Pin 2	Red or White
Signal Anti-Phase	Pin 3	Black
Signal Ground	Pin 1	Drain Wire

3.05 WIRING PRACTICE

A. Land all non-coaxial field wiring entering each equipment rack at specified terminal devices prior to connection to any equipment or devices within racks. At Contractor's option, such terminals may be located in the equipment racks or in the terminal cabinets provided. Coordinate such selection with project construction sequence and test procedures specified herein.

B. Identify all wire and cable clearly with permanent labels wrapped about the full circumference with one (1) inch of each connection. Indicate the number designed on the associated field or ship drawing or run sheet, as applies.

Assign wire or cable designations consistently throughout a given system. Each wire or cable shall carry the same labeled designation over its entire run, regardless of intermediate terminations. Provide any of the following:

1. Continuous permanent imprint; equivalent to Clifford of Vermont, Inc. "Quick-Pull."
2. Direct hot stamp.
3. Heat shrinkable factory hot stamped; equivalent to Bradysleeve Heatshrink.
4. Adhesive strip printed labels wrapped the full circumference of the wire and sealed with a clear heat shrink tubing; equivalent to Thomas and Betts or Panduit Insta-code with clear heat-shrunk tubing equivalent to Alpha.

C. Apply all crimp connectors only with manufacturer's recommended ratchet-type tooling and correct crimp dies for connector and wire size. Plier-type crimp tooling shall not be acceptable.

D. Coordinate insulation displacement (quick connect) terminal devices with wire size and type. Comply with manufacturer's recommendations. Make connections with automatic impact-type tooling set to recommended force.

E. Make all connections to screw-type barrier blocks with insulated crimp-type spade lugs. Lugs are not required at captive compression terminal-type blocks. Provide permanent designation strips designed for use with the terminal blocks provided. Make neat, intelligible markings with indelible markets equivalent to "Sharpie".

F. Tin terminated shield drain wires and insulate with heat-shrinkable tubing.

G. Use only rosin core 60/40 tin/lead solder for all solder connections.

H. Dress, lace, or harness all wire and cable to prevent mechanical stress on electrical connections. No wire or cable shall be supported by a connections point. Provide service loops where harnesses of different classes cross, or where hinged panel are to be interconnected.

I. Termination and build-out resistors and related circuit correction components shall be visible. Do not install in connector shells or internally modify equipment. Show locations on Record Drawings.

J. Correct any and all of the following unacceptable wiring conditions:

1. Deformed, brittle, or cracked insulation.
2. Insulation shrunken or stripped further than 1/8-inch away from the actual point of connection with a connector, on a punch block.
3. Cold solder joints.
4. Flux joints.
5. Solder splatter.
6. Ungrommeted, unbushed or uninsulated wire or cable entries.
7. Deformation or improper radius of wire or cable.

3.06 SIGNAL GROUNDING PROCEDURES

A. Comply with Nation Electrical Code.

B. Unless otherwise note maintain a unipoint ground scheme.

C. Signal and electrical system grounds shall be isolated except at the project ground field connection.

D. Equipment enclosures shall not be permitted to touch each other unless bolted together and electrically bonded.

E. Ground and bond equipment racks and similar equipment enclosures containing powered equipment exclusively via the Isolated Ground conductors provided. INSULATE RACK MOUNTING, ANCHORAGE, AND RACEWAY CONNECTIONS.

F. At each rack, provide an Isolated Ground bus with lug bonded to the rack frame with a #12 TW stranded wire.

G. Equipment signal ground shall be to the Isolated Ground System via the green wire of the equipment power cord. Where equipment uses two (2) wire power cords, provide #12 green bond wire to rack IG bus bar. At equipment, provide crimp lug and suitable hardware for bonding.

H. Shielded cables of this section shall be grounded exclusively to Isolated Ground by a single path. Shield shall be tied to Isolated Ground at one end only, i.e., at the low potential (receiving) end of run, unless otherwise noted.

I. Signal Ground provisions shall realize less than 0.15 ohms to the primary ground connection.

3.07 EQUIPMENT ENCLOSURE (RACK) AND EQUIPMENT BACKBOARD FABRICATION

A. Combustible material, other than incidental trim of indicated equipment, is prohibited within equipment racks.

B. Provide a permanent label on the front of the equipment rack including the rack designation, and the circuit breaker number and associated electrical distribution panel designation servicing same.

C. Maintain separation of wiring classifications as specified herein. Separately dress, route, and land microphone and line level cables and related on the right side of the equipment enclosure, as viewed from the rear; dress, route, and land loudspeaker level and control cables on the left side of the equipment enclosure, as viewed from the rear.

D. Access shall not require de-mounting or de-energizing of equipment. Install access covers, hinged panels, or pull-out drawers to ensure complete access to terminals and interior components.

F. Fasten removable covers containing any wired component with a continuous hinge along one side, with associated wiring secured and dressed to provide an adequate service loop. Provide an appropriate stop lock to hold all hinged panels and drawers in a serviceable position.

G. Provide permanent labels for all equipment and devices. Where possible, fasten such labels to the rack frame or to blank or vent panels which will remain in place when active equipment is removed for possible service.

3.08 LOUDSPEAKER ASSEMBLY INSTALLATION

A. Provide complete, all means of support, suspension, attachment, fastening, bracing, and restraint (hereinafter "support") of such loudspeaker clusters. Provide engineering of such support by parties licensed to perform work of this type in the project jurisdiction. Submit in timely manner.

1. Comply with applicable Code and the requirements of the authorities having jurisdiction.

2. Provide safety factor greater than six (6) or as required by Code, whichever is greater.

B. Mounting shall:

1. Permit each loudspeaker component to be reoriented and aimed for optimum coverage.

2. Maintain precise location and orientation of each loudspeaker due to operation at full specified system output level, and when subject to normal building motion and Code defined seismic induced building motion.

3. Use rigid metal support members, such as treated rod with locking nuts.

4. Test each loudspeaker system prior to hoisting loudspeakers to design locations. Test at least polarity and freedom from busses, rattles and objectional distortion, using procedures specified herein. Correct non-conforming conditions.

5. Do not apply any load to building structure without first obtaining written approval of the Architect. Obtain per Project procedures.

6. During Acceptance testing, adjust orientation of loud-speaker as directed to achieved optimum coverage. Provide personnel lifts as required. Perform such adjustment with no claim for additional cost or time.

3.09 SYSTEM PERFORMANCE TESTING AND ADJUSTING PROCEDURES

Upon completion of the installation of all equipment in an area, perform the following test and record results. Verify safe and proper operation of all components, devices, or equipment, establish nominal signal levels within the systems and verify the absence of extraneous or degrading signals. Make all preliminary adjustments and document the setting of all controls, parameters of all corrective networks, voltages at key system interconnection points, gains and losses, as applicable. Submit test report. Correct all non-conforming conditions prior to requesting Acceptance Review and Testing. Perform at least the following procedures:

A. Mechanical - Verify:

1. Integrity of all support provisions.

2. Absence of debris of any kind, tool, etc.

B. Power and Isolated Ground - Verify:

1. Isolation of Isolated Ground system from raceway and related ground.

2. Grounding of devices and equipment. Integrity of signal and technical power system ground connections.

3. Proper provision of power to devices and equipment.

C. Signal Wiring - Verify:

1. Integrity of all insulation, shield terminations and connections.

2. Integrity of soldered connections. Absence of solder splatter, solder bridges.

3. Routing and dressing of wire and cable.

4. Continuity, including conformance with wire designations on running sheets, field and shop drawings.

5. Absence of ground faults.

6. Polarity.

D. Use the proper sequence of energizing systems to minimize the risk of damage. Energize.

E. Sound Systems

1. Electronic Tests - Confirm:

a. Gain at 1 KHZ.
b. Maximum output.
c. Input clipping level.
d. Frequency response.
e. Total harmonic distortion.
f. Signal-to-Noise ratio.
g. Signal-to-Crosstalk ratio.

F. Intercommunication System

1. Test proper operation at all stations and receptacles.

G. Electro/Acoustic Tests

1. Uniformity of coverage.

2. Electronic and acoustic frequency response/one-third octave equalization. Measure at ear level. Representative of the architect will direct final adjustment.

3. Maximum continuous sound pressure level (in the reverberant field). Drive systems with broadband pink noise. Sustain for at least five minutes with no system damage. Measure for "A" and "C" weightings at ear level on loudspeaker axis. Turn off noise.

4. Acoustic signal-to-Noise ratio referenced to the specified maximum continuous sound pressure level in* the reverberant field. Measure for "A" and "C" weightings at ear level on loudspeaker axis with mechanical systems operating. Present comparison with previous measurement.

5. Acoustic gain before feedback. Local acoustic source (4 inch loudspeaker/pink noise generator) two feet from system microphone. Measure at system microphone position and at most distant listener position at ear level. Present comparison.

H. System Overall

1. Verify levels.

2. Provide permanent "wedge" type labels on all controls, as applies, to indicate correct settings after systems performance testing and adjustment procedures have been successfully completed.

I. SYSTEM CONTROL

1. Verify all operations and control.

3.10 ACCEPTANCE REVIEW AND TESTING PROCEDURES:

A. Complete all Work of this Section. Submit Test Report. Submit review copies of Operating and Maintenance Manuals, less reduced set of Record Drawing. Notify the Architect in writing that the Work of this Section is complete and fully complies with the Contract Documents. Request Acceptance Review and Testing. The representative of the architect will conduct Verification of Submitted Test Data, and otherwise direct testing and adjustment of this Work. These Procedures may be performed at any hour of the day or night as required by the representative of the architect to comply with the Project Schedule and avoid conflict with these procedures from possible on-going work of other Sections. Provide all specified personnel and equipment at any time without claim for additional cost or time.

B. Personnel: Provide services of the designated supervisor and additional technicians familiar with work of this Section. Provide quantity of technicians as required to comply with Project Schedule.

C. In addition, provide:

1. Set of hand and power tools appropriate for performance of adjustment of and corrections to this work. Include spare wire and connectors and specified tooling for application.
2. Ladders, scaffolding and/or lifts as required to access loudspeakers and other high devices.
3. All test equipment.
4. Complete set of latest stamped, actioned submittals of record for reference.
5. Complete set of Shop and Project Site Test Reports.
6. Complete set of manufacturer's original operation, instruction, and service manuals for each equipment item for reference.

D. Demonstrate: Complete operation of all systems and equipment, including portable equipment.

E. Adjust: As directed by the representative at the architect.

F. Correct: In timely manner, failure to comply with the Contract Documents, as reasonably determined by the representative of the architect.

3.11 CLOSEOUT

A. Punch List: Perform any and all remedial work, at no claim for additional cost or time. Where required, retest and submit Test Report. Notify architect of completion of Punch List.

B. Portable Equipment: Furnish all portable equipment and spares to the designated representative of the owner, along with complete documentation of the materials presented. Where applicable, furnish portable equipment in the original manufacturer's packing.

C. Operating and Maintenance Data: Install framed operating and maintenance instruction. Submit manuals.

D. Project Record Documents: Submit.

E. Training: Conduit two (2) four hour on-site in serve training sessions for the District personnel, instructing on the proper use and maintenance of the system. the first training session shall be at the completion of the project. The second session shall take place at a mutually agreeable time during the warranty period, when requested by the District.

F. Warranty: Submit warranty dated to run from date of Acceptance of the Work of this Section.

3.12 OWNER'S RIGHT TO USE EQUIPMENT

Acceptance of the Work of the Section will be after completion of corrections and adjustments required by the "Punch List" which results from Acceptance Review and Testing of the completed installation. The owner reserves the right to use equipment, material and services provided as part of the Work of the Section prior to Acceptance without incurring any obligation to accept any equipment or completed systems until all Punch List work is complete and all systems comply with the Contract Documents; or accept any claim for additional cost or time.

END OF SECTION
120711/270032

SECTION 16931
OCCUPANCY MOTION SENSORS

PART 1 - GENERAL

1.01 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

1.02 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit data sheets on sensors, wiring diagrams, relays, transformers, junction boxes, and mounting accessories.

1.03 EQUIPMENT QUALIFICATIONS

A. The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry.

B. System shall be Watt Stopper, Novitas or equal.

C. Occupancy motion sensor systems shall be compatible with the specific lighting fixture ballast(s) and lamps controlled. (Several types of ballasts may occur in a given area). Premature failure or life expectancy reductions of the lamps, ballasts, relays or motion sensors is not acceptable.

1.04 PERFORMANCE REQUIREMENTS

A. Occupancy motion sensor systems shall be provided in every location throughout the facility where fluorescent lighting is utilized.

B. Coordinate the locations with the Architectural Reflected Ceiling Plans.

PART 2 - PRODUCTS

2.01 MOTION SENSORS

A. Motion sensors shall be self-contained, infrared or crystal controlled to within +/- 0.01% ultrasonic, solid state low voltage devices designed specifically for energy conservation lighting control. Housing shall be white and impact-resistant.

B. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction in coverage shall occur when air conditioning or heating fans are in operation or when sensor has turned off lighting due to not sensing motion.

C. Sensitivity and time-on after activation shall be such that there will be no nuisance on/off switching of the lights by the motion sensor while the room is occupied.

D. The failure of a sensor shall cause the load contacts to close so that the motion sensor function is automatically bypassed.

E. All sensors shall be provided with an indicator light to verify that motion is being detected and that the unit is operation.

2.02 CONTROL UNITS

A. Control unit shall be an integrated self-contained unit consisting internally of load switching mechanical control relay and a transformer of sufficient capacity to provide low-voltage power to a minimum of two (2) sensors. Solid-state electronic-type relay contacts shall not be used.

B. Relay contacts shall be dry types with ratings of:

10A - 120 VAC Tungsten
20A - 120 VAC Ballast
20A - 277 VAC Ballast

Relay contacts shall be isolated.

C. Control units shall be U.L. listed.

2.03 Wiring between sensors and control units shall be 18 AWG, stranded U.L. Classified, PVC jacketed and insulated.

2.04 Enclosures for control units shall be pressed steel, NEMA I construction with mounting plates and barriers to provide separation between line and low voltage wiring or standard 4" deep junction box with control unit mounting to cover plate with 1/2" knockout.

PART 3 - EXECUTION

3.01 Provide ultrasonic type sensors in areas in which partitions, casework or other features limit the coverage of the infrared type sensors, (i.e. restrooms, laboratories, storage, files, stacks, etc).

3.02 It shall be the contractor's responsibility to provide the quantity of motion sensors required for complete and proper volumetric coverage without gaps within the range of coverage(s) of controlled areas. Rooms shall have ninety (90) to one hundred (100) percent volumetric coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s).

3.03 All ultrasonic sensors shall comply with the State of California Safety and Health Requirements. Decibel levels for ultrasonic sensors shall comply with the following California Energy Commission criteria for ultrasonic emissions:

MAXIMUM DECIBEL LEVELS
FOR ULTRASONIC EMISSIONS

Midfrequency of Sound Pressure Third-Octave Bank (kHz)	Minimum dB Level Within Third Octave Band in dB reference 20 micropascals)
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

The Contractor shall certify in wiring that all installed ultrasonic sensors comply with the specified California Energy Commission criteria for ultrasonic sound.

3.04 All sensors shall be California Energy Commission Title 24 approved and certified.

3.05 Control units shall be located in accessible ceiling spaces and be powered from the lighting circuit which they control.

3.06 Adjust and test each sensor/control unit in accordance with the manufacturers recommendations. Be certain that no obstructions block proper sensor coverage of areas desired, and minimize sensor pickup zone.

NOTE: Occupancy sensors may be affected by various conditions in the room. It may be necessary for the Contractor to make adjustments, change the location or type of sensor to obtain proper operation in a specific room. The Contractor shall have final responsibility for proper operation of the system in each room and should therefore make labor allowances for changes and adjustments.

3.07 Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the District, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. Warranty on sensors and control units will be for a period of at least two (2) years. The warranty shall commence upon Owner's acceptance of the project. Warranty on labor shall be for a period of minimum one (1) year.

3.08 The Contractor shall provide the training necessary to familiarize the District's personnel with the operation, use and adjustment of the devices.

3.09 All wiring shall be installed in conduit, except low voltage sensor cable.

3.10 Sensors shall be wall mounted in areas where fixtures are pendant mounted or other obstructions inhibit the effectiveness of a ceiling mounted device.

3.11 Sensors shall be ceiling-mounted or wall-mounted at a height to avoid obstructions which may inhibit the effectiveness of the device.

END OF SECTION
120711/270032

GEOTECHNICAL INVESTIGATION REPORT-UPDATED
Henry Elementary School (AKA Roosevelt II; DSA File No. 36-55;
DSA Application No. No. 04-107199)
Southeast of the intersection of
Mount Vernon Avenue and 16th Street
City of San Bernardino, San Bernardino County, California

August 3, 2011

Converse Project No. 04-81-156-05

AUG 11 '11 PM 1:26 FRC MED

Converse Consultants

Geotechnical Engineering, Environmental & Groundwater Science, Inspection & Testing Services

November 20, 2006
Updated August 3, 2011

Ms. Charlotte Clement, AIA Associates
Project Manager
San Bernardino City USD – Facilities Management
956 W. 9th Street
San Bernardino, CA 92411

Subject: **GEOTECHNICAL INVESTIGATION REPORT-UPDATED**
Henry Elementary School (AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
Southeast of the intersection of Mount Vernon Avenue and 16th Street
City of San Bernardino, San Bernardino County, California
Converse Project No. 04-81-156-05

Dear Ms. Clement:

Enclosed is the updated report of the geotechnical investigation performed by Converse Consultants (Converse) at the site of the Henry Elementary School, also known as Roosevelt II Elementary School in the city of San Bernardino, California.

A *Geotechnical Investigation Report* was prepared by Converse dated November 20, 2006 for this project to provide information on foundation design, construction and earthwork recommendations for the subject project. The purpose of the present study was to perform additional subsurface investigation to meet the DSA requirements of at least two borings under each building. Our services were performed in accordance with our proposal dated August 18, 2006, your signed Project Addenda dated September 6, 2006, and your Purchase Order Number 500999 dated September 26, 2006. Our additional services were performed in accordance with our proposal dated June 29, 2011, your Master Contract Number 06/07-784-0041/POA and your AOP Number 9 dated June 30, 2011.

A *Geologic Hazards Report* dated November 10, 2004 and the *Preliminary Geotechnical Investigation Report* dated June 16, 2005, were submitted to the California Geologic Survey (CGS) through the Division of the State Architect (DSA) for approval. A letter dated October 14, 2005 was issued by CGS approving the two (2) reports. Due to access limitations, all borings could not be drilled to meet DSA requirements of one boring for every 5,000 square feet of building area and at least two (2) borings under each building. Additional borings were drilled in September 2006 and July 20, 2011.

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The figures, field and laboratory data presented in the *Preliminary Geotechnical Investigation Report* dated June 16, 2005 are incorporated into this report.

Based on our field investigation, laboratory testing and geology/geotechnical analysis the site can be developed for the proposed elementary school provided our conclusions and recommendations are implemented during design and construction.

We appreciate the opportunity to be of continued service to the San Bernardino City Unified School District. If you should have any questions, please do not hesitate to contact us at (909) 796-0544.

CONVERSE CONSULTANTS

Hashmi S. Quazi, Ph.D., G. E.
Regional Manager/Principal Engineer

Dist: 4/Addressee

HS/HSQ/mjr

EXECUTIVE SUMMARY

The following is a summary of our geotechnical investigation, conclusions and recommendations, as presented in the body of this report, please refer to the appropriate sections of the report for complete conclusions and recommendations. In the event of a conflict between this summary and the report, or an omission in the summary, the report shall prevail.

- The approximately 13.3-acre site is located southeast of the intersection of Mount Vernon Avenue and 16th Street in the city of San Bernardino, California. The site is bounded by 16th Street on the north and Mount Vernon Avenue on the west, 14th Street on the south, and Garner Avenue on the east.

- The project consists of construction of the proposed Roosevelt II Elementary School. One-story buildings are planned totaling 45,119 square feet. The buildings will likely include administration, library/computer lab, multi-purpose building, classrooms, kitchen and other facilities. New parking areas will be built on the north and south sides of the site in an area now occupied as residential/commercial and institutional buildings. A bus drop-off area will be also constructed on the north side of the site.

- This site is presently predominantly developed as a single-family residential area with some retail, commercial and institutional buildings located along Mount Vernon Avenue. The majority of the residential development was constructed in approximately 1954. At that time, fill was typically placed without geotechnical observation and/or testing. Vegetation across the site is comprised of grass, shrubs, and trees.

- DSA requires one boring for every 5,000 square feet of building footprint and at least two borings for each building. Our field investigation consisted of a site reconnaissance by an engineering geologist on March 21, 2005 and September 28, 2006, included marking boring locations. All the boring locations were cleared with the owners and tenants by Mr. Terry Gardner with TLG Group Real Estate. Eight (8) exploratory borings (BH-1 through BH-8) were drilled within the project site on June 2, 2005. Ten (10) additional borings were drilled on September 28, 2006. These exploratory borings were drilled using a truck mounted rig equipped with an 8-inch diameter hollow-stem auger drill to depths ranging from 11.5 to 51.5 feet below the existing ground surface (bgs). Three (3) exploratory hand auger borings were drilled on October 14, 2006. The hand auger borings were drilled each to a depth of four (4) feet. Eight (8) additional borings were drilled on July 20, 2011 to depths ranging from 11.5 to 21.5 feet.

- Groundwater was not encountered in any of the borings drilled to a maximum depth of 51.5 feet below ground surface. In November 2005, depth to groundwater in the

vicinity was about 177 feet bgs. Depth to groundwater in the vicinity was measured at about 125 feet bgs in March 1993. In 1972, generalized depth to groundwater was about 165 feet bgs. It should be noted that the groundwater level could vary depending upon the seasonal precipitation and possible groundwater pumping activity in the site vicinity.

- Laboratory tests were conducted on representative samples for the purpose of classification and evaluation of physical properties and engineering characteristics. These tests included soil classification, *in-situ* moisture content and dry density, collapse, expansion index, soil corrosivity, R-value, percent finer than sieve No. 200, gradation analysis, maximum dry density optimum-moisture relationship, and direct shear.

- The depth of the fill soils observed in borings is between two (2) feet and nine (9) feet bgs. *In-situ* dry densities of the fill soils ranged from 86 to 107 pounds per cubic feet (pcf). At the time of our field investigation, the moisture content of the site fill soils ranged from about two (2) to twenty-nine (29) percent.

- *In-situ* dry densities of alluvial soils within six and one-half (6.5) feet bgs ranged from 85 to 105 pounds per cubic feet (pcf). At the time of our field investigation, the moisture content of those alluvial soils ranged from about one (1) to twenty-nine (29) percent.

- The maximum dry density and optimum-moisture content of the alluvial soils is 129.0 and 130.0 pcf at 9.5 percent, respectively. With the in-situ moisture content ranging from one (1) to twenty-nine (29) percent, moisture conditioning of the site soils may be required during grading.

- The site soils have a "Very Low" expansion potential, slight to moderate collapse potential, and moderate frictional resistance.

- Site soils are "Negligible" deleterious to concrete. Type II Portland cement may be used for concrete construction. Site soils, in general, are "Moderately Corrosive" corrosive to ferrous metals.

- There are no known active faults projecting toward or extending across the proposed site. The site is not situated within a currently designated State of California Earthquake Fault Zone. However, the proposed site is located in a seismically active region. The closest fault is San Jacinto Fault-San Bernardino segment, which is located approximately 2.6 miles (4.2 kilometers) from the project site. Ground shaking from earthquakes associated with nearby and distant faults may occur during the lifetime of the project.

- In accordance with Table 16A-J of the California Building Code (CBC, 2001), the geologic subgrade classification is S_D. The site seismic coefficients in accordance with Tables 16A-Q through 16A-T are:

$$N_a = 1.1 \quad C_a = 0.48$$
$$N_v = 1.4 \quad C_v = 0.87$$

- Two site specific response analyses were performed. The Upper Bound Earthquake (UBE), which represents a ten (10) percent chance of exceedance in 100 years (return period 950 years) and the Design Based Earthquake (DBE), which has a ten (10) percent chance of exceedance in 50 years (return period 475 years). Peak horizontal ground accelerations based on the two design level earthquakes are presented below:

  - Upper Bound Earthquake (UBE) – 1.15g
  - Design Based Earthquake (DBE) – 0.97g

- Site soils are not susceptible to liquefaction under earthquake ground shaking due to the fact that groundwater is more than 51.5 feet bgs.

- Review of National Flood Insurance Rate Maps (FIRM) indicates that the project site is within a Flood Hazard Zone "X". Zone "X" is designated as an "area determined to be outside of 500-year floodplain" (FIRM, March 18, 1996).

- Site preparation will require removal of existing fill, structures with their foundations, asphalt concrete, cement concrete paving and other existing underground manmade structures and utilities.

- In general, the existing fill materials should be removed; however, during grading operations, if the in-place density is 85 percent or greater, the existing fill can be left in-place. The alluvial soils that have been beneath existing fill may require excavation; depending upon observations and density testing during grading operations. Alluvial soils where there has been no fill, will require removals up to a depth of five (5) feet bgs. Actual depth of removal will depend upon observations and density testing during grading operations. Oversize materials should be broken down mechanically, buried in deep fill areas or removed from the site.

- Some over-excavation may be required to remove unsuitable surficial loose soils and to prepare a suitably compacted structural fill mat to receive new fill and/or structure, including building slabs-on-grade and the pavement areas. Thickness of compacted fill underneath the buildings should not vary.

- The proposed buildings may be supported by continuous strip and/or isolated square or rectangular shallow foundations.

- Subgrade soil surfaces that will receive compacted fill shall be scarified to a depth of at least 12 inches. The scarified soil shall be moisture-conditioned to within ± three (3) percent of optimum for coarse-grained soils and two (2) percent above optimum for fine-grained soils. Scarified soil shall be compacted to a minimum of 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557.

- Site soils should be excavatable with conventional heavy-duty earth-moving equipment. Excavated site soils free of organic matter or other debris are suitable for placement as compacted fill after proper processing. Such processing may include moisture conditioning and mixing.

- At least the upper 12 inches of subgrade soils under streets and parking areas should be compacted to a minimum of 95 percent of the laboratory maximum dry density as per ASTM Standard D1557 test method.

- For shallow footings founded on compacted fill, an allowable net bearing capacity of 2,500 pounds per square foot (psf) may be used. Footings should be at least 18 inches and 12 inches wide for isolated and continuous footings, respectively. Footing should be embedded at least 18 inches and 12 inches below the lowest adjacent final soil grade for exterior and interior walls, respectively.

- Total settlement of footings due to the maximum allowable bearing pressure should be less than 3/4-inch. Differential settlement can be considered to be one half of the total settlement in 50 feet span.

- Cantilevered earth retaining walls should be designed based on an active earth pressure equal to that developed by a fluid density of 35 pounds per cubic foot (pcf). This pressure assumes a level ground surface behind the walls for a distance greater than the wall height.

- Resistance to lateral loads may be provided by the passive earth pressures acting behind the footings and by the frictional resistance at the base. An allowable value of the passive earth pressure resistance of 240 psf per foot of footing depth may be used for design. The passive resistance should be limited to a maximum of 3,500 psf. An ultimate value of the frictional coefficient of 0.30 may be used to evaluate base frictional forces between soil and concrete.

Results of our investigation indicate that the site is suitable from a geotechnical standpoint for the proposed development, provided that the recommendations contained in this report are incorporated into the design and construction of the project.

PROFESSIONAL CERTIFICATION

This report has been prepared by the staff of Converse under the professional supervision of the individuals whose seals and signatures appear hereon.

The findings, recommendations, specifications or professional opinions contained in this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice in this area of Southern California. There is no warranty, either expressed or implied.

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Appendix A ..... *Field Exploration*
Appendix B ..... *Laboratory Testing Program*
Appendix C ..... *Earthwork Specifications*

1.0 INTRODUCTION

This report contains the findings of our geotechnical investigation performed at the site of the Henry Elementary School, also known as Roosevelt II Elementary School, located southeast of the corner of Mount Vernon Avenue and 16th Street in the city of San Bernardino, California, as shown on Figure No. 1, *Site Location Map*.

A *Geologic Hazards Report* dated November 10, 2004 and the *Preliminary Geotechnical Investigation Report* dated June 16, 2005, were submitted to the California Geologic Survey (CGS) through the Division of the State Architect (DSA) for approval. A letter dated October 14, 2005 was issued by CGS approving the two (2) reports. However, due to access limitations, all borings could not be drilled to meet DSA requirements of one boring for every 5,000 square feet of building area and at least two (2) borings under each building. Additional borings were drilled on September, 2006. Additional borings were also drilled on July 20, 2011 to meet the DSA requirements.

The purpose of this investigation was to evaluate the nature and pertinent engineering properties of the subsurface materials at the site and to provide recommendations regarding earthwork and geotechnical parameters for the design and construction of the proposed project.

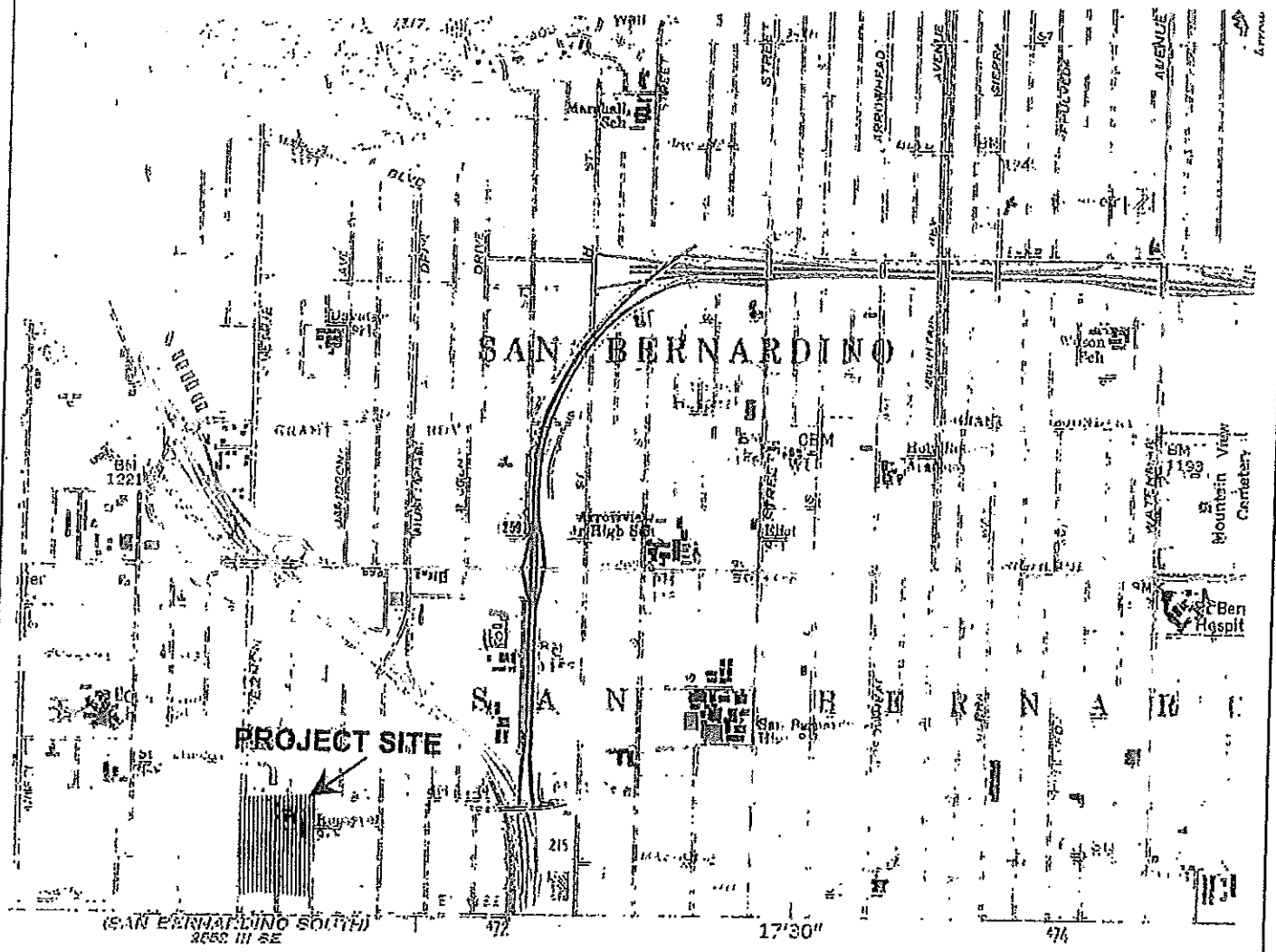
Prior to preparing this report, we discussed the project with Mr. Roy Gutierrez of PSWC Group, Architects (Project Manager), and used the aerial photograph provided by PSWC Group, Architects as a reference for our Figure Nos. 2 and 2b, *Approximate Boring Location Map*.

This report is written for the project described herein and is intended for use solely by San Bernardino City Unified School District and its design team. It should not be used as a bidding document but may be made available to the potential contractors for information on factual data only. For bidding purposes, the contractors should be responsible for making their own interpretation of the data contained in this report.

2.0 PROJECT DESCRIPTION

Based on the Information provided by PSWC Group, Architects, the project consists of construction of ten (10) one-story buildings and other facilities, totaling 45,119 square feet, for the proposed Roosevelt II Elementary School, and which will include the following:

- Administration
- Library/Computer Lab
- Multi-Purpose Building
- Special Education
- Playfields
- Hardcourts



SCALE 1:24000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Reference:

U.S. GEOLOGICAL SURVEY, San Bernardino South Quadrangle
California, San Bernardino County, Ca. 7.5- minute series, 1967, Photorevised 1988

Site Coordinates:

Site Coordinates: North Latitude: 34.12686 Degrees
West Longitude: 117.31249 Degrees

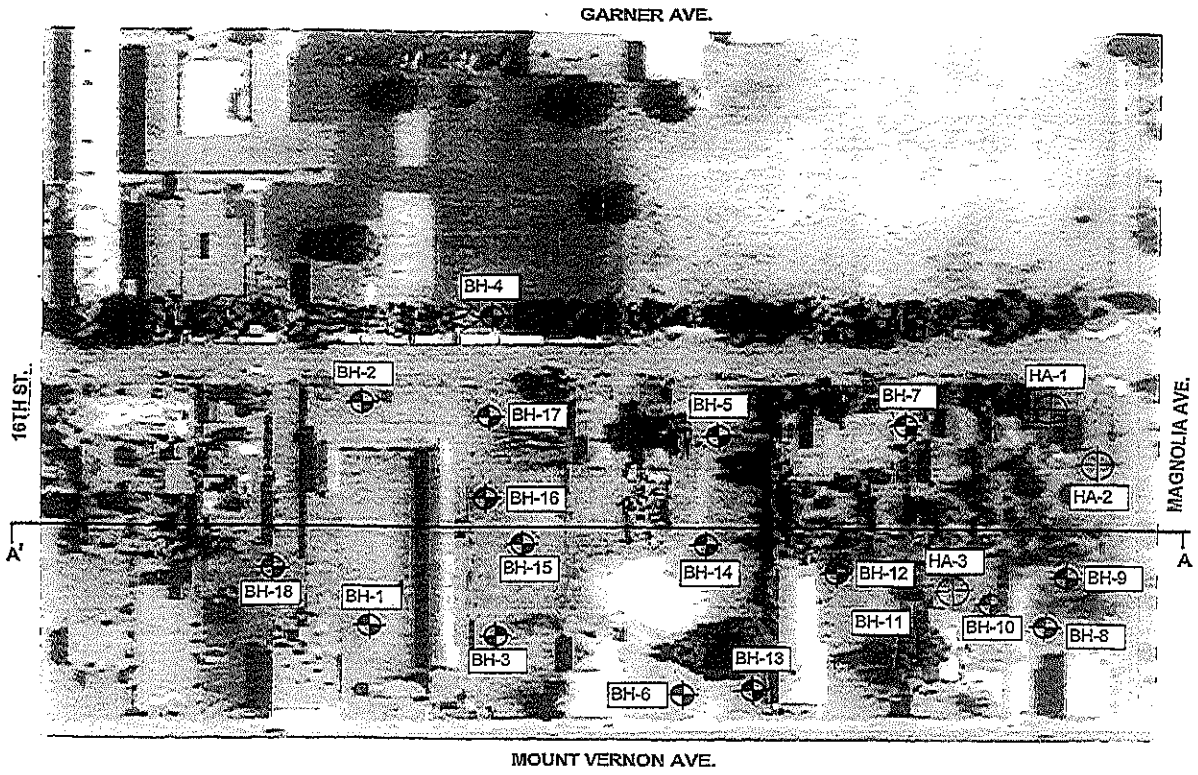
SITE LOCATION MAP

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No.
04-81-156-02

Figure No.
1

Converse Consultants



EXPLANATION

BH - 1 Number and Approximate Boring Location

HA - 1 Number and Approximate Hand Auger Location

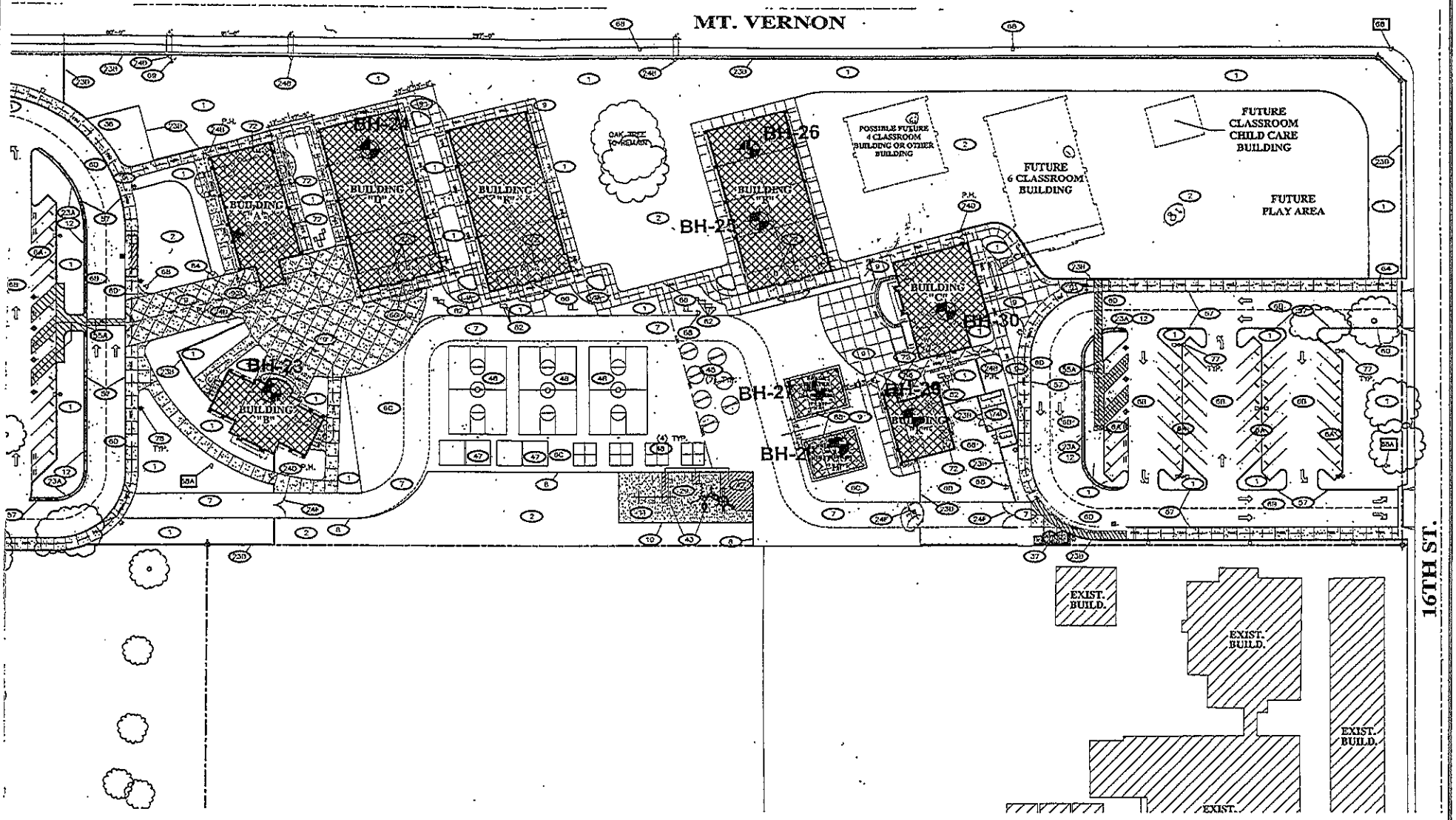
A — A' Approximate Location of Cross Section

APPROXIMATE BORING LOCATION MAP

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Converse Consultants

Scale	NTS
Prepared By	KQ
Checked By	RJR
Approved By	HSQ
Project No.	04-81-156-03
Figure No.	2



APPROXIMATE BORING LOCATION MAP

Henry Elementary School

(AKA Roosevelt II; DSA File No. 36-55;DSA Application No. No. 04-107199)

City of San Bernardino, San Bernardino County, California

For: San Bernardino City USD – Facilities Management

Project Number:

04-81-156-05

Approximate Boring Location

Converse Consultants

Figure No. 2b

- Outdoor Stage
- Food Service
- Lunch Shelter
- One Story Classroom
- Courtyard
- Kindergarten
- Kindergarten Play Area
- Service Yard
- Parking
- Student Drop-off
- Bus Drop-off
- Fire Lane
- Future Growth

3.0 SITE COORDINATES

The coordinators for the project site are shown on Figure No. 1, *Site Location Map*. The site coordinates shown on Figure No. 1 are as follows:

North latitude: 34.12686 degrees
West longitude: 117.31249 degrees

These coordinates were centered on the subject site and used to calculate the earthquake ground motions for the project site. Review of the Engineering Geology and Seismology for Public Schools and Hospitals in California, dated July 1, 2004 (page 27) indicates that accuracy to within a few hundred meters of these coordinates is sufficient for the computation of the earthquake ground motion of the project site.

4.0 SITE DESCRIPTION

The approximately 13.3-acre site is located southeast of the intersection of Mount Vernon Avenue and 16th Street in the city of San Bernardino, California. The subject site is "rectangular" shaped and bounded on the north by 16th Street, on the west by Mount Vernon Avenue, on the south by 14th Street, and on the east by Garner Avenue.

Between Mount Vernon Avenue and Garner Avenue, Turrill Avenue traverses through the middle of the property. On the east side of Turrill Avenue, Roosevelt Elementary School exists. The west and south sides are developed as a single-family residential area with some retail, commercial and institutional buildings located along Mount Vernon Avenue. Vegetation associated with residential development exists across the site and is comprised of grass, shrubs, and trees. Access to the site is via existing 14th, 16th, and Garner Streets, and Magnolia, Mount Vernon, and Turrill Avenues. Scattered debris exists in portions of the site.

The ground surface elevation of the proposed elementary school site is approximately 1,160 feet above mean sea level (MSL) and the site has relatively flat topography. The site drainage is by sheet-flow and gutters to the west and south and performed by the existing storm drains.

5.0 SCOPE OF WORK

Our scope of work consists of the tasks described in the following subsections.

5.1 Subsurface Exploration

We drilled twenty-one (21) borings for this project (BH-1 through BH-18, HA-1 through HA-3) at the locations where access was available on June 2, 2005 and September 28, 2006. The three (3) hand auger borings were drilled on October 14, 2006 in areas where there was no drill rig access. Hand auger borings were each drilled to a depth of four (4) feet. Additional eight (8) borings (BH-19 through BH-26) were drilled on July 20, 2011. The truck-mounted drill borings were drilled to the depths of between 11.5 and 51.5 feet bgs.

Each boring was visually logged by our geologist and sampled at regular intervals, and at changes in subsurface soils. Both relatively undisturbed and bulk soil samples were obtained for laboratory testing.

The borings were backfilled with soil cuttings following the completion of drilling. The soil in the borings was densified by reverse spinning of the auger during the backfill operation and tamping of the borings with the auger. Where bulk samples were taken, hand auger borings were backfilled with sand and capped with a few inches of soil. Where no sample was taken, the hand auger boring was backfilled with soil cuttings.

The approximate locations of the exploratory borings and hand augurs drilled on June 2, 2005, September 28, 2006 and October 14, 2006 are shown in Figure No. 2, *Approximate Boring Location Map*. The approximate locations of the exploratory borings drilled on July 20, 2011 are shown in Figure No. 2b, *Approximate Boring Location Map*. For a description of the field exploration and sampling program see Appendix A, *Field Exploration*.

5.2 Laboratory Testing

Representative samples of the site soils were tested in the laboratory to aid in the classification and to evaluate relevant engineering properties. The tests performed included:

- *In situ* moisture contents and dry densities (ASTM Standard D2216)
- Collapse (ASTM Standard D5333)
- Expansion Index (ASTM Standard D4829)
- Soil corrosivity tests (Caltrans 643, 422, 417, and 532)
- Sand equivalent (ASTM D24A)

- R-value (ASTM Standard D2844)
- Percent passing the #200 sieve (ASTM Standard D1140)
- Grain size distribution (ASTM Standard C136)
- Maximum dry density and optimum-moisture content relationship (ASTM Standard D1557)
- Direct shear (ASTM Standard D3080)
- Consolidation (ASTM Standard D2435)

For *in-situ* moisture and density data, see the Logs of Borings in Appendix A, *Field Exploration*. For a description of the laboratory test methods and test results, see Appendix B, *Laboratory Testing Program*.

5.3 Analyses and Report

Data obtained from the exploratory fieldwork and laboratory-testing program were analyzed and evaluated. This report was prepared to provide the findings, conclusions and recommendations developed during our investigation and evaluation.

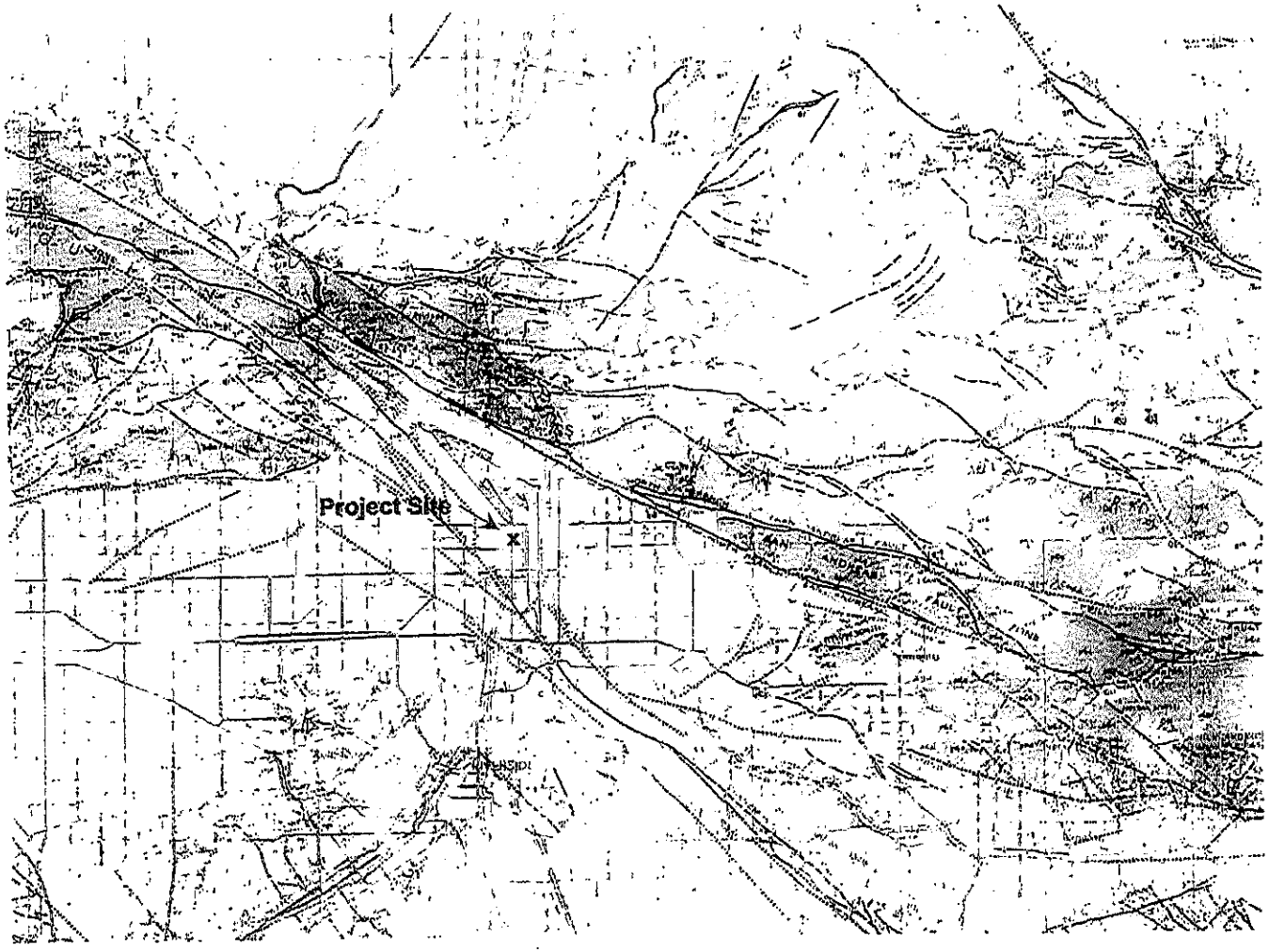
6.0 ENGINEERING GEOLOGY

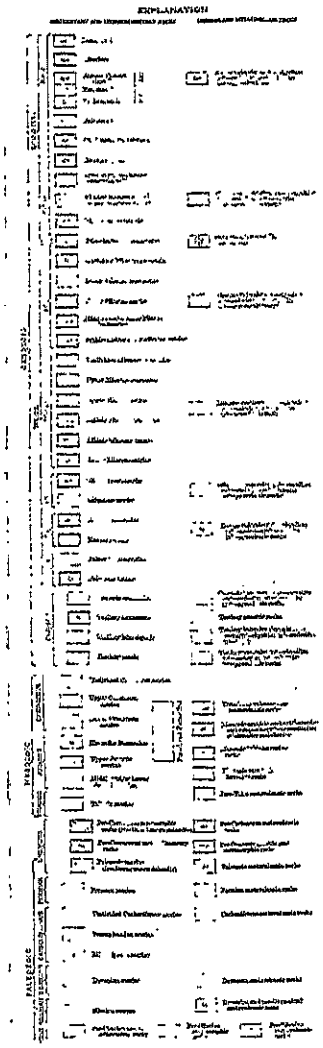
6.1 Regional Geology and Regional Fault Map

The project site is located within the northern portion of a large structural block of land known as the Perris Block. The Perris Block is part of the Peninsular Ranges Geomorphic Province of Southern California. The Peninsular Ranges extends southward from the San Gabriel Mountains to several hundred miles into Baja California. Northwest-trending mountain ranges and broad intervening valleys typically bordered by active northwest-trending strike-slip faults, characterize the province.

The northern Perris Block bounded by three major convergent fault systems: 1) northwest-trending high angle strike-slip faults of the San Andreas system projecting along the northeastern boundary of the Peninsular Ranges, and 2) east-trending low angle reverse or reverse-oblique faults bounding the south margin of the Traverse Ranges and 3) high angle northeast-trending strike-slip faults of the Whittier-Elsinore system. Faults of group one include the San Jacinto Fault and San Bernardino segment of the San Andreas Fault. Faults of group two include the Cucamonga Fault and faults of group three include the Chino-Central Avenue and Whittier-Elsinore faults.

Figure No. 3, *Regional Geologic Map*, has been prepared to show the location of the proposed project site with respect to regional geology of the vicinity. Figure No. 4, *Southern California Regional Fault Map* has been prepared to show the location of the





Reference: Portions of the Geologic Map of California, San Bernardino Sheet (1967) and Santa Ana Sheet (1966)

REGIONAL GEOLOGIC MAP

Roosevelt II Elementary School

San Bernardino, San Bernardino County California

For: San Bernardino City Unified School District

Project Number:

04-81-156-02

Converse Consultants

Figure No.

3

proposed project site with respect to local and regional faults in Southern California. The nearby active local and regional faults shown on Figure No. 4 were used for the probabilistic seismic hazard analysis.

6.2 Geology of Project Site

Figure No. 5, *Geologic Map of Site Vicinity*, has been prepared to show the location of the project site with respect to local geologic exposures mapped by Fred K. Miller, Jonathan C. Matti and Scott E. Carson (Geologic Map of the San Bernardino South 7.5' Quadrangle). As shown on Figure No. 5, the project site is underlain by Holocene and Pliocene young alluvial valley deposits and Late Holocene very young wash deposits.

The geologic cross section presented on Figure No. 6, *Geologic Cross Section*, has been drawn across the proposed project site and tied to the exploratory borings. Artificial fill consisting of sandy silt, sand and clayey sand was encountered at Boring Nos. BH-7, BH-8, BH-9, BH-10, BH-12, BH-14, and BH-18, between two (2) and nine (9) feet in depth.

6.3 Active Faulting and Seismic Hazards

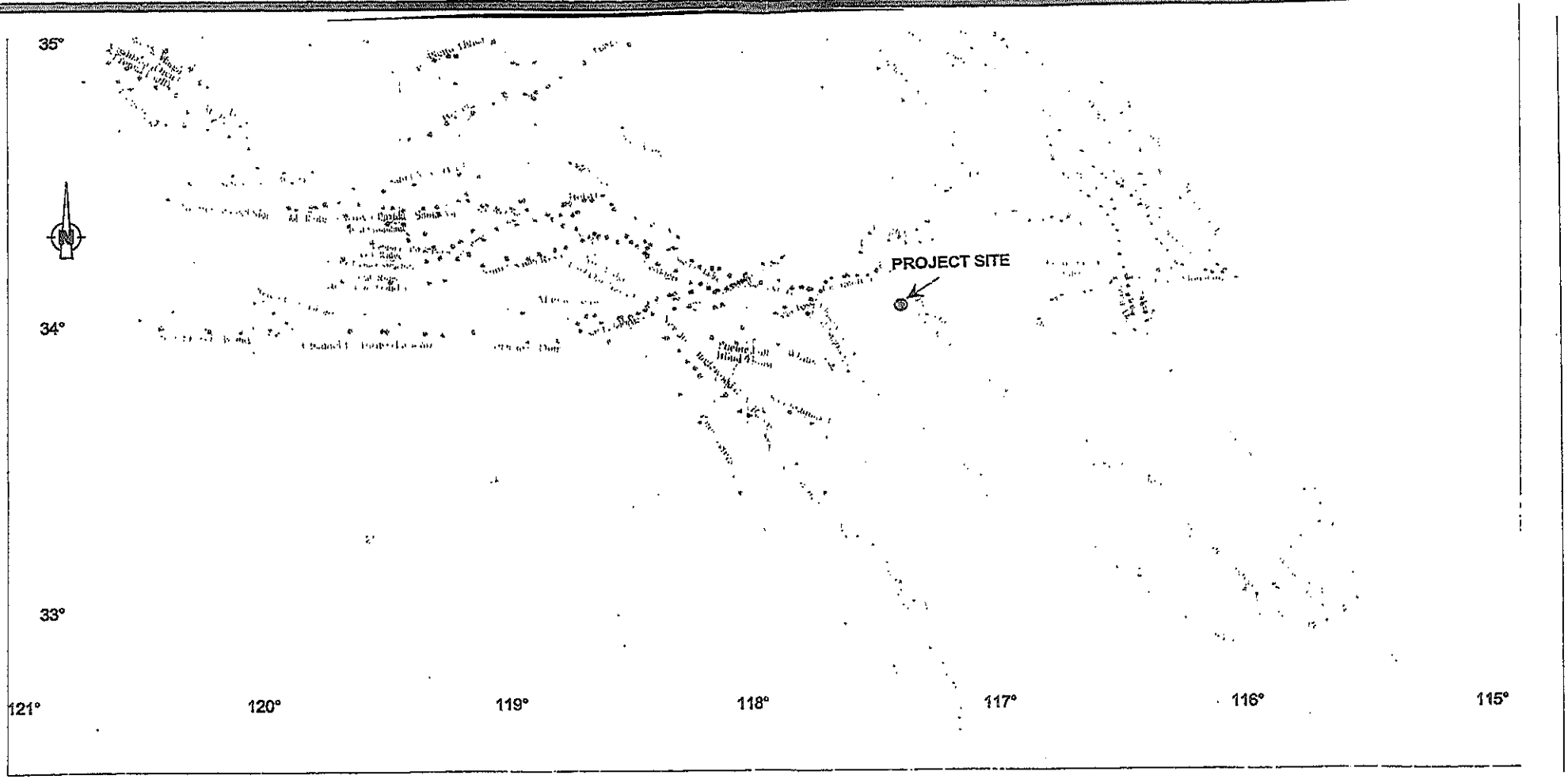
The project site is not located within a currently designated State of California Earthquake Fault – Rupture Hazard Zone (name changed from Alquist-Priolo Special Studies Zone in January 1994). No faults are known to project towards or extend across the site. The closest known active fault to the project site is the San Bernardino segment of the San Jacinto Fault located 2.6 miles to the southwest of the site.

Review of recent seismological and geophysical publications indicates that the seismic hazard for the project site still remains high. The seismic hazard for the project site is similar to that of the heavily populated San Fernando Valley as demonstrated by the 1971 San Fernando and 1994 Northridge earthquakes. The epicenters for historic earthquakes in the region are shown on Figure No. 7, *Epicenters Map of Southern California Earthquakes (1800-1999).*

The scientific community's most current understanding of the complex tectonic framework of the northern Perris Block has been complied into the 2002 CGS Fault Model and has been used in our current Probabilistic Seismic Hazard Analysis (PSHA) for the fire station site.

6.4 Subsurface Profile

Existing fill and alluvial deposits were encountered at the project site to the maximum depth explored of 51.5 feet below ground surface (bgs).



REFERENCE: PORTION OF CGS 2002 CALIFORNIA FAULT MODEL MODIFIED FOR USE WITH FRISKSP AND EQFAULT BY THOMAS F. BLAKE, AUGUST 2004

FAULT SOURCES

BLIND THRUST FAULT, POLYGONS INDICATE RUPTURE PLANES AND DIP DIRECTION

SOUTHERN CALIFORNIA REGIONAL FAULT MAP

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Converse Consultants

Scale	1"=750
Prepared By	KQ
Checked By	GT
Approved By	RJR
Project No.	04-81-156-02
Figure No.	4

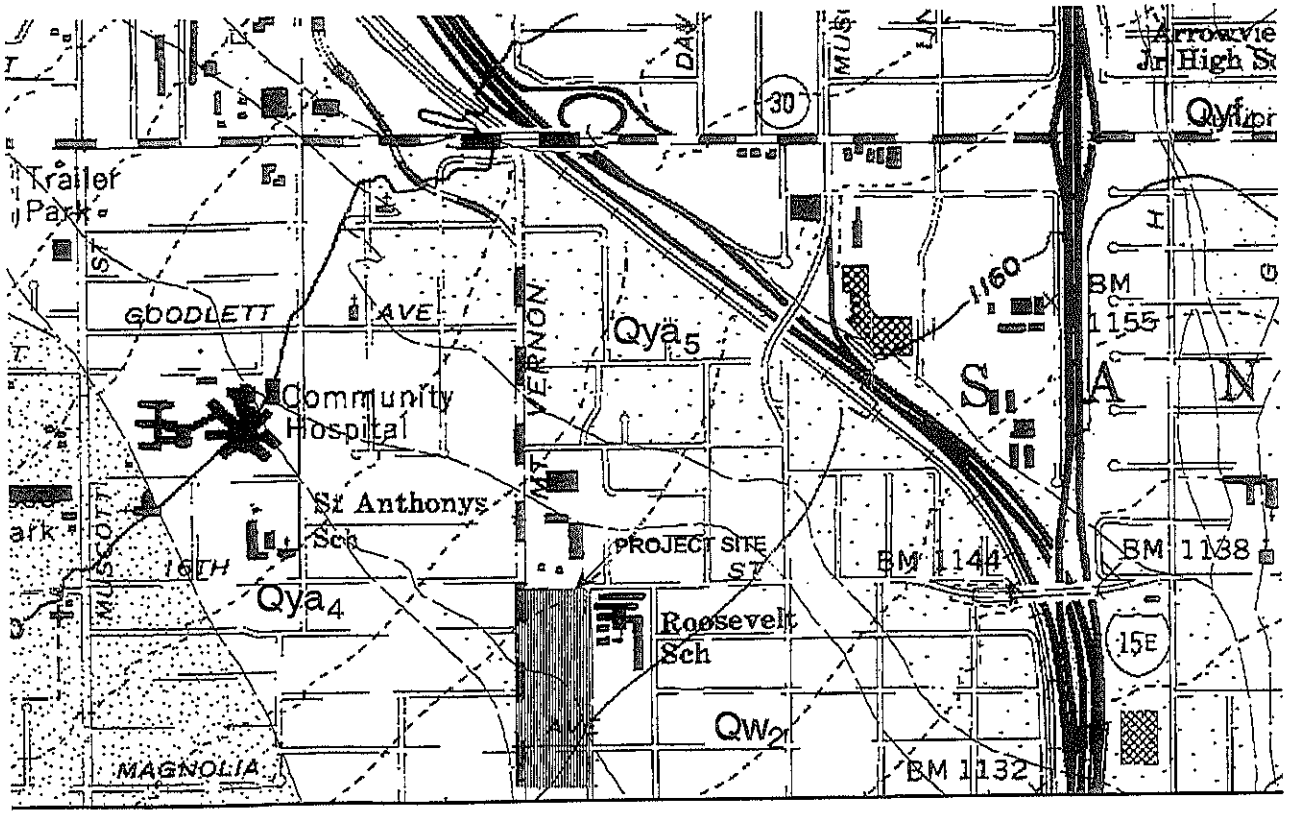
DESCRIPTION OF MAP UNITS

VERY YOUNG SURFICIAL DEPOSITS—Sediment recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes. Soil-profile development is non-existent to minimal. Includes:

- **Qw** — Very young wash deposits (late Holocene)—Unconsolidated to locally cemented sand, gravel, and boulder deposits in active washes of streams and on active surfaces of alluvial fans. Typically shows fresh flood scours and channel-and-bar morphology. Locally includes small areas of older surficial deposits. Most deposits are centimeters to a few meters thick. Includes:
  - **Qw_2** — Very young wash deposits, Unit 2 (late Holocene)—Chiefly sand and gravel. Distinguished as lower level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant
  - **Qw_1** — Very young wash deposits, Unit 1 (late Holocene)—Chiefly sand and gravel. Distinguished as upper level terraces in Qw terrace sequence; pebble to boulder clasts are sparse to abundant
- **Qf** — Very young alluvial-fan deposits (late Holocene)—Unconsolidated to locally cemented, undissected deposits of gravel and sand that for active parts of alluvial fans. Essentially no pedogenic soil development
  - **Qf_1** — Very young alluvial-fan deposits, Unit 1 (late Holocene)—Undissected, unconsolidated to loosely compacted deposits of gravel and sand. Distinguished as high-level terrace in Qf terrace sequence
- **Qc** — Very young colluvial deposits (late Holocene)—Unconsolidated to slightly consolidated sandy and pebbly deposits of hillslopes and base of slopes. No pedogenic soil development
- **Qt** — Very young talus deposits (late Holocene)—Unconsolidated deposits of angular and sub-angular pebble-, cobble-, and boulder-sized clasts that form scree and rubble on hillslopes and at bases of slopes
- **Qls** — Very young landslide deposits (late Holocene)—Slope-failure deposits that consist of displaced bedrock blocks and (or) chaotically mixed rubble. Most deposits are probably active or recently active
- **Qu** — Very young surficial deposits, undifferentiated (late Holocene)—Sand and pebble to small cobble gravel deposits not assigned to any specific surficial materials unit. Unconsolidated to slightly consolidated. Includes wash, alluvial fan, colluvial, and valley-filling deposits

YOUNGER SURFICIAL DEPOSITS—Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits (Qyf series) typically have high Coarse/fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed pedogenic-soil profiles (A/C to $A/AC/B_{cambric}C_{ox}$ profiles). Includes:

- **Qyf** — Young alluvial-fan deposits (Holocene and late Pleistocene)—Slightly consolidated to cemented, undissected to slightly dissected deposits of unsorted boulders, cobbles, gravel, and sand that form inactive parts of alluvial fans. Many have unsorted clast and matrix supported debris-flow fabrics. Subunits of Qyf generally form a nested series of thin fills that include from younger to older:
  - **Qyf_5** — Young alluvial-fan deposits, Unit 5 (late Holocene)—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Occupies topographically highest position relative to other Qyf units
  - **Qyf_4** — Young alluvial-fan deposits, Unit 4 (late Holocene)—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated; sand is fine to coarse grained. Differs from Qyf_5 and from Qyf_3 by relative position in terrace sequence, consolidation, and surface dissection
  - **Qyf_3** — Young alluvial-fan deposits, Unit 3 (late and middle Holocene)—Sand and pebble-boulder gravel. Unconsolidated to slightly consolidated, sand is fine to coarse grained. Differs from Qyf_4 and from Qyf_2 by relative position in terrace sequence, consolidation, and surface dissection
  - **Qyf_2** — Young alluvial-fan deposits, Unit 2 (early Holocene)—Sand, silty sand, and granule-pebble gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_3 by relative position in terrace sequence, consolidation, surface dissection, and average grainsize and from Qyf_1 by relative topographic position and slight difference in average grain size
  - **Qyf_1** — Young alluvial-fan deposits, Unit 1 (early Holocene and late Pleistocene)—Sand and pebble-boulder gravel. Slightly to moderately consolidated; sand is fine to coarse grained. Differs from Qyf_2 by relative position in terrace sequence, consolidation, surface dissection, and slight difference in average grainsize
- Young alluvial-valley deposits (Holocene and late Pleistocene)—Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Generally finer grained than Qyf units Includes:
  - **Qya_5** — Young alluvial-valley deposits, Unit 5 (Holocene and late Pleistocene)—Slightly dissected, slightly consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_4 by relative position in terrace sequence, consolidation, and surface dissection
  - **Qya_4** — Young alluvial-valley deposits, Unit 4 (Holocene and late Pleistocene)—Slightly to moderately dissected, consolidated to cemented deposits of angular to subangular silt, sand and pebbles. Differs from Qya_5 and Qya_3 by relative position in terrace sequence, consolidation, and surface dissection

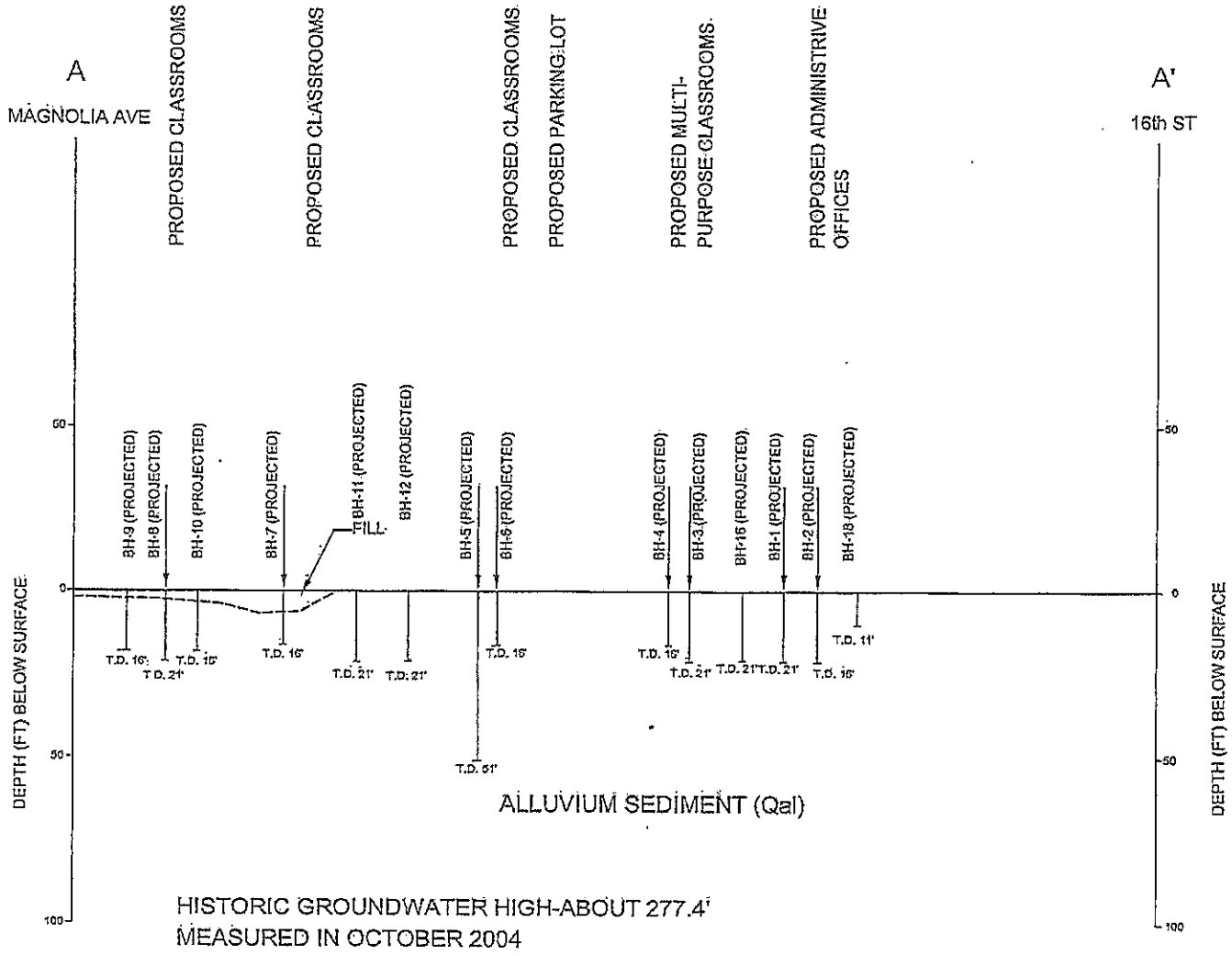


GEOLOGIC MAP OF SITE VICINITY

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Converse Consultants

Scale	1"=750
Prepared By	KQ
Checked By	GT
Approved By	RJR
Project No.	04-81-156-02
Figure No.	5



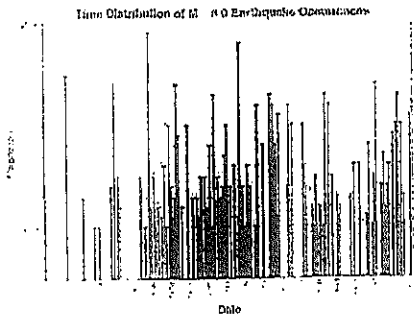
GEOLOGIC CROSS SECTION

Converse Consultants

ROOSEVELT ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Figure No. 6



Main Sources of Information

Bolt, B.A. and Miller, R.D. (1975). Catalogue of earthquakes in northern California and adjoining areas, 1 January 1910 - 31 December 1972. Seismographic Stations, University of California, Berkeley, California, 567 p.

Caltech/USGS earthquake catalog, http://www.scec.org/catalog-search.html. Southern California earthquake catalog and phase data, Southern California Seismic Network, U.S. Geological Survey, Pasadena; Caltech Seismological Laboratory, California Institute of Technology, Pasadena.

Toppozada, T.R. and Branum, D.M. (in press). California M > 5.5 earthquakes, history and areas damaged. In Lee, W.H., Kanamori, H. and Jennings, P. International Handbook of Earthquake and Engineering Seismology, International Association of Seismology and Physics of the Earth's Interior.

Toppozada, T.R. and Parke, D.L. (1982). Areas damaged by California earthquakes, 1900-1949. California Division of Mines and Geology Open-File Report 82-17, 65 p.

Toppozada, T.R., Parke, D.L. and Higgins, C.H. (1978). Seismicity of California 1900-1931. California Division of Mines and Geology Open-File Report 125.

Toppozada, T.R., Real, C.R. and Parke, D.L. (1981). Preparation of isoseismal maps and summaries of reported effects for pre-1900 California earthquakes. California Division of Mines and Geology Open-File Report 81-11 SAC, 182 p.

UC Berkeley/USGS earthquake catalog, http://quake.geo.berkeley.edu/ncsn/catalog-search.html. Northern California earthquake catalog and phase data, Northern California Seismic Network, U.S. Geological Survey; Menlo Park; Berkeley Seismological Laboratory, University of California, Berkeley, California.

EPICENTERS MAP OF SOUTHERN CALIFORNIA EARTHQUAKES (1800-1999)

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Converse Consultants

Scale	1"=750
Prepared By	KQ
Checked By	GT
Approved By	RJR
Project No.	04-81-156-02
Figure No.	7

Artificial fill consisting of sandy silt, sand and clayey sand was encountered in all borings ranging from two (2) to nine (9) feet in depth. The fill had 75 to 85 percent of relative compaction and therefore is considered unsuitable for support of any structure or additional fill.

The alluvial soils consisted of various mixtures of sand, and silt to the maximum depth explored of 51.5 feet bgs.

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration*.

6.5 Groundwater

Groundwater was not encountered in any of the borings drilled to a maximum depth of 51.5 feet bgs. In November 2005, depth to groundwater in the vicinity was about 177 feet bgs. Depth to groundwater in the vicinity was measured at about 125 feet bgs in March 1993. In 1972, generalized depth to groundwater was about 165 feet bgs. The historical groundwater at site vicinity was determined at about 100 feet bgs in the fall of 1903.

It should be noted that the groundwater level could vary depending upon the seasonal precipitation and possible groundwater pumping activity in the site vicinity.

6.6 Subsurface Variations

Based on results of the subsurface exploration and our experience, some variations in the continuity and nature of subsurface conditions within the project site should be anticipated. Because of the uncertainties involved in the nature and depositional characteristics of the earth material at the site, care should be exercised in interpolating or extrapolating subsurface conditions between or beyond the boring locations. If, during construction, subsurface conditions different from those presented in this report are encountered, this office should be notified immediately so that recommendations can be modified, if necessary.

6.7 Flooding

Review of National Flood Insurance Rate Maps (FIRM, March 18, 1996) indicates that the project site is within Flood Hazard Zone "X". The Zone "X" is designated as "Areas determined to be outside the 500-year floodplain".

6.8 *Laboratory Testing*

- *In-situ* Moisture and Dry Density – The *In-situ* dry density and moisture content of fill materials from five (5) to nine (9) feet bgs ranged from 86 to 107 pounds per cubic feet (pcf) and 2 to 19 percent, respectively. Alluvial soils from five (5) to ten (10) feet bgs ranged from 85 to 105 pcf and 1 to 29 percent. Results of *in-situ* moisture and dry density tests are presented on the Logs of Borings in Appendix A, *Field Exploration.*

- Collapse Potential – The collapse potential of six (6) relatively undisturbed samples were tested under a vertical stress of 2.0 kips per square foot (ksf) in accordance with the ASTM Standard D5333 test method. The test results indicated -0.14 to -2.45 percent collapse, which corresponds to "Slight" to "moderate" collapse potential based on the ASTM Standard D5333. One sample swelled to +0.03. This indicates that the soil tested has slight swelling potential when submerged in water. Test results are included in Appendix B, *Laboratory Testing Program.*

- Expansion Index – Four (4) representative samples from the upper five (5) feet of the site soils were tested to evaluate Expansion Index (EI) in accordance with the California Building Code (CBC, 2001) Standard. Test results are included in Appendix B, *Laboratory Testing Program.* The values of the measured EIs were 4 and 6. These values of EIs indicate that the site soils have "Very Low" expansion potential.

- Soil Corrosivity – Three (3) representative samples of the site soils was tested to determine soil corrosivity with respect to common construction materials such as concrete and steel. The test results are presented in Appendix B, *Laboratory Testing Program.* Test results are discussed in Section 9.8, *Soil Corrosivity Evaluation.*

- Sand Equivalent – One (1) sample of the site soils was tested to determine the Sand equivalent (SE) to evaluate potential use as utility pipe bedding. The test result is presented in Appendix B, *Laboratory Testing Program.* The SE value was 20, which indicates that the soil tested is not appropriate for pipe bedding.

- R-value Tests – Two (2) R-value tests were performed on representative bulk soil samples. The test result is presented in Appendix B, *Laboratory Testing Program.* Based on the test results, the R-value of near surface site soils is 17. This value indicates that the subgrade soil have low resistance to traffic loading.

- Percent Passing Sieve #200 – Results are presented in Appendix B, *Laboratory Testing Program*. The results indicate the soils within the upper nine (9) feet are primarily silty sand (SM), clayey sand and sandy silt (ML).

- Gradation Analysis – Three (3) representative samples were tested to determine the relative grain sizes. Results are presented in Appendix B, *Laboratory Testing Program*. The results indicate the soil tested were silty sand (SM) and sandy silt (ML).

- Maximum Dry Density and Optimum Moisture Content – Typical moisture-density relationship of the representative near surface soils are presented in Appendix B, *Laboratory Testing Program*. The laboratory maximum dry density and optimum moisture content of samples tested were between 129 and 130 pounds per cubic foot (pcf) and 9.5 to 11.5 percent, respectively.

- Direct Shear – Three (3) direct shear tests on relatively undisturbed soil samples and two (2) tests on soil sample remolded to 90 percent of the laboratory maximum dry density were performed on representative sample. Results of the direct shear tests are presented in Appendix B, *Laboratory Testing Program*. The test results indicate the soil tested has moderate shear strength.

- Consolidation Test – Data obtained from this test performed on one (1) relatively undisturbed soil sample was used to evaluate the settlement characteristics of the foundation soils under load. Test result is included in Appendix B, *Laboratory Testing Program*.

For additional information on the subsurface conditions, see the Logs of Borings in Appendix A, *Field Exploration*.

7.0 FAULTING AND SEISMICITY

7.1 Faulting

There are no known active faults projecting toward or extending across the project site. The site is not situated within a currently designated State of California Earthquake Fault-Rupture Hazard Zone. Table No. 1, *Seismic Characteristics of Nearby Active Faults*, presents nearest distances of the site from various nearby active faults.

7.2 Seismicity

The proposed site is situated in a seismically active region. As is the case for most areas of Southern California, ground-shaking resulting from earthquakes associated with nearby and more distant faults may occur at the project site. During the life of the

project, seismic activity associated with active faults can be expected to generate moderate to strong ground shaking at the site.

According to the California Building Code (2001), the proposed site is located in Seismic Zone 4. Seismic Zone 4 includes those areas of California that have experienced major (Richter magnitude greater than seven) historic earthquakes and high levels of recent seismicity. Major damage corresponding to intensities VIII or higher on the Modified Mercalli Intensity Scale should be expected within this zone.

An analysis of the seismic history of the site using the computer program EQSEARCH, (Blake, 2000), and attenuation relationships proposed by Boore et al. (1997) for alluvium soil conditions indicates that since the year 1800 there have been 133 earthquakes with a moment magnitude of 5.0 or greater occurring within a distance of 100 kilometers of the site. The analysis also indicates that the largest earthquake induced ground acceleration at the site during this time period was 0.422g as a result of a M7.6 magnitude earthquake that occurred in 1905 with a reported epicenter about 1.4 miles away from the site. The largest earthquakes occurring within the above listed time period and distance were two earthquakes occurring between 1812 and 1858 with a magnitude of about M7.0.

Table No. 1, Seismic Characteristics of Nearby Active Faults

Fault Name and Section	Approximate Distance to Site (kilometers)	Source Type (A, B, C)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
SAN JACINTO-SAN BERNARDINO	4.2	A	6.7	12.00
SAN ANDREAS – Southern (Mojave)	8.0	A	7.4	30.00
CUCAMONGA	12.8	B	6.9	5.00
SAN JACINTO-SAN JACINTO VALLEY	14.2	A	6.9	12.00
CLEGHORN	16.6	B	6.5	3.00
NORTH FRONTAL FAULT ZONE (West)	17.6	B	7.2	1.00
SAN ANDREAS - 1857 Rupture	28.5	A	7.8	34.00
SAN JOSE	34.7	B	6.4	0.50
SIERRA MADRE (Central)	37.0	B	7.2	2.00
CHINO-CENTRAL AVE. (Elsinore)	38.5	B	6.7	1.00
ELSINORE-WHITTIER	42.6	A	6.8	2.50
ELSINORE-GLEN IVY	42.6	A	6.8	5.00
NORTH FRONTAL FAULT ZONE (East)	48.3	B	6.7	0.50

Fault Name and Section	Approximate Distance to Site (kilometers)	Source Type (A, B, C)	Max. Moment Magnitude (Mmax)	Slip Rate (mm/yr)
HELENDALE - S. LOCKHARDT	48.5	B	7.3	0.60
CLAMSHELL-SAWPIT	50.6	B	6.5	0.50
ELSINORE-TEMECULA	54.0	A	6.8	5.00
PINTO MOUNTAIN	54.9	B	7.2	2.50
SAN JACINTO-ANZA	56.5	A	7.2	12.00
RAYMOND	63.8	B	6.5	1.50
LENWOOD-LOCKHART-OLD WOMAN SPRGS	66.9	B	7.5	0.60
VERDUGO	72.3	B	6.9	0.50
JOHNSON VALLEY (Northern)	73.2	B	6.7	0.60
NEWPORT-INGLEWOOD (L.A. Basin)	80.7	B	7.1	1.00
NEWPORT-INGLEWOOD (Offshore)	81.4	B	7.1	1.50
LANDERS	81.8	B	7.3	0.60
BURNT MTN.	83.6	B	6.5	0.60
SOUTH EMERSON. - COPPER MTN.	84.3	B	7.0	0.60
HOLLYWOOD	84.4	B	6.4	1.00
EUREKA PEAK	84.6	B	6.4	0.60
ELSINORE-JULIAN	88.0	A	7.1	5.00
GRAVEL HILLS - HARPER LAKE	90.4	B	7.1	0.60
SAN GABRIEL	91.5	B	7.2	1.00
SIERRA MADRE (San Fernando)	91.8	B	6.7	2.00
CALICO - HIDALGO	93.9	B	7.3	0.60
PALOS VERDES	96.4	B	7.3	3.00

7.3 Response Spectra Analysis

The site-specific response analysis was developed using the computer program FRISKSP, (Blake, 2000), and the 2002 CGS Statewide Fault Model. Attenuation relationships proposed by Boore et al. (1997) termed as the mean plus one standard deviation for alluvium soil conditions were used in the analysis.

Two design levels were selected to represent a reasonable range of earthquake energy levels. The first design level is Upper Bound Earthquake (UBE) that represents a ten percent chance of exceedance in 100 years (return period 950 years). The second

design level is the Design Based Earthquake (DBE), which has a ten percent chance of exceedance in 50 years (return period 475 years). The subject school is considered to be an Essential Service Building. Converse recommends, in accordance with CBC requirements, that the proposal structure(s) be designed for the DBE and checked for structural collapse for the UBE.

Output of FRISKSP program is presented on Figure No. 8, *Probability of Exceedance vs. Acceleration* and summarized below:

- Upper Bound Earthquake (UBE) – 1.15g
- Design Based Earthquake (DBE) – 0.97g

Site Specific Response Spectra for horizontal elastic response ground motions were generated using the FRISKSP program and are presented on Figure Nos. 9a and 9b, *Earthquake Design Spectra*, for the two design earthquakes. These curves correspond to response values obtained from Boore et al. (1997) attenuation relations for alluvium soil conditions for horizontal elastic single-degree-of-freedom systems with equivalent viscous damping of 5 percent of critical damping. A list of horizontal pseudo spectral acceleration for various damping ratios is presented in the following table.

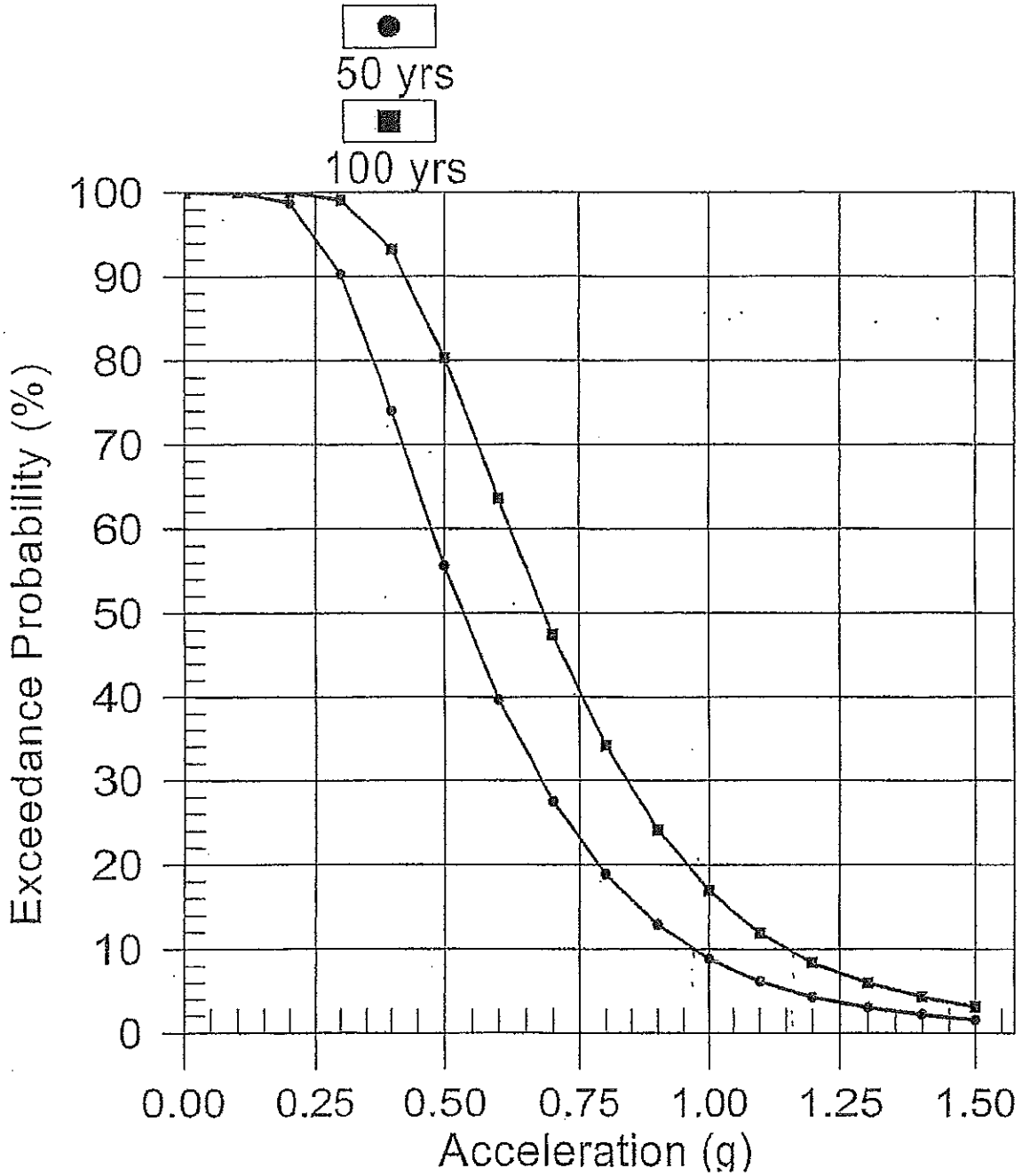
Table No. 2, Probabilistic Seismic Response Pseudo Velocity and Acceleration for 5 Percent Damping

Period (Sec)	10% Probability of Exceedance in 50 Years (T=475 years)		10% Probability of Exceedance in 100 Years (T=950 years)	
	Pseudo Relative Velocity (ft/sec)	Pseudo Relative Acceleration (sq ft/sec)	Pseudo Relative Velocity (ft/sec)	Pseudo Relative Acceleration (sq ft/sec)
0.01	0.0499	0.9743	0.0581	1.1352
0.03	0.1494	0.9723	0.1743	1.1346
0.10	0.8486	1.6572	0.9883	1.9300
0.15	1.5312	1.9934	1.7684	2.3023
0.20	2.2471	2.1941	2.6035	2.5422
0.30	3.6264	2.3606	4.2505	2.7669
0.40	4.7519	2.32	5.6459	2.7564
0.50	5.6038	2.1887	6.7467	2.6351
0.75	6.6742	1.7378	7.8012	2.4123
1.00	7.0940	1.3854	8.2113	2.2046
1.50	7.4563	0.9707	8.3087	2.0013
2.00	7.5250	0.7348	8.5010	1.0981

Vertical acceleration at the site may be estimated by multiplying the horizontal acceleration by an adjustment factor. The adjustment factor should be 1.6 for periods less than 0.1 seconds. Between periods of 0.1 and 0.3 seconds, the adjustment factor should linearly decrease to a value of 0.5. For periods greater than 0.3, a value of 0.5

PROBABILITY OF EXCEEDANCE

BOORE ET AL. (1997) SOIL (310)1



PROBABILITY OF EXCEEDANCE VS. ACCELERATION

ROOSEVELT II ELEMENTARY SCHOOL

San Bernardino, California

For: San Bernardino City Unified School District

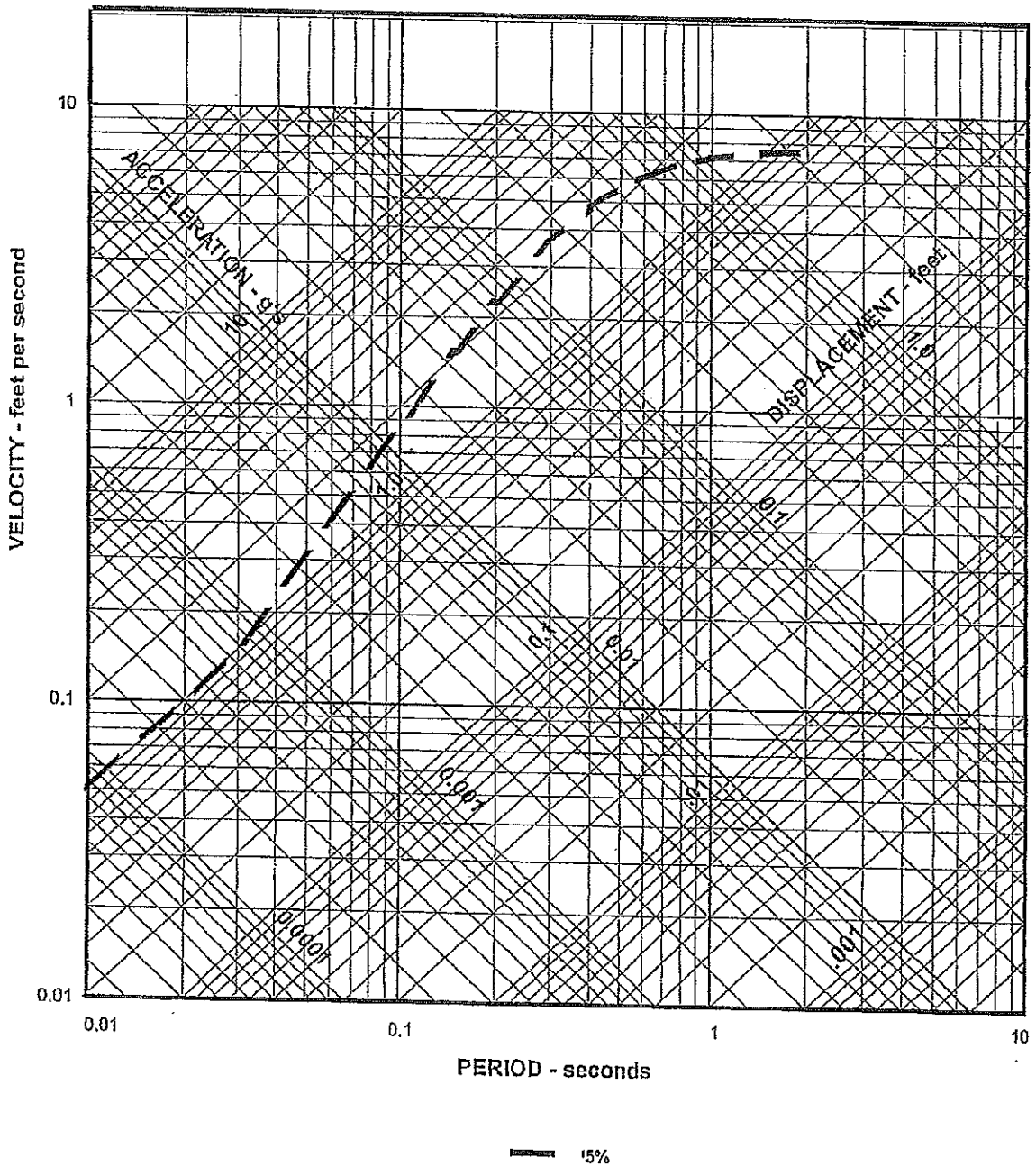
Project No.

04-81-156-02

Figure No.

Converse Consultants

RESPONSE SPECTRA
10% Probability of Exceedance in 50 Years



EARTHQUAKE DESIGN SPECTRA

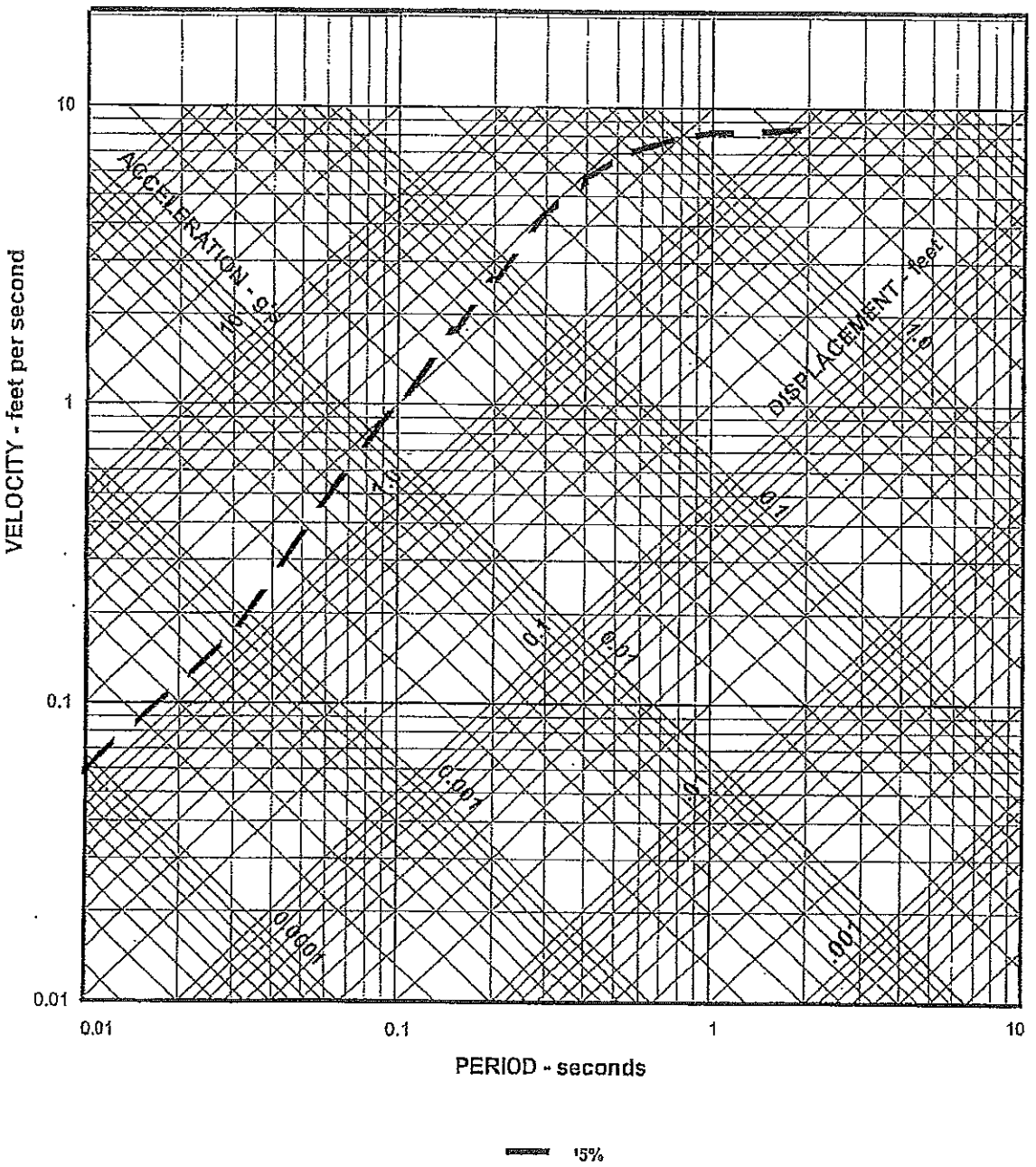
Roosevelt II Elementary School
San Bernardino, California
For: San Bernardino City Unified School District

Project No.
04-81-156-02

Converse Consultants

Figure No.
9a

RESPONSE SPECTRA
10% Probability of Exceedance in 100 Years



EARTHQUAKE DESIGN SPECTRA

Roosevelt II Elementary School
San Bernardino, California
For: San Bernardino City Unified School District

Project No.
04-81-156-02

Converse Consultants

Figure No.
9b

may be used. These adjustment factors were developed by Bozorgnia et. al. (1999). When combining horizontal and vertical acceleration in the structural analysis, it should be noted that the vertical motion will have, in general, a 40 to 60 percent higher frequency than the horizontal motions, the maximum vertical and horizontal accelerations seldom occur simultaneously.

7.4 Seismic Coefficients

Based on the results of our borings and laboratory testing, and in accordance with the CBC, the site should be considered as having a S_D soil profile (CBC Table 16A-J). The following seismic coefficients calculated from the UBCSEIS Computer Program by Blake in accordance with CBC Tables 16A-Q through 16A-T, are considered appropriate for analysis:

$N_a = 1.1$ $C_a = 0.48$
$N_v = 1.4$ $C_v = 0.87$

7.5 Other Effects of Seismic Activities

Secondary effects of seismic activity include surface fault rupture, soil liquefaction, seismic settlement, lateral spreading, landslides, earthquake-induced flooding, tsunamis, seiches, and volcanic eruption hazard. Site-specific potential for each of these seismic hazards is discussed in the following sections.

Surface Fault Rupture: The site is not located within a currently designated State of California Earthquake Fault Zone. Based on a review of existing geologic information, no known active fault zone crosses or projects toward the site. The potential for surface rupture resulting from the movement of the nearby major faults is not known with certainty but is considered very low.

Liquefaction: Liquefaction is defined as the phenomenon in a soil mass, because of the development of excess pore pressures, soil mass suffers a substantial reduction in its shear strength. During earthquakes, excess pore pressures in saturated soil deposits may develop as a result of induced cyclic shear stresses, resulting in liquefaction. Soil liquefaction occurs in submerged granular soils during or after strong ground shaking. There are several requirements for liquefaction to occur. They are as follows:

- Soils must be submerged
- Soils must be primarily granular
- Soils must be contractive, that is, loose to medium-dense
- Ground motion must be intense
- Duration of shaking must be sufficient for the soils to lose shear resistance

The depth to groundwater at the project site is more that 51.5 feet from the existing ground surface with a historic depth to groundwater in 1909 of about 100 feet. Due to absence of shallow groundwater, the project site is not considered to be susceptible to liquefaction.

Lateral Spreading: Seismically induced lateral spreading involves primarily lateral movement of earth materials due to ground shaking. It differs from the slope failure in that complete ground failure involving large movement does not occur due to the relatively smaller gradient of the initial ground surface. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography at the project site and in the immediate vicinity of the site is relatively flat. Under these circumstances, the potential for lateral spreading at the subject site is considered very low.

Landslides: Seismically induced landslides and other slope failures are common occurrences during or soon after earthquakes. The project site is relatively flat. In the absence of significant ground slopes, the potential for seismically induced landslides to affect the proposed site is considered to be nil.

Earthquake-Induced Flooding: This is flooding caused by failure of dams or other water-retaining structures as a result of earthquakes. The potential of earthquake-induced flooding of the subject site is considered to be very low.

Tsunamis: Tsunamis are tidal waves generated by fault displacement or major ground movement. Based on the location of the site, tsunamis do not pose a hazard.

Seiches: Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Based on the site location, seiches do not pose a hazard.

Volcanic Eruption Hazard: There are no known volcanoes near the site. According to Jennings (1975) the nearest listed volcano of Quatemary or Pliocene age is about 45 miles southeast of the project site, about 8 miles east of Temecula, California. The next nearest volcanoes are shown to be in the Little Lake area about 140 miles north of the project site. With the great distances involved and prevailing wind patterns it is unlikely the project site area will be subjected to ash fall-out from any of the above-mentioned volcanoes.

8.0 EARTHWORK AND SITE GRADING RECOMMENDATIONS

8.1 General Evaluation

Based on our field exploration, laboratory testing, and analyses of subsurface conditions at the site, remedial grading is required to prepare the site for support of the proposed

structures and pavements. To reduce differential settlement, variations in the soil type, degree of compaction, and thickness of the compacted fill placed underneath the footings should be kept to a minimum.

Site grading recommendations provided below are based on our experience with similar projects in the area and our evaluation of this investigation.

Site preparation will require removal of existing structures with their foundations, asphalt concrete, cement concrete paving and other existing underground manmade structures and utilities.

The site soils can be excavated utilizing conventional heavy-duty earth-moving equipment. The excavated site soils, free of vegetation, shrub and debris, may be placed as compacted fill in structural areas after proper processing. Rocks larger than three (3) inches in the largest dimension should not be placed as fill. Rocks larger than one (1) inch should not be placed within the upper 12 inches of subgrade soils.

Soils containing organic materials should not be used as structural fill. The extent of removal should be determined by the geotechnical representative based on soil observation during grading.

8.2 Over-excavation/Removal within Building Pads

In general, the existing fill materials should be removed; however, during grading operations, if the in-place density is 85 percent or greater, the existing fill can be left in-place. The alluvial soils that have been beneath existing fill may require excavation; depending upon observations and density testing during grading operations. Alluvial soils where there has been no fill, will require removals up to a depth of five (5) feet bgs. Actual depth of removal will depend upon observations and density testing during grading operations. The actual depth of over-excavation should be determined to provide required minimum amount of fill under building footings and slab-on-grade as follows:

- Continuous or isolated footings should be placed on compacted fill, the thickness of which should be equal to footing width or two (2) feet, whichever is greater.

- Over-excavation should provide as a minimum of two (2) feet of structural fill below the bottom of slab-on-grade.

The actual depth of removal should be based on recommendations and observation made during grading. Therefore, some variations in the depth and lateral extent of over-excavation recommended in this report should be anticipated.

Over-excavations should extend at least five (5) feet outside building footprints or a distance equal to the actual depth of removal, whichever is greater.

8.3 Over-excavation/Removal for Pavement Areas

In areas receiving asphalt concrete or Portland concrete paving, including driveways, street areas, sidewalks, curbs and gutters and other flatwork, the upper two (2) feet of native surficial soils or existing fill should be excavated. Such over-excavation should extend at least two (2) feet beyond the pavement edges. Where depth of cut exceeds two (2) feet, no additional over-excavation will be required. The pavement sections may be placed on at least one (1) foot of fill; moisture conditioned if necessary, and recompacted to at least 95 percent of laboratory maximum dry density.

8.4 Structural Fill

The approved bottom of the excavations should be scarified to a depth of at least twelve (12) inches. The scarified soils should be moisture conditioned to near-optimum moisture content and compacted to at least 90 percent of the laboratory maximum dry density to produce a firm and unyielding surface.

All structural fill should be placed on competent, scarified and compacted native materials as determined by a Converse representative and in accordance with the specifications presented in this section and in Appendix C, *Recommended Earthwork Specifications*.

Excavated site soils, free of deleterious materials and rock particles larger than three (3) inches in the largest dimension, should be suitable for placement as compacted fill. Any import fill should be tested and approved by Converse. The import fill should be non-expansive with an expansion potential less than 20.

Prior to compaction, fill materials should be thoroughly mixed and moisture conditioned when necessary, to within ± three (3) percent of optimum moisture content for granular soils and two (2) percent above optimum for fine-grained soils. All fill, if not specified otherwise elsewhere in this report, should be compacted to at least 90 percent of the laboratory dry density in accordance with the ASTM Standard D1557 test method.

At the time of our recent field investigation, *in-situ* dry density and moisture content of fill materials from five (5) to nine (9) feet bgs ranged from 86 to 107 pounds per cubic feet (pcf) and 2 to 19 percent, respectively. Alluvial soils from five (5) to ten (10) feet bgs ranged from 85 to 105 pcf and 1 to 29 percent. Therefore some moisture conditioning may be necessary prior to the material being placed as compacted fill. The amount of processing required for proper moisture conditioning at the site will depend on the seasonal variations in the *in-situ* moisture conditions, the depth of cut, the equipment, and the processing method.

8.5 Excavatability

Based on our field exploration, the earth materials at the site should be excavatable with conventional heavy-duty earth moving and trenching equipment.

8.6 Shrinkage and Subsidence

The shrinkage and/or bulkage would depend on, among other factors, the depth of cut and/or fill, and the grading method and equipment utilized. For preliminary estimation, bulking and shrinkage factors for various units of earth material at the site may be taken as presented below:

- The approximate shrinkage factor for the upper six and one-half (6.5) feet of fill and an alluvial soil is estimated to range from ten (10) to twenty-seven (27) percent with and average of twenty (20) percent.
- Subsidence would depend on the construction methods including type of equipment utilized. For estimation purposes, ground subsidence may be taken as 0.20 feet.

Although these values are only approximate, they represent our best estimates of the factors to be used to calculate lost volume that may occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field-testing using the actual equipment and grading techniques be conducted.

8.7 Subgrade Preparation

Final subgrade soils should be uniform and non-yielding. To obtain a uniform subgrade, soils should be well mixed and uniformly compacted. The subgrade soils should be non-expansive and well drained. The majority of the near-surface site soils is fine-grained and is not considered to be free draining. We recommend that at least the upper six (6) inches of subgrade soils underneath the slab-on-grade should be comprised of well-drained granular soils such as sands, gravel or crushed aggregate satisfying the following criteria:

- Maximum size $\leq$ 1.5 inches
- Percent passing U.S. #200 sieve $\leq$ 12 percent
- Sand equivalent $\geq$ 30

The subgrade soils should be moisture conditioned before placing concrete.

9.0 DESIGN RECOMMENDATIONS

The various design recommendations provided in this section are based on the assumptions that in preparing the site, the earthwork and site grading recommendations provided in this report will be followed.

The proposed buildings may be supported on continuous (strip) and/or isolated spread footings.

9.1 Shallow Spread Footing Design Parameters

Continuous and isolated spread footings should be at least 12 inches and 18 inches wide, respectively. The depth of embedment below lowest adjacent soil grade of interior and exterior footings should be at least 12 and 18 inches, respectfully. Footings should be founded on at least 24 inches of compacted fill, or equal to the maximum footing dimension, whichever is greater.

For shallow spread footings founded on compacted structural backfill as indicated in Section 8.4, *Structural Fill*, an allowable net bearing capacity of 2,500 pounds per square foot (psf) may be used.

The allowable net bearing capacity is defined as the maximum allowable net bearing pressure on the ground. It is obtained by dividing the net ultimate bearing capacity by a safety factor. The ultimate bearing capacity is the bearing stress at which ground fails by shear or experiences a limiting amount of settlement at the foundation. The net ultimate bearing capacity is obtained by subtracting the total overburden pressure on a horizontal plane at the foundation level from the ultimate bearing capacity.

The net allowable bearing values indicated above are for the dead loads and frequently applied live loads and are obtained by applying a factor of safety of 3.0 to the net ultimate bearing capacity. If normal code requirements are applied for design, the above vertical bearing value may be increased by 33 percent for short duration loadings, which will include loadings induced by wind or seismic forces.

9.2 Lateral Earth Pressures and Resistance to Lateral Loads

The lateral earth pressures and resistance to lateral loads are estimated by using on-site native soils or imported material with a minimum total unit weight of 130 pounds per cubic foot (pcf), and an internal friction angle of 26 degrees, compacted to an average 92 percent of the laboratory maximum dry density.

9.3 Active Earth Pressure

If retaining walls are planned, the following recommendations should be followed in its design and construction. The earth pressure behind any buried wall depends primarily on the allowable wall movement, type of backfill materials, backfill slopes, wall inclination, surcharges, and any hydrostatic pressure. The following fluid pressures are recommended for vertical walls with no hydrostatic pressure, no surcharge, and level backfill:

Equivalent Fluid Pressure	
Free to deflect (Cantilever)	35
Restrained (At-rest)	55
Seismic	12H (reverse triangle where H is the height of the wall)

9.4 Passive Earth Pressure

Lateral loads can be resisted by an allowable passive earth pressure of 240 pounds per foot of depth for natural soil or compacted fill applied against below-grade wall elements. The allowable passive earth pressure indicated above is obtained by applying a factor of safety of 1.5. Due to the low overburden stress of the soil at shallow depth, the upper one foot of passive resistance should be neglected unless the soil is confined by pavement or slab. The maximum passive pressure should not exceed 2,500 psf. In addition, a friction coefficient of 0.3 between the concrete and compacted fill can be used in combination with passive earth pressures to resist lateral loads. The coefficient of friction should be applied to net normal dead loads only.

9.5 Settlement

The static settlement of structures supported on strip and/or spread footings founded on compacted fill will depend on the actual footing dimensions and the imposed vertical loads. Based on the maximum allowable net bearing pressures of 2,500 psf, as presented above, settlement less than 1-inch should be anticipated. In order to evaluate differential settlement, data on the relative dimension of adjacent footings, magnitude of imposed loads and distance between footings is needed. In the absence of such data, and based on our experience on similar projects for similarly loaded footings, the differential settlement may be taken as equal to about one half of the total settlement over a horizontal distance of 50 feet.

The dynamic settlement was estimated to be 0.50-inch, and the dynamic differential settlement may be taken as equal to about one half of the total dynamic settlement over a horizontal distance of 50 feet.

9.6 Modulus of Subgrade Reaction

For the subject project, design of the structures supported on subgrade prepared in accordance with the recommendations provided in this report may be based on a soil modulus of subgrade reaction of (k_s) of 200 pounds per square inch per inch.

9.7 Slabs-on-grade

The design of the slabs-on-grade will depend on, among other factors, the expansive potential of the pad soils. Based on the expansion index test performed during this investigation, the expansive potential of the pad soils is "Very Low". The expansion potential of the building pads should be verified at the completion of the grading. Building specific recommendations regarding type of slabs-on-grade should be based on the expansion index testing of the pad subgrade soils at the completion of grading and structural requirements.

The CBC (2001) recommends special design considerations for slabs where subgrade soils exhibit expansion index greater than 20, per CBC Section 1803A.2.

Structural design elements such as thickness, reinforcement, joint spacing, etc., for the slabs-on-grade should be selected based on the analysis performed by the project structural engineer considering anticipated loading conditions and the modulus of subgrade reaction of the supporting soils, as presented above.

In areas where a moisture-sensitive floor covering (such as vinyl tile or carpet) is used, slabs should be protected by at least a ten-mil-thick polyethylene vapor barrier between the slab and compacted subgrade. Where a vapor barrier is used, it should be protected with two (2) inches of sand placed above the barrier, to reduce the potential for punctures and to aid concrete curing. Polyethylene sheets should be overlapped a minimum of six (6) inches, and should be taped or otherwise sealed

The two (2) inches of sand placed above the vapor barrier may be omitted in accordance with American Concrete Institute (ACI) recommendation (ACI Publication 302.1R-04), if approved by the owner and the vapor barrier is increased to a thickness of at least 15 mil. However, as pointed out in the current edition of ACI 302, control of the concrete placement, especially as far as slump and water is extremely critical. ACI 302 indicates that if strict control of the concrete placement is not done, problems with shrinkage, curling, settlement cracking, longer bleeding period and finishing may occur.

Minimum reinforcement of 6" x 6"-#10/#10 wire mesh, or equivalent, properly centered in the middle of the slabs, is recommended. As indicated above, the structural design may require greater thickness and/or reinforcement.

Subgrade soils must be firm and non-yielding prior to placement of concrete.

In hot weather, the contractor should take appropriate curing precautions after placement of concrete to minimize cracking of the slabs. The potential for slab cracking may be lessened by the addition of fiber mesh to the concrete and/or control of the water/cement ratio.

Joints for concrete slabs-on-grade must be carefully designed. Joint spacing is dependent upon slab thickness and concrete properties and should be selected by the structural engineer.

Concrete should be cured by protecting it against loss of moisture and rapid temperature change for at least seven (7) days after placement. Moist curing, waterproof paper, white polyethylene sheeting, white liquid membrane compound, or a combination thereof may be used after finishing operations have been completed. The edges of concrete slabs exposed after removal of forms should be immediately protected to provide continuous curing.

The above recommendations are based on the results of tests performed on representative site soils. If soils other than those presently encountered within the project site are placed as structural fill within the building pad, the modulus of subgrade reaction should be reevaluated. The final slab design should be based on the actual modulus of subgrade reaction.

9.8 Soil Corrosivity Evaluation

Anaheim Test Laboratory, Santa Ana, California, tested one (1) bulk soil sample and Schiff Associates, Claremont, California tested two (2) collected from shallow depth during our investigation. The tests included minimum resistivity, pH, soluble sulfates, and chloride content.

The sulfate content of the samples tested was between 70 and 208 ppm, which indicated that site soils are "Negligibly" deleterious to concrete. Type II Portland Cement is recommended for the construction of the foundations or slabs.

The chloride content of the samples was between 6.5 and 54 ppm. The pH value of the site soils were between 8.0 and 8.3. The measured values of the minimum electrical resistivity when saturated was between 1,640 and 2,844 Ω-cm. These values indicate a "Corrosive" potential to ferrous metals in contact with these soils. A corrosion engineer should be consulted for the detailed mitigation procedures. Conventional corrosion mitigation measures may include the following:

- All steel and wire concrete reinforcement should have at least three (3) inches of concrete cover where cast against soil, unformed.

- As a minimum, below-grade ferrous metals should be given a high-quality protective coating, such as 18-mil plastic tape, extruded polyethylene, coal-tar enamel or Portland cement mortar.

- Below-grade metals should be electrically insulated (isolated) from above-grade metals by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade.

9.9 Pavement Design

Two (2) representative samples of the site soils were tested to evaluate the Resistance (R) value in accordance with the State of California Standard Test Method 301-G. The test is designed to provide a relative measure of soil strength for use in pavement design. Values were 17 and 49.

Asphalt concrete pavement structural section was calculated corresponding to Traffic Indices (TIs) ranging from 5 to 10 and an R-value of 17. The design was based on Caltrans' procedure for flexible pavement structural without the recommended safety factor of 0.20 feet, when evaluating the required Gravel Equivalent (GE) of the Asphalt Concrete (AC).

The site soils will be substantially mixed during site grading and the R-values of the final subgrade soils are likely to be different. At the completion of grading, the R-value of the subgrade soils should be determined and the pavement structural sections should be reevaluated.

A summary of preliminary pavement section is presented in the following table.

Table No. 3, Preliminary Pavement Sections
R-value=17

Area and Recommended Traffic Index (T.I.)		Preliminary Pavement Section	
		A.C. (inch)	A.B. (inch)
Automobile access and parking	5.0	3.5	6.5
	6.0	4.0	9.0
Bus access, fire engine access lane and city streets	7.0	5.0	11.0
	8.0	6.0	12.5
	9.0	7.0	14.0
	10.0	7.5	16.5

Pavement subgrade should be prepared in accordance with Section 301 of the Standard Specifications for Public Works Construction (SSPWC, 2000). The upper 12 inches of subgrade should be compacted to a relative compaction of at least 95 percent of the laboratory maximum dry density as per ASTM Standard D1557 test method.

Base materials should conform to Section 200-2.2, "Crushed Aggregate Base," of the current Standard Specifications for Public Works Construction (SSPWC, 2000 edition) and should be placed in accordance with Section 301.2 of the SSPWC.

Asphaltic concrete materials should conform to Section 203 of the SSPWC and should be placed in accordance with Section 302.5 of the SSPWC.

9.10 Special Consideration for Excavation Adjacent to Existing Structures

Various utility lines and existing structure foundations may be within the excavation limits for the proposed structures. The depths and locations of the existing facilities may require special construction considerations during excavation to protect these facilities (if necessary) during excavation.

Excavations for the proposed improvements should not extend below a 1:1 (horizontal: vertical) plane extending beyond and down from the bottom of the existing utility lines or foundations. The proposed excavation should not cause loss of bearing and/or lateral support of the existing utilities or structures.

If the excavation for the proposed structures extend below a 1:1 horizontal:vertical (H:V) plane extending beyond and down from the bottom of the existing utility lines or existing foundation, a maximum of 20 feet in length along the footing or existing utility lines can be exposed at a time to prevent the existing utility lines or structure from becoming unstable. Backfill should be accomplished in the shortest period of time and in alternating sections.

9.11 Site Drainage

Adequate positive drainage should be provided away from the structures to prevent ponding and to reduce percolation of water into structural backfill. A desirable slope for surface drainage is two (2) percent in landscaped areas and one (1) percent in paved areas.

Planters and landscaped areas adjacent to the building perimeter should be designed to minimize water infiltration into the subgrade soils. Gutters and downspouts should be installed on the roof, and runoff should be directed to the storm drain through non-erosive devices.

10.0 CONSTRUCTION RECOMMENDATIONS

10.1 General

Site soils should be excavatable using conventional heavy-duty excavating equipment. Temporary sloped excavation is feasible if performed in accordance with the slope ratios provided in Section 10.2, *Temporary Excavations*. Existing utilities should be accurately located and either protected or removed as required.

10.2 Temporary Excavations

Based on the materials encountered in the exploratory borings, sloped temporary excavations may be constructed according to the slope ratios presented in Table No. 4, *Slope Ratios for Temporary Excavation*. Any loose utility trench backfill or other fill encountered in excavations will be less stable than the native soils. Temporary cuts encountering loose fill or loose dry sand may have to be constructed at a flatter gradient than presented in the following table.

Table No. 4, Slope Ratios for Temporary Excavation

Maximum Depth of Cut (feet)	Maximum Slope Ratio* (horizontal: vertical)
0 - 5	vertical
5 - 10	1:1

*Slope ratio assumed to be uniform from top to toe of slope.

Surfaces exposed in slope excavations should be kept moist but not saturated to retard raveling and sloughing during construction. Adequate provisions should be made to protect the slopes from erosion during periods of rainfall. Surcharge loads, including construction, should not be placed within five (5) feet of the unsupported trench edge. The above maximum slopes are based on a maximum height of six (6) feet of stockpiled soils placed at least five (5) feet from the trench edge.

All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1987 and current amendments, and the Construction Safety Act should be met. The soils exposed in cuts should be observed during excavation by the project's geotechnical consultant. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

Temporary shoring is not anticipated for this project. If shoring is required, this office should be contacted for earth pressure recommendations.

11.0 PLAN REVIEW AND CONSTRUCTION INSPECTION SERVICES

This report has been prepared to aid in evaluation of the site, to prepare site-grading recommendations, and to assist the civil/structural engineer in the design of the proposed new structures. It is recommended that this office be provided the opportunity to provide final site-grading and design recommendations once the final grading plan is available.

All site grading and earthwork should be completed under the observation and testing of a qualified geotechnical consultant to verify compliance with the recommendations set forth in this report. All ground surfaces should be examined and approved by the project geotechnical consultant prior to placing any fill and/or structure. All footing excavations should be observed prior to placement of steel and concrete to see that footings are founded on satisfactory soil and that excavations are free of loose, disturbed or deleterious materials.

12.0 CLOSURE

The findings and recommendations of this report were prepared in accordance with generally accepted professional engineering and engineering geologic principles and practice. We make no other warranty, either expressed or implied. Our conclusions and recommendations are based on the results of the field and laboratory investigations, combined with an interpolation and extrapolation of soil conditions between and beyond boring locations. If conditions encountered during construction appear to be different from those shown by the borings, this office should be notified.

Design recommendations given in this report are based on the assumption that the earthwork and site grading recommendations contained in this report are implemented. Additional consultation may be prudent to interpret Converse's findings for contractors, or to possibly refine these recommendations based upon the review of the final site grading and actual site conditions encountered during construction. If the scope of the project changes, if project completion is to be delayed, or if the report is to be used for another purpose, this office should be consulted.

13.0 REFERENCES

BLAKE, T. F., 2000, UBCSEIS, FRISKSP, and EQSEARCH Computer Programs for Performing Probabilistic, and Seismic Coefficient Analysis and Historical Earthquake Search.

BLAKE, T. F., 2002 CGS Fault Model, Computer Model Files, CGS Source Data, Maps for Performing Probabilistic Seismic Hazard Analysis, Copyright 2004, Thomas F. Blake, August 2004.

BOLT, B. A., et al., 1977, Geologic Hazards (Revised, 2nd Edition), published by Springer-Verlag, New York.

BOWLES, J. E., 1982, *Foundation Analysis and Design*, McGraw-Hill, Inc.

CALIFORNIA BUILDING CODE (2001), International Conference of Building Officials.

CALIFORNIA DIVISION OF MINES AND GEOLOGY, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Faulting Zoning Act with Index to Earthquake Fault Zone Maps, Special Publication 42, Revised 1997, Supplements 1 and 2 added 1999.

CALIFORNIA GEOLOGIC SURVEY, 2004, Engineering Geology and Seismology for Public Schools and Hospitals in California, July 1, 2004, 227 pages.

CALTRANS – TRENCHING & SHORING MANUAL, January 1990, Revision II (12/96), Issued by Office of Structural Construction.

CAO, T., BRYANT, W.A., ROWSHANDEL, B., BRANUM, D., AND WILLS, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, June 2003: California Geological Survey web page, <http://www.consrv.ca.gov/cgs/rghm/psha/fault_parameters/pdf/2002_CA_Hazard_Maps.pdf> (November 18, 2005).

CIVILTECH SOFTWARE, *LiquefyPro, Version 4.3K, 2003, A Computer Program for Computation of Liquefaction and Seismic Settlements.*

CONVERSE CONSULTANTS, *Preliminary Geotechnical Investigation Report,* Roosevelt II – Elementary School, San Bernardino City Unified School District, City of San Bernardino, California, Converse Project No. 04-81-156-02, dated June 16, 2005.

CONVERSE CONSULTANTS, *Geologic Hazards Report,* Roosevelt Elementary School II, 1554 North Garner Avenue, San Bernardino, California, Converse Project No. 04-81-156-01, dated November 10, 2004.

DEPARTMENT OF NAVY (NAVFAC), DESIGN MANUAL 7.1, Soil Mechanics, May 1982.

FIFE, D. L., et. al., 1976, *Geologic Hazards in Southwestern San Bernardino County, California*, California Division of Mines and Geology, Special Report 113, p.40.

FLOOD INSURANCE RATE MAP (FIRM), City of San Bernardino City, California, Panel No. 06071C 7945F, Federal Emergency Management Agency, dated March 18, 1996.

RUBEY, W. W., 1981, The Geotectonic Development of California, W. G. Ernst, Editor, Volume 1.

STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (2000), Joint Committee of the Southern California Chapter, American Public Works Association and Southern California Districts Associated General Contractors of California.

STUDIES IN GEOPHYSICS, 1986, Active Tectonics, Geophysics Study Committee, National Academy Press.

TOLIMATSU, K. AND SEED, H. B., 1987; Evaluation of Settlement in Sands Due to Earthquake Shaking, ASCE Journal of Geotechnical Engineering, Vol. 118.

TOPPOZADA, T., et. al., 2000, Epicenters of and Areas Damaged by M≥5 California Earthquakes, 1800-1999, Map Sheet 49, California Geologic Survey.

U.S. GEOLOGICAL SURVEY, Geologic Map of the San Bernardino North Quadrangle, San Bernardino County, California, 7.5-minute series, Digital Map version 1.0.

U.S. GEOLOGICAL SURVEY, San Bernardino North Geologic Quadrangle, California, 7.5-minute series, map dated 1967, photorevised 1988.

WESTERN MUNICIPAL WATER DISTRICT, Fall 2005, Cooperative Well Measuring Program.

DEPARTMENT OF CONSERVATION

CALIFORNIA GEOLOGICAL SURVEY

801 K STREET • MS 12-32 • SACRAMENTO, CALIFORNIA 95814
PHONE 916 / 323-8569 • FAX 916 / 445-3334 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov/cgs

RECEIVED
OCT 20 2005
BY:

Mr. Douglas Humphrey
Division of the State Architect
16680 W. Bernardo Drive
San Diego, CA 92127

October 14, 2005

Subject: Engineering Geology and Seismology Review for Roosevelt II Elementary School - New Campus Southeast Corner of Mount Vernon Avenue and 14th Street, San Bernardino, California
DSA File No. 36-55 DSA Application No. 04-107199

Dear Mr. Humphrey:

accordance with your request and transmittal of documents on June 23, 2005; the California Geological Survey (CGS) has reviewed the engineering geology and seismology aspects of the consulting report prepared for the Roosevelt II Elementary School in San Bernardino, California. It is our understanding this project consists of construction of a new campus that includes single-story structures for administration, classrooms, and a multipurpose room. This review was performed in accordance with Title 24, California Code of Regulations, 2001 California Building Code (CBC) and followed CGS Note 48 guidelines. We reviewed the following consulting reports:

Geologic Hazards Report, Roosevelt Elementary School II, San Bernardino, California: prepared by Converse Consultants, 10391 Corporate Drive, Redlands, California 92374; Converse Project No. 04-81-156-01; dated November 10, 2004; 8 pages.

Preliminary Geotechnical Investigation Report, Roosevelt II - Elementary School, San Bernardino City Unified School District, City of San Bernardino, California: prepared by Converse Consultants, 10391 Corporate Drive, Redlands, California 92374; Converse Project No. 04-81-156-02; dated June 16, 2005; 25 pages (with Appendices A, B, and C).

The consultant calculates the Upper Bound Earthquake and Design Basis Earthquake peak ground accelerations for the site at **1.15g** and **0.97g**, respectively. The consultant also states that the top five feet of artificial fill and alluvial sediments are not suitable for supporting structures and will be removed and/or recompacted. We recommend to the consultant that during subgrade inspection, if this unsuitable material extends below five feet, this material should also be removed and/or recompacted.

. . . ne consultant indicates that historic-high ground water is located at 100-feet below the surface and, therefore, seismically induced settlement due to liquefaction is not likely at the site. Dynamic settlement for the "dry" soil column at the site was not considered. The moderate-to-high "blow count" data from the boring logs indicate the soils beneath the site are relatively dense and will not likely settle significantly durit g an earthquake. CGS recommends that, in the future, the consultant should evaluate the potential for seismically induced settlement from within the "dry" soil column.

Based on our review of the information provided in the geotechnical report for this project, CGS concludes: ***The engineering geology and seismology aspects of CCR Title 24 pertaining to static building distress at the site have been adequately addressed for this project.*** No further geologic review is necessary for this issue.

If you would like to discuss the findings of this review or require additional information, please contact the undersigned at (916) 327-0981.

Respectfully submitted,

Rick I. Wilson
Engineering Geologist
RG 5878, CEG 1881

PROFESSIONAL GEOLOGIST
Rick I. Wilson
No. 1881
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Reviewed by,

Jennifer Thornburg
Senior Engineering Geologist
PG 5476, CEG 2240

PROFESSIONAL GEOLOGIST
Jennifer Thornburg
No. 2240
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Enclosure:

Note 48 Checklist Review Comments (3 pages)
keyed to: *Note 48 - Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*

Copies to:

Hashmi S. Quazi, K. Mahmood Khan, and Roy J. Rushing, Converse Consultants, 10391 Corporate Drive, Redlands, California 92374

James M. Stinson, PSWC Group, 1887 Business Center Drive #3, San Bernardino, California 92408

Arturo Delgado (Superintendent), San Bernardino City Unified School District, 777 North "E" Street, San Bernardino, California 92410

Note 48 Checklist Review Comments

In the numbered paragraphs below, this review is keyed to the paragraph numbers of California Geological Survey Note 48 (January, 2004 edition), *Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings*. The checklist can be found on the CGS web site at the following address:
http://www.consrv.ca.gov/cgs/information/publications/cgs_notes/note_48/note_48.pdf

Project Location

1. Site Location: Adequately addressed.
2. Boreholes: Adequately addressed.
3. Site Coordinates: Adequately addressed: 34.12686°N and -117.31249°W.

Engineering Geology

4. Regional Geology and Fault Maps: Adequately addressed.
5. Geologic Map of Site: Adequately addressed.
6. Subsurface Geology at Site: Adequately addressed.
7. Geologic Cross Sections: Adequately addressed.
8. Evaluation of Active Faulting & Coseismic Deformation: Adequately addressed. The consultants report that this site is outside of any Alquist-Priolo Earthquake Fault Zone, that no evidence for active faulting was encountered, and that the risk of surface rupture at this site is considered low.
9. Seismic Hazard Zones: Adequately addressed.
10. Landslides: Adequately addressed. The consultants report that there is little relief in the site vicinity, and that therefore the potential for earthquake-induced landslides is considered low.
11. Geotechnical Laboratory Testing: Adequately addressed.
12. Expansive Soils: Adequately addressed. The consultants report that the site soil has very low expansion potential.
13. Geochemistry of the Geologic Subgrade: Adequately addressed.
14. Flooding: Adequately addressed. The consultants report that the site is located outside the limits of the 500-year Flood Plain.

Seismology & Calculation of Earthquake Ground Motion

15. Evaluation of Historic Seismicity: Adequately addressed.
16. Probabilistic Seismic Hazard Analysis (PSHA) Methodology: Adequately addressed.
17. Upper-Bound Earthquake Ground Motion: Adequately addressed.
18. Design-Basis Earthquake Ground Motion: Adequately addressed.
19. Classify the Geologic Subgrade: OK. The consultants classify the site **Soil Profile Type S_D, stiff soil**, from the 2001 CBC classification chart.
20. Near-Source Coefficients: OK. The consultants report $N_a = 1.1$ and $N_v = 1.4$.

21. Peak Ground Acceleration: Adequately addressed. PGA values obtained by the consultants using the PSHA method are:
Upper-Bound Earthquake ground-motion, 10% exceedance in 100 years
Peak Ground Acceleration, PGA_{UBE} =1.15g.

Design-Basis Earthquake ground-motion, 10% exceedance in 50 years
Peak Ground Acceleration, PGA_{DBE} =0.97g.

Independent calculation by the California Geological Survey of the ground motion using the California Geological Survey State-Wide Model (from Peterson and others 1996, CGS Open-File Report 96-08; updated by Cao and others, 2003), for Type S_D, stiff soil, indicates that the above values are reasonable and appropriate.

22. Normalized Spectral Acceleration: Not applicable.
23. California Seismic Zone 3 or 4: Adequately addressed. The consultants report the site lies within Zone 4 and that Z=0.40.
24. Scaled Time-Histories of Earthquake Ground Motion: Not applicable.

Liquefaction Analysis

25. Geologic Setting: Adequately addressed. The data appear to support the consultants' conclusion that historic high ground water levels are deeper than 50 feet, and that therefore the potential for liquefaction is low.
26. Liquefaction Methodology: OK – not applicable.
27. Liquefaction Calculations: OK – not applicable.
28. Seismic Settlement of the entire Soil Column: OK - Dynamic settlement for the "dry" soil column at the site was not considered. The moderate-to-high "blow count" data from the boring logs indicate the soils beneath the site are relatively dense and will not likely settle significantly during an earthquake. CGS recommends that, in the future, the consultant should evaluate the potential for seismically induced settlement from within the "dry" soil column.
29. Lateral Spreading due to Liquefaction: Not applicable.
30. Remedial Options for Liquefaction: Not applicable.
31. Acceptance Criteria for Liquefaction Remediation: OK – not applicable.

Exceptional Geologic Hazards or Site Conditions:

32. Phase I & II Environmental Site Assessment Work: Not addressed by the consultants, and therefore not reviewed.
33. Hazardous Materials: Not addressed by the consultants, and therefore not reviewed.
34. California Environmental Quality Act: Not addressed by the consultants, and therefore not reviewed.
35. Ground-Water Quality: Not addressed by the consultants, and therefore not reviewed.
36. On-Site Septic Systems: Not addressed by the consultants, and therefore not reviewed.

37. Non-Tectonic Faulting and Hydrocollapse of Alluvial Fan Soils: Not addressed by the consultants, and therefore not reviewed.
38. Regional Subsidence: Not addressed by the consultants, and therefore not reviewed.
39. Volcanic Eruption: Not addressed by the consultants, and therefore not reviewed.
40. Tsunami or Seiche: Adequately addressed. The consultants report that the potential for tsunami or seiche is very low at the site.
41. Asbestos in serpentine terrain: Not addressed by the consultants, and therefore not reviewed.
42. Radon-222 gas: Not addressed by the consultants, and therefore not reviewed.
43. Other Geologic Hazards: None known.

Site Grading Plan Review & Foundation Plan Review

44. Areas of Cut and Fill, Preparation of Ground: Adequately addressed.
45. Geologic and Geotechnical Inspections and Problems Anticipated During Grading: Adequately addressed. The consultant states that the top five feet of artificial fill and alluvial sediments are not suitable for supporting structures and will be removed and/or recompacted. We recommend to the consultant that during subgrade inspection, if this unsuitable material extends below five feet, that it also be removed and/or recompacted.
46. Subdrain Plans for Ground Water and Surface Water: Not addressed by the consultants, and therefore not reviewed.
47. Cut-Fill Prisms: Not applicable.
48. Deep Foundation Plans: Not applicable.
49. Retaining Walls and Engineered Fill Buttresses: Adequately addressed.

Report Documentation

50. Geology, Seismology, and Geotechnical References: Adequately addressed.
51. Certified Engineering Geologist: signature, valid license number: Adequately addressed. Rushing, Roy J., Certified Engineering Geologist 1080.
52. Registered Geotechnical Engineer: signature, valid license number & seal Adequately addressed. Quazi, Hashmi S., Registered Geotechnical Engineer 2517.

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Our field investigation included a site reconnaissance of the site and a subsurface exploration program consisting of drilling soil borings. During the site reconnaissance, the surface conditions were noted and the locations of the borings were determined. The borings were located using existing boundary features as a guide and should be considered accurate only to the degree implied by the method used.

We drilled eighteen (18) borings for this project (BH-1 through BH-18) on June 2, 2005 and September 28, 2006. Boring Nos. BH-1 through BH-8 were drilled at locations where access for a drill rig was then available for the preliminary geotechnical investigation report dated June 16, 2005. One (1) boring was drilled fifty-one and one-half (51.5) feet below existing ground surface (bgs), six (6) borings were drilled twenty-one and one-half (21.5) feet bgs, seven (7) borings were drilled sixteen and one-half (16.5) feet bgs, and four (4) borings were drilled eleven (11) feet bgs. To meet the DSA requirements of at least two borings below each building, we drilled additional eight (8) borings (BH-23 through BH-26) on July 20, 2011 to depths between 11.5 and 21.5 feet.

The borings were drilled using a truck-mounted rig equipped with 8-inch diameter hollow-stem augers for soil sampling. Soils were logged by our geologist or engineer and classified in the field by visual examination in accordance with the Unified Soil Classification System. The field descriptions have been modified where appropriate to reflect the laboratory test results.

Relatively undisturbed ring and bulk samples of the subsurface soils were obtained at frequent intervals in the borings. The undisturbed samples were obtained using a California Steel Sampler (2.4 inches inside diameter and 3.0 inches outside diameter) lined with thin sample rings. The sampler was driven into the bottom of the boreholes with successive drops of a 140-pound hammer falling 30 inches by means of a mechanically driven pulley. The number of successive drops of the driving weight ("blows") required for every 6-inch of penetration of the sampler are shown on the Logs of Borings in the "blows/6-inch" column.

The soil was retained in brass rings (2.4 inches in diameter and one inch in height). The central portion of the sample was retained and carefully sealed in waterproof plastic containers for shipment to the laboratory. Bulk soil samples were also collected in plastic bags and brought to the laboratory.

Standard Penetration Tests (SPTs) were performed starting at 25 feet bgs. In this test a standard split-spoon sampler (1.4 inches inside diameter and 2.0 inches outside

diameter) was driven into the ground with successive drops of a 140-pound hammer falling 30 inches by means of a mechanically driven pulley. The number of successive drops of the driving weight ("blows") required for every 6-inch of penetration of the sampler are shown on the Logs of Borings in the "blows/6-inch" column.

The soil retrieved from the spoon sampler was carefully sealed in waterproof plastic containers for shipment to the laboratory.

Three (3) hand auger borings (HA-1 through HA-3) were each drilled to a depth of four (4) feet bgs on October 14, 2006 using a four-inch diameter hand auger. Bulk samples were obtained from two (2) of the borings.

For a key to soil symbols and terminology used in the boring logs, refer to Drawing No. A-1, *Unified Soil Classification and Key to Boring Log Symbols*. For logs of borings, see Drawings No. A-2 through A-19, and A-23 through A-30, *Logs of Borings*. For logs of hand auger borings, see Drawings No. A-20 through A-22, *Logs of Borings*.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

BORING LOG SYMBOLS

SAMPLE TYPE

- STANDARD PENETRATION TEST — Split barrel sampler in accordance with ASTM D-1586-84 Standard Test Method
- DRIVE SAMPLE — 2.42" I.D. sampler.
- DRIVE SAMPLE — No recovery
- BULK SAMPLE
- GROUNDWATER WHILE DRILLING
- GROUNDWATER AFTER DRILLING

LABORATORY TESTING ABBREVIATIONS

TEST TYPE
(Results shown in Appendix B)

CLASSIFICATION

Plasticity	pl
Grain Size Analysis	ma
Passing No. 200 Sieve	wa
Sand Equivalent	se
Expansion Index	ei
Compaction Curve	max
Hydrometer	h

STRENGTH

Pocket Penetrometer	p
Direct Shear	ds
Direct Shear (single point)	ds*
Unconfined Compression	uc
Triaxial Compression	tx
Vane Shear	vs
Consolidation	c
Collapse Test	col
Resistance (R) Value	r
Chemical Analysis	ca
Electrical Resistivity	er
Permeability	perm

UNIFIED SOIL CLASSIFICATION AND KEY TO BORING LOG SYMBOLS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 1

Log of Boring No. BH - 1

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine- to medium-grained, brown.						ma, max, ei, ds
		ALLUVIUM (Qal) **SILTY SAND (SM):** fine- to medium-grained, brown.			3/4/5	10	103	
5		**SAND (SP):** fine- to medium-grained, little silt, yellow brown.			4/7/7	3	99	
		SANDY CLAY (CL): fine- to medium-grained sand, brown.			4/7/9	23	94	
10		**SILTY SAND (SM):** fine-grained, gray.			6/13/21	5	96	
15					9/12/24	6	109	
20					16/37/50 (6")	7	117	
		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 2

Log of Boring No. BH - 2

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine-grained, brown.						
			■		3/3/4	4	94	col
5		**ALLUVIUM (Qal)** **SILTY SAND (SM):** fine-grained, brown.	■		7/10/10	6	96	
		CLAY (CL): with fine-grained sand, gray to brown.	■		2/3/6	29	85	
10			■		4/9/14	22	95	
15		**SILT (ML):** with fine-grained sand, gray to brown.	■		4/7/10	14	109	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
20								
25								
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 3

Log of Boring No. BH - 3

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SANDY SILT (ML):** fine- to coarse-grained sand, few gravel to 1" maximum dimension, brown.	■		3/4/4	12	93	wa
5		**ALLUVIUM (Qal)** **SAND (SP):** fine- to coarse-grained, few gravel to 1" maximum dimension, gray.	■		2/3/5	2	99	
		SANDY SILT WITH CLAY (ML): fine-grained sand, dark brown.	■		3/6/6	16	98	
10		**SILT (ML):** trace fine-grained sanc, gray.	■		4/7/8	16	91	
15			■		5/9/12	9	91	
20		**SAND WITH SILT (SP-SM):** fine-grained, yellow brown.	■		11/20/30	7	111	
		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
25								
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 4

Log of Boring No. BH - 4

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		2.5" ASPHALT CONCRETE OVER 6" AGGREGATE BASE						ma, er, ca
		FILL (Af) **SILTY SAND (SM):** fine-grained, brown.	■		3/4/7	2	92	
5		**ALLUVIUM (Qal)** **SILTY SAND (SM):** fine-grained, brown.	■		4/4/6	1	94	wa
		SILT (ML): with fine-grained sand, light gray.	■		4/7/17	5	90	
10		**SAND (SP):** fine-grained, light gray.	■		10/13/21	2	100	
15		**SANDY SILT (ML):** fine-grained sand, brown.	■		8/20/26	4	102	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 5

Log of Boring No. BH - 5

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine-grained, brown.	■		3/3/3	5	86	
5		**ALLUVIUM (Qal)** **SANDY SILT (ML):** fine-grained sand, dark brown.	■		3/4/6	12	100	wa, col
			■		4/5/7	10	93	
10		**SAND WITH SILT (SP-SM):** fine-grained, brown.	■		6/9/11	3	97	
15		**SANDY SILT (ML):** fine-grained sand, brown.	■		7/14/22	10	106	
20			■		8/33/50 (5")	6	108	
25		**SAND (SP):** fine-grained, little silt, yellow brown.	☒		15/26/29			
30			■		17/21/50 (5")	2	115	

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ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 6a

Log of Boring No. BH - 5

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		SAND (SP): fine-grained, little silt, fine gravel and broken cobbles, tan brown.	X		9/11/17			
40			■		18/50 (6")	2	106	
45		**GRAVELLY SAND (SP):** fine- to coarse-grained, broken cobbles, gray.	X		40/50 (5")			
50					43/50 (4")			
		End of boring at 51.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
55								
60								
65								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 6b

Log of Boring No. BH - 6

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine-grained, tan brown.						max, ei, ds
		ALLUVIUM (Qal) **SILTY SAND (SM):** fine-grained, tan brown.			3/4/6	6	96	
5					5/8/12	8	103	
					7/10/17	5	93	
10		**SANDY SILT WITH CLAY (ML):** fine-grained sand, dark brown.			5/9/13	9	93	
15					5/10/21	12	104	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
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30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 7

Log of Boring No. BH - 7

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SANDY SILT WITH CLAY (ML):** fine- to medium-grained sand, dark brown.	■		4/10/11	19	95	
5		**SILTY SAND (SM):** medium-grained, gray to brown.	■		4/4/4	13	107	ds
			■		4/6/12	7	92	
10		**ALLUVIUM (Qal)** **SANDY SILT (ML):** fine-grained sand, light gray.	■		5/9/16	7	100	
15			■		5/13/15	13	93	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 8

Log of Boring No. BH - 8

Dates Drilled: 6/2/2005 Logged by: AB Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		3" ASPHALT CONCRETE						r, wa
		FILL (Af) **CLAYEY SAND (SC):** fine- to coarse-grained, few gravel, brown to gray.			2/2/3	29	87	
		ALLUVIUM (Qal) **SAND (SP):** fine- to medium-grained, yellow brown.						
5					7/13/24	3	105	
		SANDY SILT WITH CLAY (ML): fine-grained sand, trace clay, brown.			6/6/11	19	100	col
10					5/6/10	12	97	
15		**SILTY SAND (SM):** fine-grained, brown.			7/16/33	9	110	
20		**SAND (SP):** fine- to medium-grained, few gravel, gray brown.			11/11/11	4	119	
		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 06-02-05.						
25								
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 9

Log of Boring No. BH - 9

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		4" ASPHALT CONCRETE						
		FILL (Af) **SANDY SILT (ML):** fine-grained sand, light brown.	■		5/8/9	12	93	ma, max, ds, er, ca
5		**ALLUVIUM (Qal)** **SILTY SAND (SM):** fine-grained, gray.	■		8/8/11	3	100	
		SANDY SILT (ML): fine-grained sand, gray brown.	■		5/10/17	7	87	
10			■		5/10/16	9	89	wa
15			■		9/15/16	8	106	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings and surface patched with asphalt concrete on 09/28/06.						
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 10

Log of Boring No. BH -10

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine-grained, light gray.						
			■		4/7/10	6	95	
5								
		ALLUVIUM (Qal) **SAND WITH SILT (SP-SM):** fine- to medium-grained, brown.	■		3/5/6	2	104	wa
10		**SANDY SILT (ML):** fine- to medium-grained sand, brown.	■		3/4/7	22	99	
15		- fine-grained, trace to little clay, brown	■		3/9/13	17	111	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
20								
25								
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 11

Log of Boring No. BH -11

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal) **SANDY SILT (ML):** fine-grained sand, little clay, light gray.	■		5/7/9	8	92	
5		**SAND TO SILTY SAND (SP-SM):** fine- to medium-grained, gray brown.	■		4/8/10	3	97	
		SANDY SILT (ML): fine-grained sand, gray.	■		4/9/14	12	98	c
10			■		5/10/12	8	88	
15		**CLAYEY SILT (ML):** few fine-grained sand, gray brown.	■		4/10/17	19	95	
20		**SAND TO SILTY SAND (SP-SM):** fine- to coarse-grained, gray brown.	■		10/25/46	3	110	
		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 12

Log of Boring No. BH -12

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		6" ASPHALT CONCRETE						
		FILL (Af) SANDY SILT (ML): fine-grained sand, brown.	■		2/3/4	12	88	ei
5		ALLUVIUM (Qal) SILTY SAND (SM): fine-grained, light gray.	■		4/4/4	5	88	
			■		4/7/9	4	97	
10			■		5/10/10	3	93	
15		SANDY SILT (ML): fine-grained sand, little to some clay, brown.	■		4/10/15	12	103	wa
20		SILTY SAND (SM): fine- to medium-grained, brown.	■		6/14/24	7	112	
25		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings and surface patched with asphalt concrete on 09/28/06.						
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 13

Log of Boring No. BH -13

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal) **SANDY SILT (ML):** fine-grained sand, light gray.						ca, er
			■		3/3/4	8	93	
5		**SILTY SAND (SM):** fine- to medium-grained, dark brown.	■		3/3/6	5	96	
			■		6/10/15	4	91	
10		- gray brown	■		4/4/8	7	93	
15			■		5/8/14	8	101	
		End of boring at 16.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 14

Log of Boring No. BH -14

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SANDY SILT (ML):** fine-grained sand, brown.						se
			■		3/4/4	10	94	
5		**ALLUVIUM (Qal)** **SAND (SP):** fine- to coarse-grained, light gray.	■		3/4/5	1	101	
			■		5/12/18	2	99	
10			■		6/11/12	2	95	
		End of boring at 11.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
15								
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 15

Log of Boring No. BH -15

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal) **SILTY SAND (SM):** fine-grained, light gray.						ei
			■		5/6/7	3	93	
5		**SAND (SP):** fine- to coarse-grained, gray brown.	■		2/3/6	2	91	ds, col
		- fine- to medium-grained	■		5/7/12	2	97	
10		**SAND TO SILTY SAND (SP-SM):** fine- to medium-grained, gray brown.	■		6/10/12	4	93	
		End of boring at 11.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 9/28/06.						
15								
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 16

Log of Boring No. BH -16

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal) **SILTY SAND (SM):** fine- to medium-grained, brown.						
			■		4/6/7	2	94	
5			■		3/6/8	4	89	col
10			■		3/6/7	3	93	
15		**SANDY SILT (ML):** fine- to medium-grained sand, gray brown.	■		3/7/11	11	99	
20		**SILTY SAND (SM):** fine- to medium-grained, brown.	■		5/13/22	6	110	
		End of boring at 21.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 17

Log of Boring No. BH -17

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		ALLUVIUM (Qal) **SILTY SAND (SM):** fine-grained, light gray.	■	▨	4/7/7	3	91	
5		**SAND TO SILTY SAND (SP-SM):** fine-grained, light gray.	■		4/5/8	3	90	col
10		**SAND (SP):** fine-grained, brown.	■		4/7/9	3	96	
		End of boring at 11.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
15								
20								
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Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 18

Log of Boring No. BH -18

Dates Drilled: 9/28/2006 Logged by: CKL Checked By: RJR

Equipment: CME 75 WITH 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		5" ASPHALT CONCRETE						r
		FILL (Af) **SILTY SAND (SM):** fine- to medium-grained, dark brown.	■		2/2/2	7	100	
5		**ALLUVIUM (Qal)** **SAND TO SILTY SAND (SP-SM):** fine- to medium-grained, brown.	■		6/7/11	4	99	
		SILT (ML): trace to little clay and fine sand, brown.	■		2/3/6	28	85	
10		**SILTY SAND (SM):** fine-grained, brown.	■		3/5/7	8	92	
		End of boring at 11.5 feet. Groundwater not encountered during drilling. Boring backfilled with soil cuttings on 09/28/06.						
15								
20								
25								
30								

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ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 19

Log of Boring No. HA - 1

Dates Drilled: 10/14/2006 Logged by: RJR Checked By: HSQ

Equipment: N/A Driving Weight and Drop: N/A

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine- to medium-grained, brown.						
5		End of hand auger at 4.0 feet. Groundwater not encountered during drilling. Boring backfilled with sand, capped with soil on 10/14/06.						
10								
15								
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 20

Log of Boring No. HA - 2

Dates Drilled: 10/14/2006 Logged by: RJR Checked By: HSQ

Equipment: N/A Driving Weight and Drop: N/A

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine- to medium-grained, brown.						
5		End of hand auger at 4.0 feet. Groundwater not encountered during drilling. Boring backfilled with sand, capped with soil on 10/14/06.						
10								
15								
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 21

Log of Boring No. HA - 3

Dates Drilled: 10/14/2006 Logged by: RJR Checked By: HSQ

Equipment: N/A Driving Weight and Drop: N/A

Ground Surface Elevation (ft): N/A Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6"	MOISTURE (%)	DRY UNIT WT. (pcf)	OTHER
		FILL (Af) **SILTY SAND (SM):** fine-grained, gray to brown.						
5		End of hand auger at 4.0 feet. Groundwater not encountered during drilling. Boring backfilled with sand, capped with soil on 10/14/06.						
10								
15								
20								
25								
30								

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. A - 22

Log of Boring No. BH - 19

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1164 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)	
		SAND WITH SILT (SP/SM): fine- to medium-grained, few gravel up to 1" in largest dimension, light brown.						
			■		2/3/4	3	90	max
5		- fine-grained, light-brown	■		4/4/6	2	95	
			■		6/9/9	2	96	
10		**SANDY SILT (ML):** fine-grained sand, some caliche, slightly cemented, gray-brown.	■		5/6/9	8	90	
15		**SILTY SAND (SM):** fine- to medium-grained, light brown.	■		10/14/15	4	101	
20			■		11/19/31	3	119	
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.						

Converse Consultants

Project No. 04-81-156-05 Drawing No. A - 23

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Log of Boring No. BH - 20

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1166 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SANDY SILT (ML): fine-grained sand, light brown.					
			■		2/4/6	4	88
5		**SAND WITH SILT (SP-SM):** fine-grained, light brown.	■		3/4/7	6	100
		SANDY SILT (ML): fine-grained sand, little caliche stringes, light brown.	■		4/7/7	2	96
10		- gray-brown	■		3/3/6	19	95
15			■		7/10/15	8	97
20		**SAND WITH SILT (SP-SM):** fine- to medium-grained, brown.	■		9/12/21	3	114
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Project No. 04-81-156-05 Drawing No. A - 24

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Log of Boring No. BH - 21

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1168 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SANDY SILT (ML): fine- to medium-grained sand, light brown.	■		3/5/6	7	86
5		**SILTY SAND (SM):** fine- to medium-grained, brown.	■		3/5/6	2	96
		SANDY SILT (ML): fine-grained sand, light brown.	■		3/5/10	6	93
10			■		3/5/8	5	93
15			■		7/9/11	6	95
		SILTY SAND (SM): fine-grained, tan.					
20			■		10/14/26	3	113
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Project No. 04-81-156-05 Drawing No. A - 25

Log of Boring No. BH - 22

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1168 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SANDY SILT (ML): fine- to coarse-grained sand, few gravel up to 2" in largest dimension, light brown.					
			■	▨	3/4/5	3	87
5		**SILTY SAND (SM):** fine- to medium-grained, light brown.	■		4/6/7	2	101
		SANDY SILT (ML): fine-grained sand, light brown.	■		4/4/6	7	95
10			■		4/7/9	5	97
15		- some caliche	■		6/10/11	4	102
20		**SILTY SAND (SM):** fine- to medium-grained, orange-brown.	■		6/8/15	4	108
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Project No. 04-81-156-05 Drawing No. A - 26

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Log of Boring No. BH - 23

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1168 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)	
		SANDY SILT (ML): fine-grained sand, brown.						max
			■		3/3/4	14	95	
5		**SILTY SAND (SM):** fine- to medium-grained, brown.	■		2/2/2	7	94	
			■		3/3/4	6	97	
10		**SANDY SILT (ML):** fine-grained sand, brown.	■		2/3/4	19	90	
		End of boring at 11.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.						

Converse Consultants

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Project No. 04-81-156-05 Drawing No. A - 27

Log of Boring No. BH - 24

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1168 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SILTY SAND (SM): fine- to medium-grained, brown.	■		2/3/4	7	100
5		**SAND (SP):** fine- to medium-grained, light gray -brown.	■		3/3/4	4	90
		CLAYEY SILT (ML): some fine- to medium-grained sand, dark brown.	■		2/3/6	16	97
10		**SANDY SILT (ML):** fine-grained sand, light gray.	■		not recorded	10	92
		End of boring at 11.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Project No. 04-81-156-05 Drawing No. A - 28

Log of Boring No. BH - 25

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1168 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SILTY SAND (SM): fine- to medium-grained, few gravel up to 1" in largest dimension, light brown.	■		3/3/4	4	91
5		**SAND (SP):** fine- to medium-grained, brown.	■		3/4/6	2	91
		SANDY SILT (ML): fine- to medium-grained sand, some caliche stringes, gray-brown.	■		3/4/6	4	90
10		**SAND WITH SILT (SP/SM):** fine-grained, light brown-gray.	■		4/6/6	3	94
15		**SILTY SAND (SM):** fine-grained, dark brown.	■		4/5/8	11	104
20		**CLAYEY SAND (SC):** fine- to coarse-grained, brown.	■		3/9/23	11	125
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

Project No. 04-81-156-05 Drawing No. A - 29

Log of Boring No. BH - 26

Dates Drilled: 7/20/2011 Logged by: SMW Checked By: HSQ

Equipment: CME 75 / 8" HSA Driving Weight and Drop: 140 lbs / 30 in

Ground Surface Elevation (ft): ±1170 Depth to Water (ft): NOT ENCOUNTERED

Depth (ft)	Graphic Log	SUMMARY OF SUBSURFACE CONDITIONS This log is part of the report prepared by Converse for this project and should be read together with the report. This summary applies only at the location of the boring and at the time of drilling. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of actual conditions encountered.	SAMPLES DRIVE	SAMPLES BULK	BLOWS/ 6"	MOISTURE (%)	DRY UNIT WT. (pcf)
		SANDY SILT (ML): fine- to medium-grained sand, few gravel up to 1/2" in largest dimension, light brown.	■	▨	4/4/6	3	86
5		**SAND (SP):** fine-grained, tan.	■	▨	2/3/4	2	91
		SILTY SAND (SM): fine- to medium-grained, tan.	■		2/3/4	6	94
10		**SANDY SILT (ML):** fine-grained sand, gray-brown.	■		5/3/5	24	89
15		**SILTY SAND (SM):** fine-grained, gray-brown.	■		5/5/7	7	106
20		**SANDY SILT (ML):** fine-grained sand, gray-brown.	■		6/11/19	6	115
		End of boring at 21.5 feet. No groundwater encountered during drilling. Borehole backfilled loose with soil cuttings on 7-20-2011.					

Converse Consultants

Project No. 04-81-156-05 Drawing No. A - 30

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management

APPENDIX B

LABORATORY TESTING PROGRAM

APPENDIX B

LABORATORY TESTING PROGRAM

Tests were conducted in our laboratory on representative soil samples for the purpose of classification and evaluation of their relevant physical characteristics and engineering properties. The amount and selection of tests were based on the geotechnical requirements of the project. Test results are presented herein and on the Logs of Borings in Appendix A, *Field Exploration*. The following is a summary of the laboratory tests conducted for this project.

Moisture Content and Dry Density

Results of moisture content and dry density tests, performed on relatively undisturbed ring samples were used to aid in the classification of the soils and to provide quantitative measure of the *in situ* dry density. Data obtained from this test provides qualitative information on strength and compressibility characteristics of site soils. For test results, see the Logs of Borings in Appendix A, *Field Exploration*.

Collapse Potential

To evaluate the moisture sensitivity (collapse/swell potential) of the encountered soils, six (6) ring samples were loaded up to approximately two kips per square foot (ksf), allowed to stabilize under load, and then submerged. The tests were conducted in accordance with the ASTM Standard D5333. The results (including the result from the consolidation test) are presented in the following table.

Table No. B-1, Collapse Tests Results

Boring No	Sample Depth (feet)	Soil Description	Percent Collapse(-) swell (+)
BH-2	2.0-3.5	Silty Sand (SM), brown	-2.45
BH-5	5.0-6.5	Sandy Silt (ML), brown	-0.14
BH-8	7.0-8.5	Sandy Silt (ML), brown	+0.03
BH-11*	7.0-8.5	Sandy Silty (ML), brown	0.00
BH-15	5.0-6.5	Sand (SP), brown	-1.35
BH-16	5.0-6.5	Silty Sand (SM), light gray	-0.85
BH-17	5.0-6.5	Sand to Silty Sand (SP-SM), light gray	-0.70

* Consolidation test

Expansion Index Test

Four (4) representative bulk samples were tested for expansion index to evaluate the expansion potential of material encountered at the site. The tests were conducted in accordance with ASTM Standard D4829. Test results are presented in the following table.

Table No. B-2, Expansion Index Test Results

Boring No.	Depth (feet)	Soil Description	Expansion Index	Expansion Potential
BH-1	0.0-5.0	Silty Sand (SM), brown	6	Very Low
BH-6	0.0-5.0	Silty Sand (SM), brown	4	Very Low
BH-12	0.5-5.0	Sandy Silt (ML), brown	10	Very Low
BH-15	0.5-5.0	Silty Sand (SM), brown	11	Very Low

Soil Corrosivity

Three (3) representative soil samples were tested to determine minimum electrical resistivity, pH, and chemical content, including soluble sulfate and chloride concentrations. The purpose of these tests is to determine the corrosion potential of site soils when placed in contact with common construction materials. These tests were performed by Anaheim Test Laboratory of Santa Ana, and Schiff Associates of Claremont, California. The test results are presented in the following table.

Table No. B-3, Corrosivity Test Results

Sample Location (Boring/Depth)	pH	Soluble Sulfate (CA 417) (ppm)	Soluble Chlorides (CA 422) (ppm)	Saturated Resistivity (CA 643) Ohm-cm
BH-4/0-5'	8.3	70	54.0	2,844
BH-9/0-5'	8.2	193	6.5	1,640
BH-13/0-5'	8.0	208	18.0	2,440

Sand Equivalent Test

One (1) representative soil sample was tested in accordance with the ASTM Standard D24A to determine the Sand Equivalent (SE). The test results are presented in the following table.

Table No. B-4, Sand Equivalent Test Result

Boring No.	Depth (feet)	Soil Description	Sand Equivalent
BH-14	0-5	Sandy Silt (ML)	20

R-value Tests

Two (2) representative bulk soil samples were tested for resistance value (R-value) in accordance with State of California Standard Method 301-G. This test is designed to provide a relative measure of soil strength for use in pavement design. The test results are shown in the following table.

Table No. B-5, R-value Test Results

Boring No.	Depth (feet)	Soil Classification	Measured R-value
BH-8	0.0-2.0	Clayey Sand (SC)	17
BH-18	0.5-5.0	Silty Sand (SM)	49

Percent finer than Sieve No. 200

The percent finer than sieve No. 200 tests were performed on seven (7) representative soil samples to aid in the classification of the on-site soils and to estimate other engineering parameters. Testing was performed in general accordance with the ASTM Standard D1140 test method. The test results (including three from grain size analysis) are presented in the following table:

Table No. B-6, Percent Passing Sieve #200 Results

Boring No.	Depth (feet)	Soil Classification	Percent Passing Sieve No. 200
BH-1	0.0-5.0	Silty Sand (SM), fine- to medium grained, brown	35.1
BH-3	2.0-3.5	Sandy Silt (ML), fine-to coarse-grained sand, brown	58.0
BH-4	0.0-5.0	Silty Sand (SM), fine-grained, brown	43.0
BH-4	5.0-6.5	Silty Sand (SM), fine-grained, brown	19.5
BH-6	7.0-8.5	Silty Sand (SM), fine-grained, brown	44.9
BH-8	0.0-2.0	Clayey Sand (SC), fine- to coarse-grained, brown to gray	49.6
BH-9	0.0-5.0	Sandy Silt (ML), fine- to coarse-grained, gray	52.4
BH-9	10.0-11.5	Sandy Silty (ML), fine-grained sand, brown	65.5
BH-10	8.0-9.5	Sand with Silt (SP-SM), fine- to medium-grained, brown	6.5
BH-12	15.0-16.5	Sandy Silt (ML), fine-grained sand, little clay, brown	58.1

Grain-Size Analysis

To assist in classification of soils, mechanical grain-size analyses were performed on three (3) selected samples. Testing was performed in general accordance with the ASTM Standard C136 test method. Grain-size curves are shown in Drawing No. B-1, *Grain Size Distribution Results.*

Maximum Dry Density Tests

Three (3) laboratory maximum dry density-moisture content relationship tests were performed on representative bulk samples during the investigation in September 2006. Two (2) additional laboratory maximum dry density-moisture content relationship tests were performed in July 2011. The tests were conducted in accordance with ASTM Standard D1557 laboratory procedure. The test results are presented on Drawing No. B-2a and B-2b, *Moisture-Density Relationship Results.*

Direct Shear

Direct shear tests were performed on three (3) relatively undisturbed samples and two (2) samples remolded to 90 percent of the laboratory maximum dry density at soaked moisture conditions. For each test, three samples contained in brass sampler rings were placed, one at a time, directly into the test apparatus and subjected to a range of normal loads appropriate for the anticipated conditions. The sample was then sheared at a constant strain rate of 0.01 inch/minute. Shear deformation was recorded until a maximum of about 0.25-inch shear displacement was achieved. Ultimate strength was selected from the shear-stress deformation data and plotted to determine the shear strength parameters. For test data, including sample density and moisture content, see Drawing Nos. B-3 through B-7, *Direct Shear Test Results* and the following table.

Table No. B-7, Direct Shear Test Results

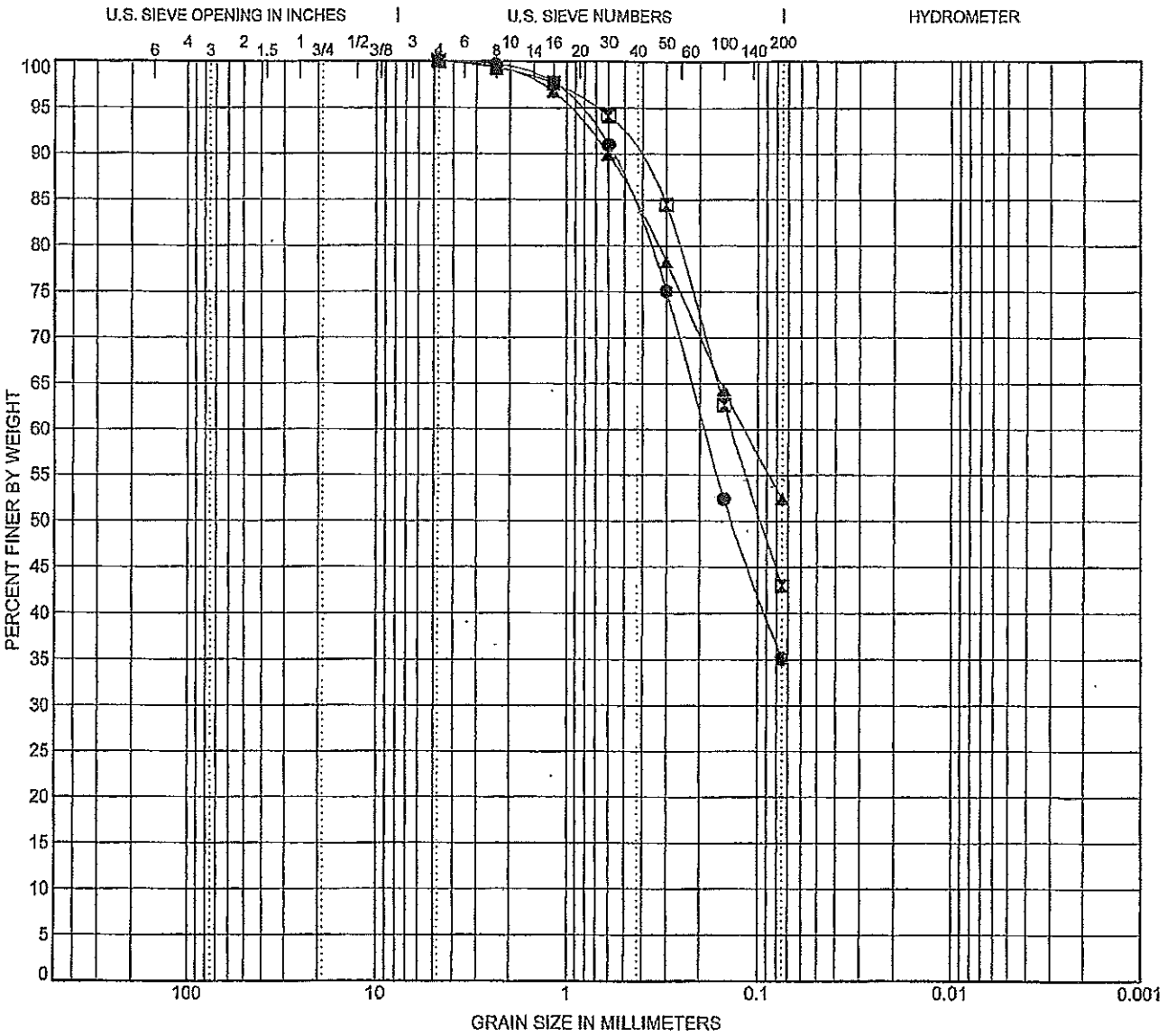
Boring No.	Depth (feet)	Test Condition	Soil Classification	Peak Strength Parameters	
				Friction Angle (degrees)	Cohesion (psf)
BH-1	2.0-3.5	Natural	Silty Sand (SM)	21	650
BH-6	0.0-5.0	Remolded to 90 percent of laboratory maximum dry density	Silty Sand (SM)	31	650
BH-7	5.0-6.5	Natural	Silty Sand (SM)	27	650
BH-9	0.0-5.0	Remolded to 90 percent of laboratory maximum dry density	Sandy Silt (ML)	31	600
BH-15	5.0-6.5	Natural	Sand (SP)	30	350

Consolidation Test

Data obtained from this test performed on one (1) relatively undisturbed soil sample was used to evaluate the settlement characteristics of the foundation soils under load. Preparation for this test involved trimming the sample and placing the one-inch high brass ring into the test apparatus, which contained porous stones, both top and bottom, to accommodate drainage during testing. Normal axial loads were applied to one end of the sample through the porous stones, and the resulting deflections were recorded at various time periods. The load was increased after the sample reached a reasonable state of equilibrium. Normal loads were applied at a constant load-increment ratio, successive loads being generally twice the preceding load. The samples were tested at field and submerged conditions. The test results, including sample density and moisture content, are presented in Drawing No. B-8, *Consolidation Test Results*.

Sample Storage

Soil samples presently stored in our laboratory will be discarded 30 days after the date of this report, unless this office receives a specific request to retain the samples for a longer period.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring No.	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	BH - 1	0.0-5.0'	SILTY SAND (SM)					
⊠	BH - 4	0.0-5.0'	SILTY SAND (SM)					
▲	BH - 9	0.0 - 5.0'	SANDY SILT (ML)					

	Boring No.	Depth (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH - 1	0.0-5.0'	4.75	0.188			0.0	64.9	35.1	
⊠	BH - 4	0.0-5.0'	4.75	0.136			0.0	57.0	43.0	
▲	BH - 9	0.0 - 5.0'	4.75	0.116			0.0	47.6	52.4	

GRAIN SIZE DISTRIBUTION RESULTS

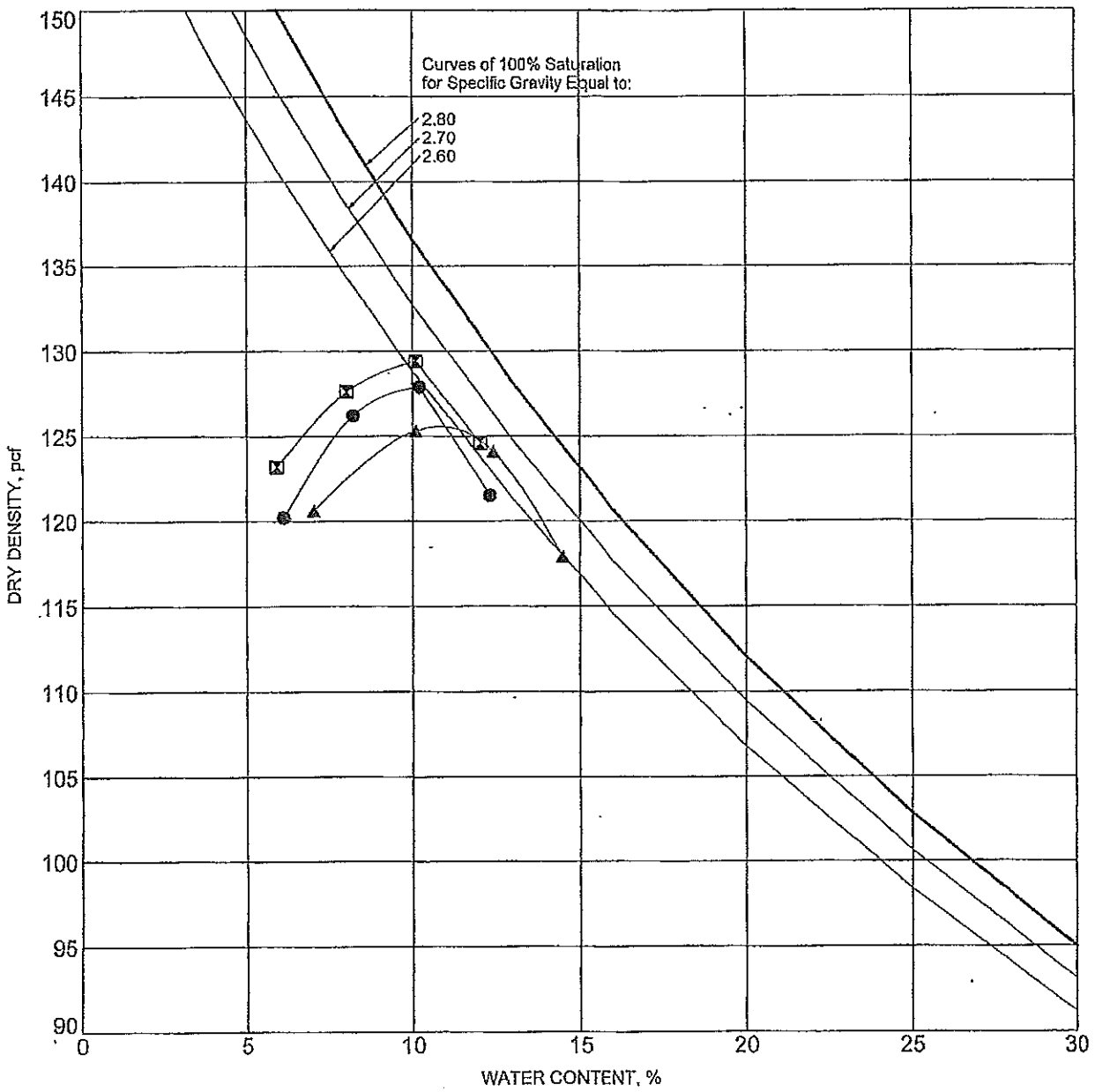
Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 1

Project ID: 04-81-156-03.GPJ; Template: GRAIN SIZE



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH - 1	0.0-5.0'	SILTY SAND (SM), brown	A	9.5	129.0
⊠	BH - 6	0.0-5.0'	SILTY SAND (SM), brown	A	9.5	130.0
▲	BH - 9	0.0 - 5.0'	SANDY SILT (ML), brown	A	11.5	126.5

MOISTURE-DENSITY RELATIONSHIP RESULTS

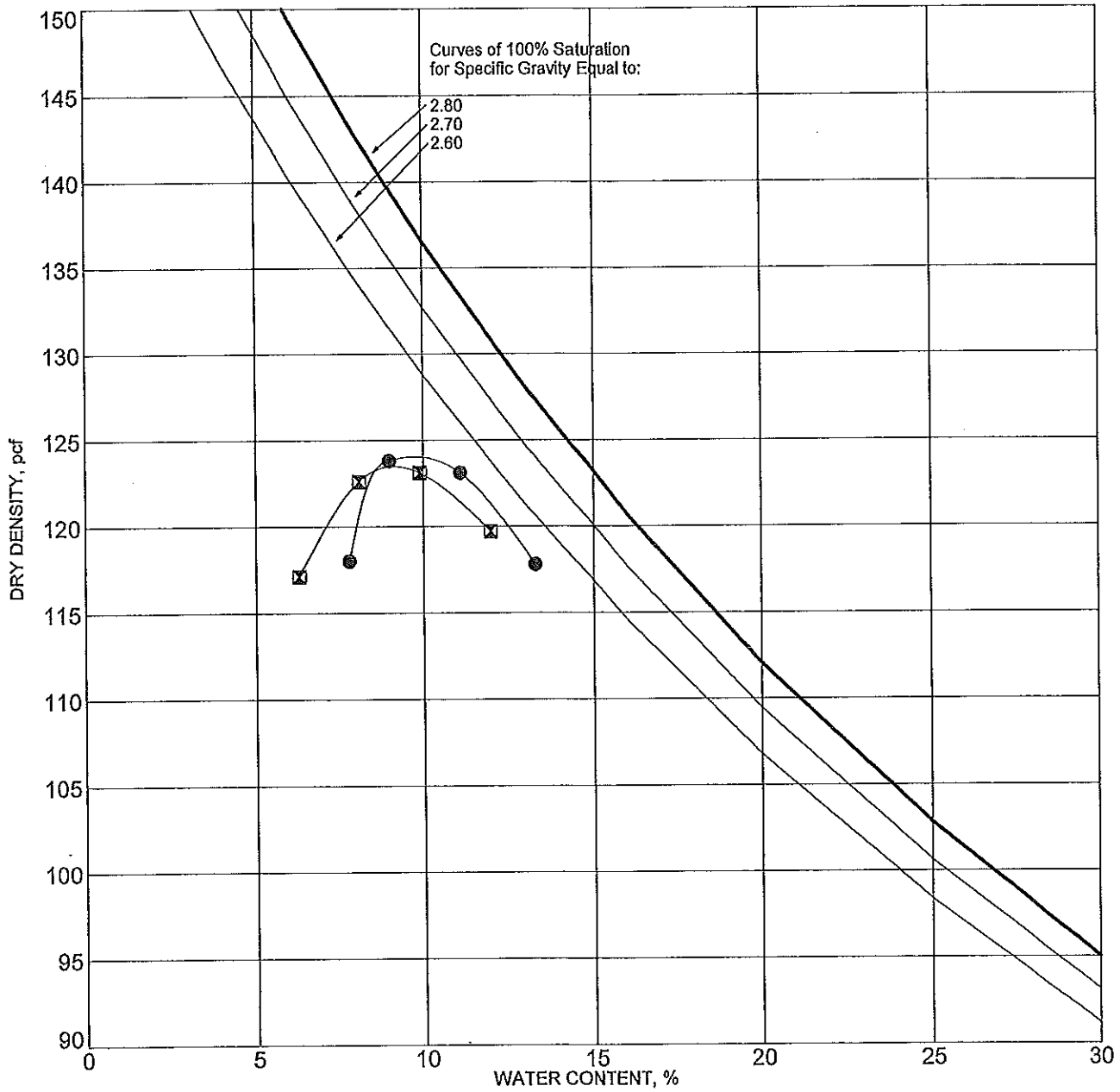
Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 2

Project ID: 04-81-156-03.GPJ; Template: COMPACTION



SYMBOL	BORING NO.	DEPTH (ft)	DESCRIPTION	ASTM TEST METHOD	OPTIMUM WATER, %	MAXIMUM DRY DENSITY, pcf
●	BH - 19	0-5	SILTY SAND (SM), brown	D1557 - A	10.0	124.5
⊠	BH - 23	0-5	SILTY SAND (SM), brown	D1557 - A	9.0	124.0

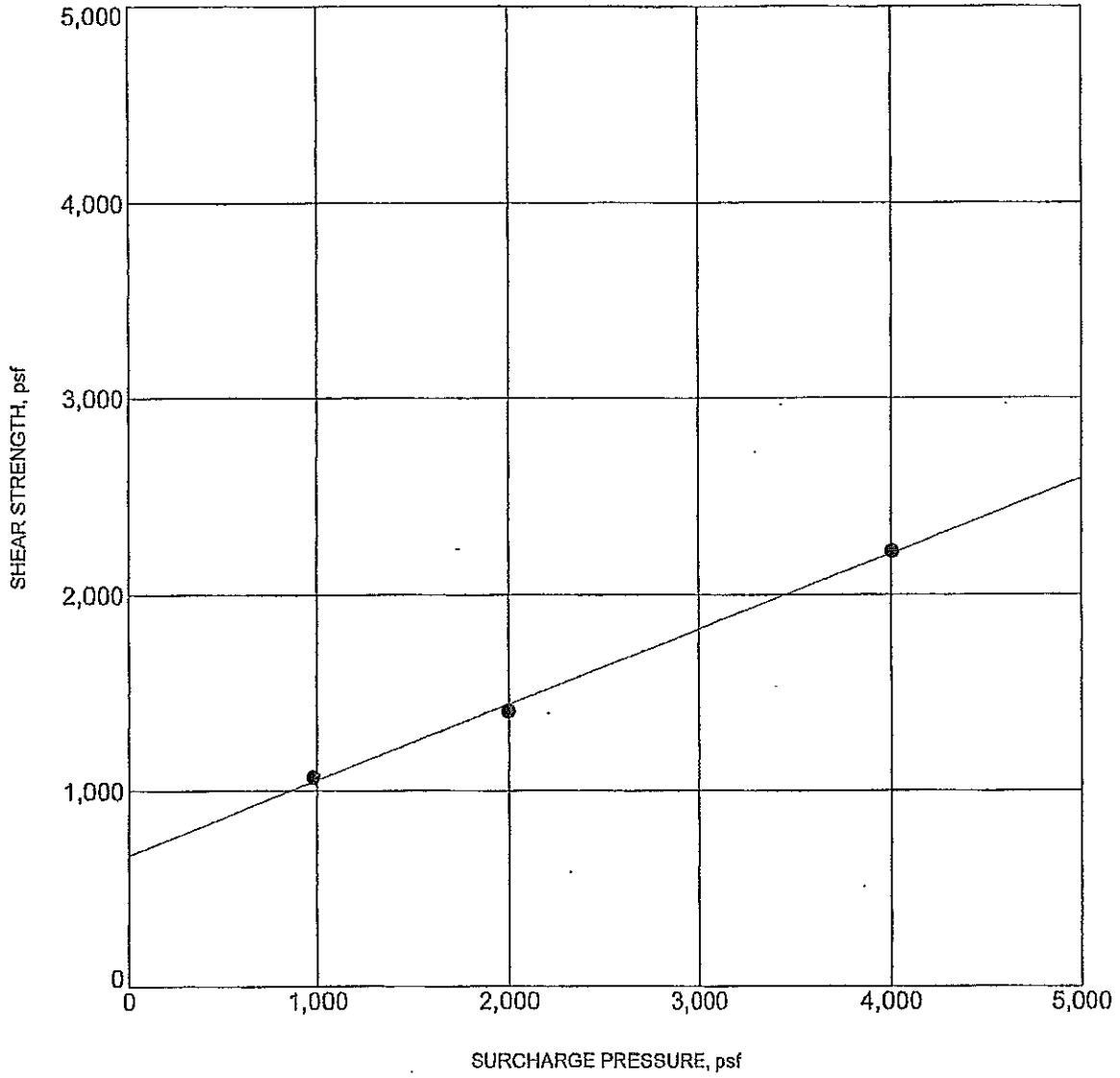
MOISTURE-DENSITY RELATIONSHIP RESULTS

Converse Consultants

Project No. 04-81-156-05

Drawing No. B - 2b

Henry Elementary School
(AKA Roosevelt II; DSA File No. 36-55; DSA Application No. No. 04-107199)
City of San Bernardino, San Bernardino County, California
For: San Bernardino City USD - Facilities Management



BORING NO.	:	BH - 1	DEPTH (ft)	:	2.0-3.5'
DESCRIPTION	:	SILTY SAND (SM)			
COHESION (psf)	:	650	FRICTION ANGLE (degrees)		21
MOISTURE CONTENT (%)	:	10.4	DRY DENSITY (pcf)	:	103.0

NOTE: Ultimate Strength.

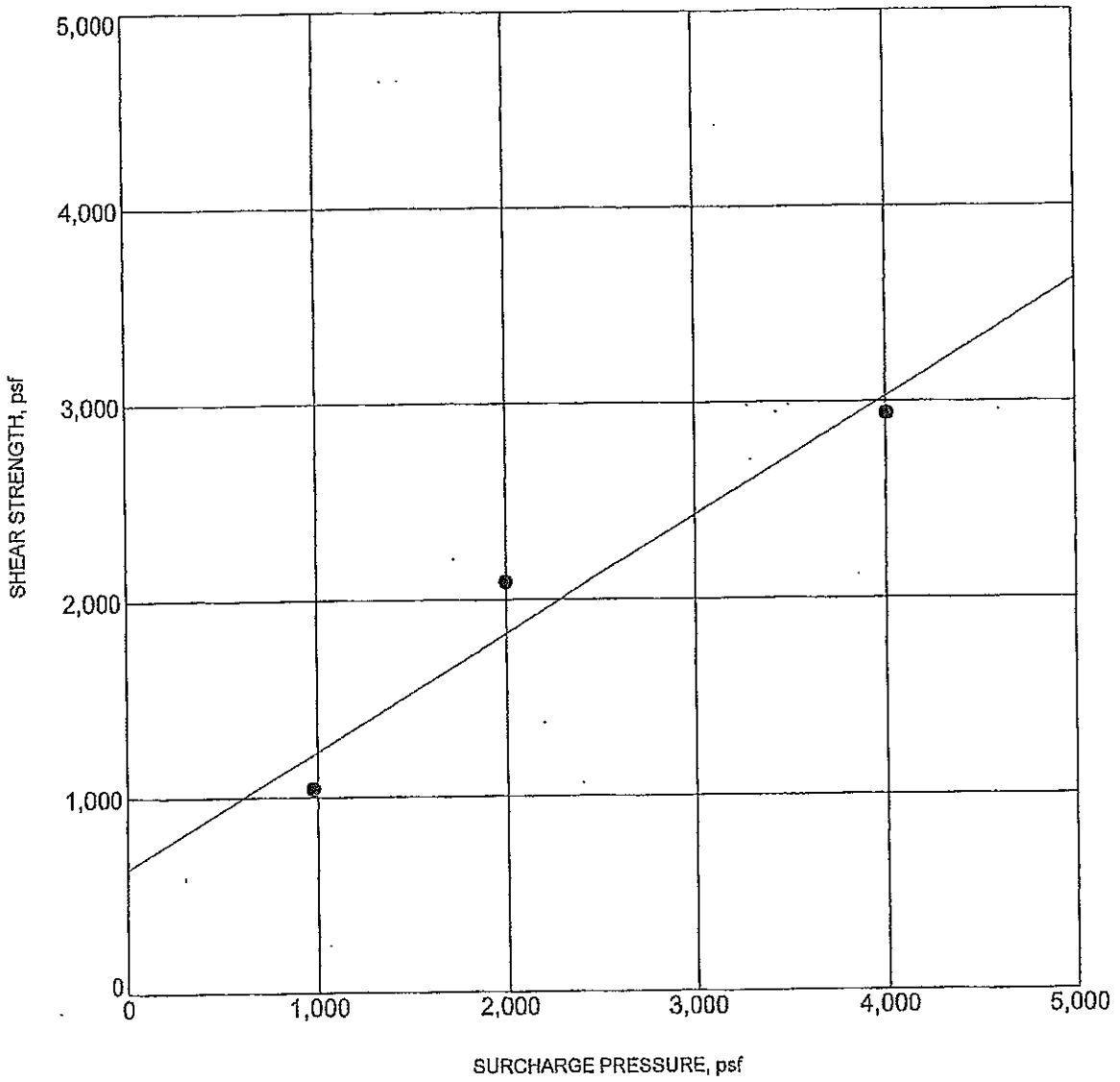
DIRECT SHEAR TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 3



BORING NO. :	BH - 6	DEPTH (ft) :	0.0-5.0'
DESCRIPTION :	SILTY SAND (SM)		
COHESION (psf) :	650	FRICTION ANGLE (degrees)	31
MOISTURE CONTENT (%) :	9.2	DRY DENSITY (pcf) :	118.6

NOTE: Ultimate Strength.

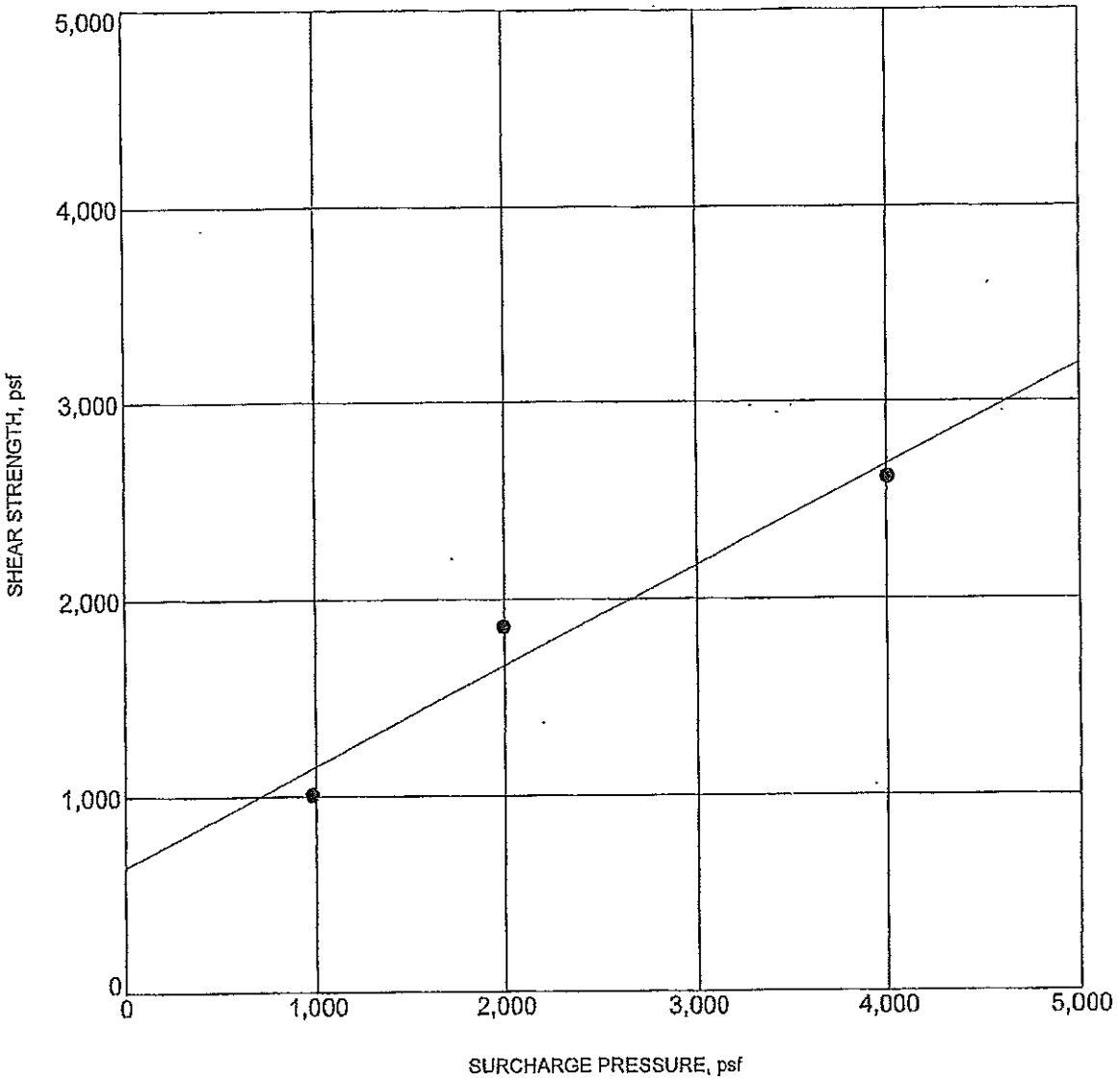
DIRECT SHEAR TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 4



BORING NO. :	BH - 7	DEPTH (ft) :	5.0-6.5'
DESCRIPTION :	SILTY SAND (SM)		
COHESION (psf) :	650	FRICTION ANGLE (degrees)	27
MOISTURE CONTENT (%) :	12.8	DRY DENSITY (pcf) :	105.1

NOTE: Ultimate Strength.

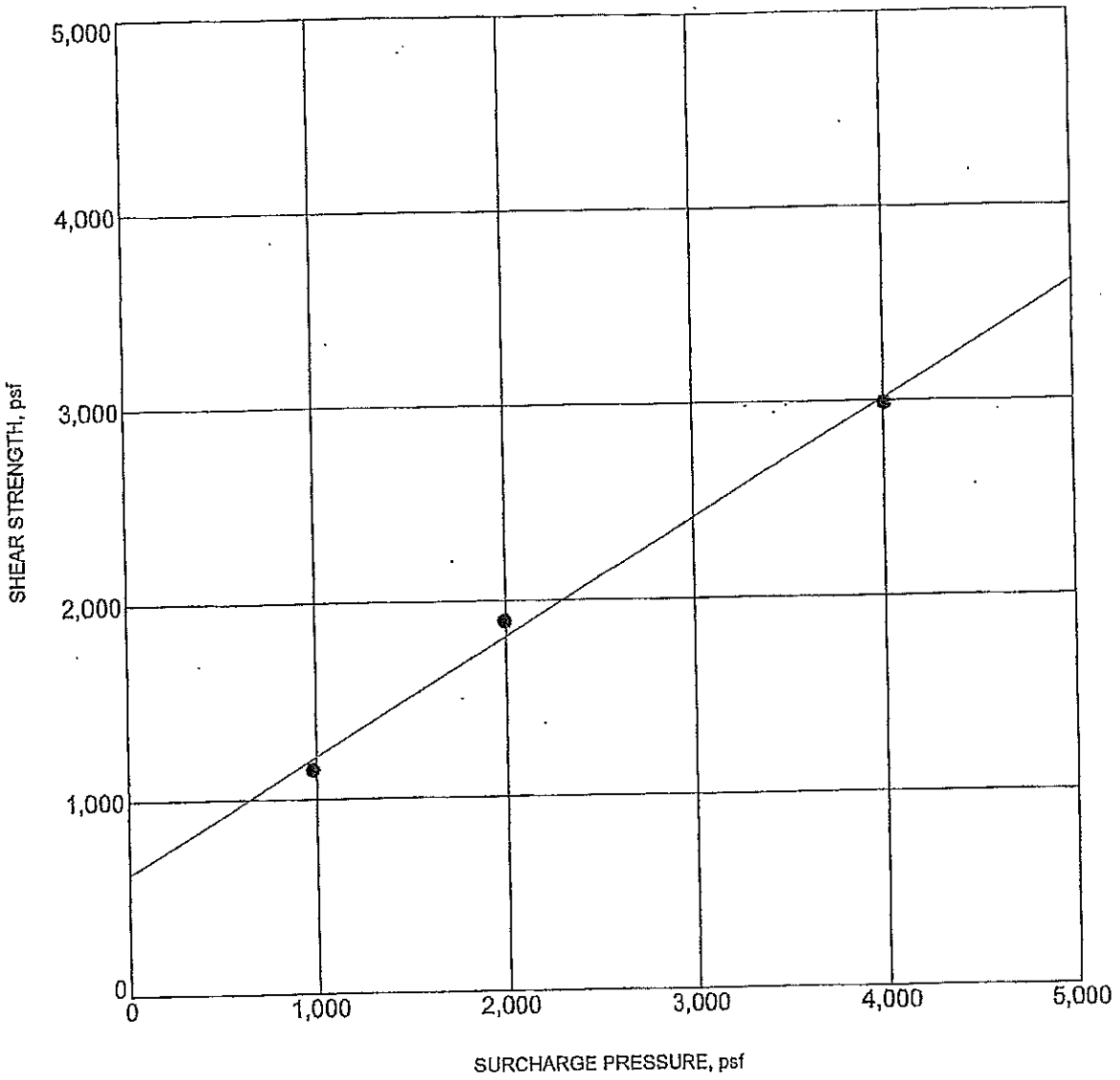
DIRECT SHEAR TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 5



BORING NO. :	BH - 9	DEPTH (ft) :	0.0 - 5.0'
DESCRIPTION :	SANDY SILT (ML)		
COHESION (psf) :	600	FRICTION ANGLE (degrees)	31
MOISTURE CONTENT (%) :	11.3	DRY DENSITY (pcf) :	114.9

NOTE: Ultimate Strength, Sample Remolded to 90% Relative Compaction

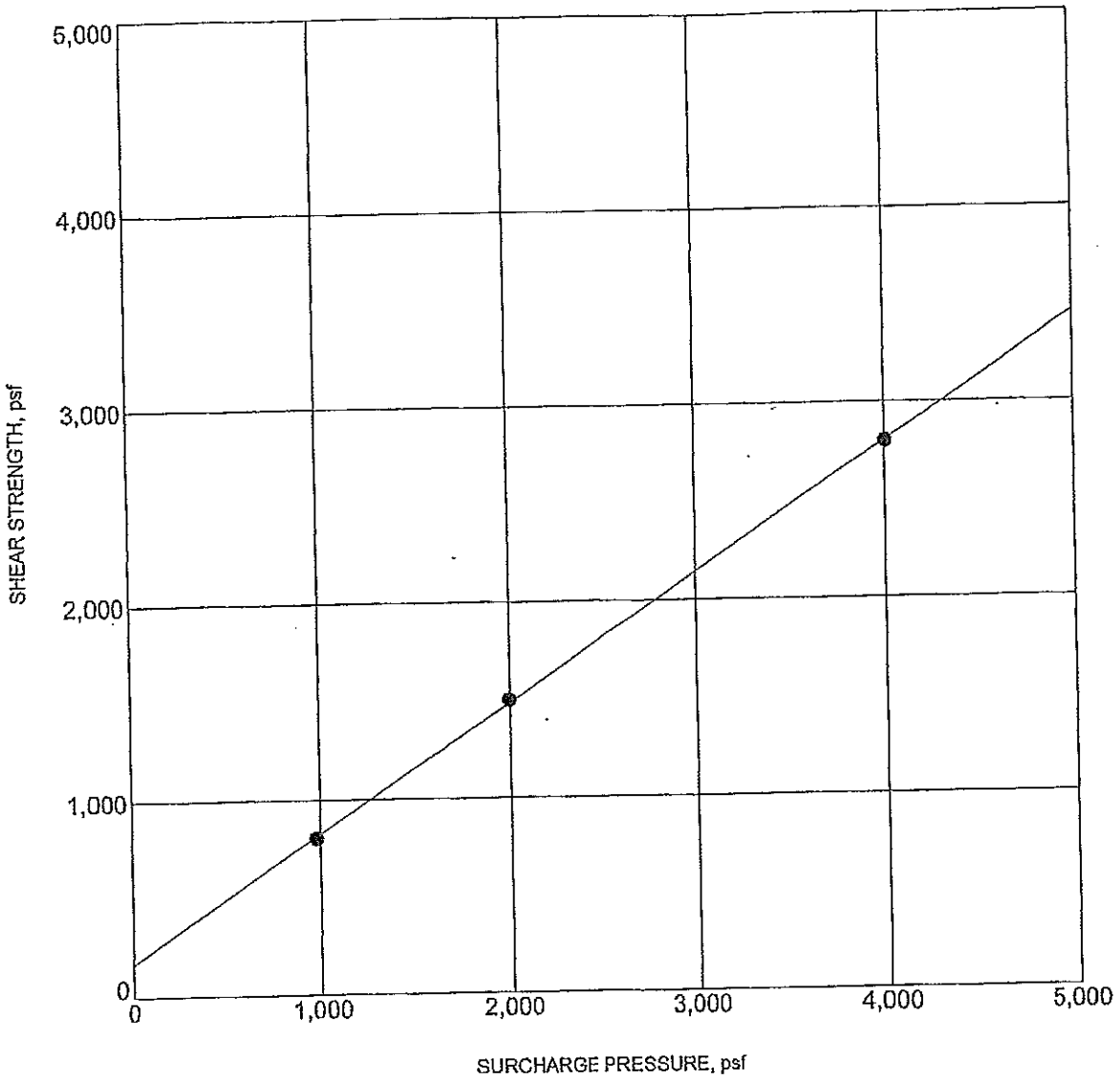
DIRECT SHEAR TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 6



BORING NO. :	BH -15	DEPTH (ft) :	5.0-6.5'
DESCRIPTION :	SAND (SP)		
COHESION (psf) :	150	FRICTION ANGLE (degrees)	33
MOISTURE CONTENT (%) :	2.8	DRY DENSITY (pcf) :	91.4

NOTE: Ultimate Strength.

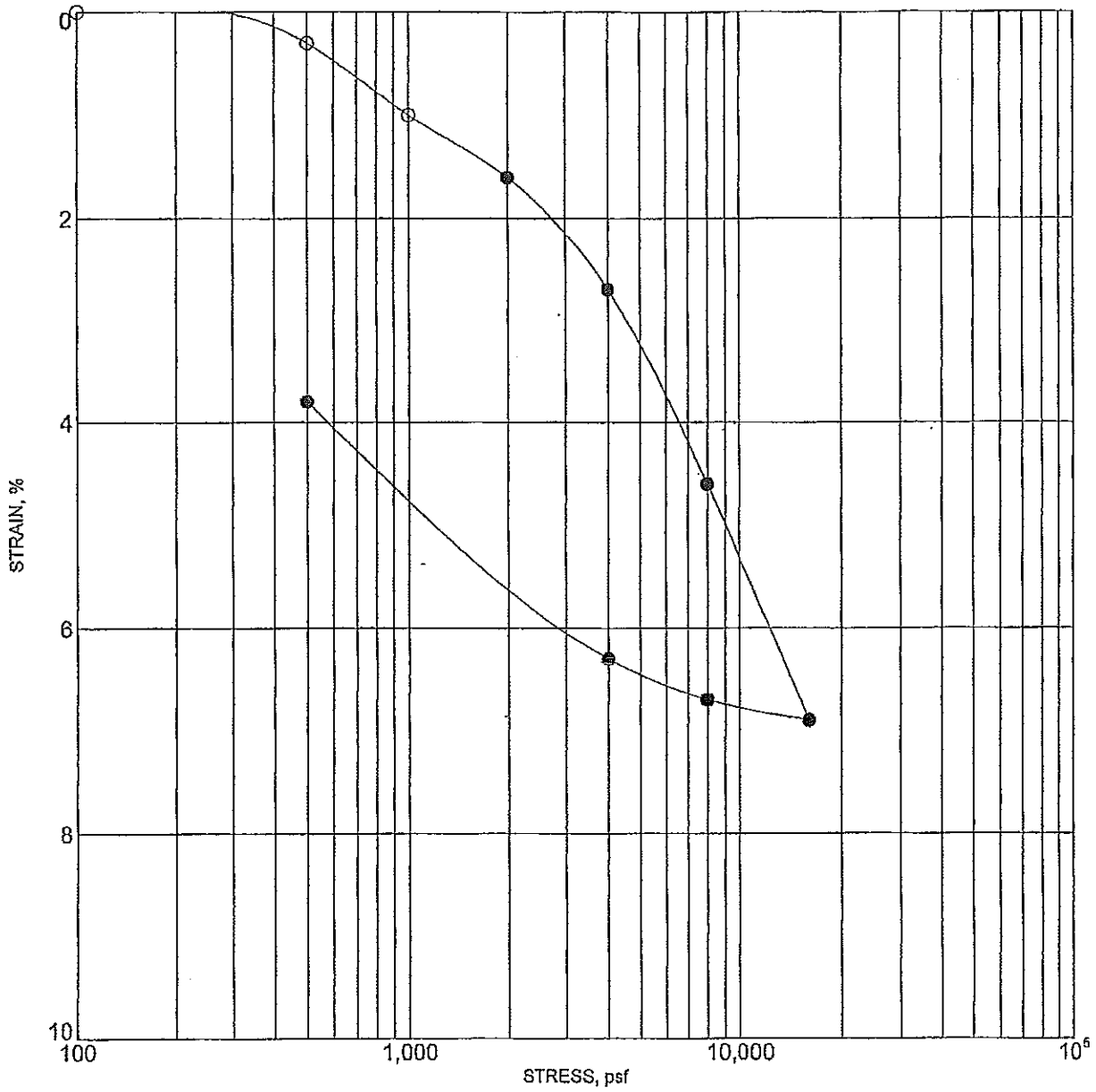
DIRECT SHEAR TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 7



BORING NO. :	BH -11	DEPTH (ft) :	7.0-8.5'
DESCRIPTION :	SILTY SAND (SM)		

	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	PERCENT SATURATION	VOID RATIO
INITIAL	12.3	98.4	48	0.676
FINAL	24.1	102.3	100	0.612

NOTE: Solid Circles Indicate Readigns After Addition of Water

CONSOLIDATION TEST RESULTS

Converse Consultants

ROOSEVELT II ELEMENTARY SCHOOL
San Bernardino, California
For: San Bernardino City Unified School District

Project No. 04-81-156-03

Drawing No. B - 8

APPENDIX C

EARTHWORK SPECIFICATIONS

APPENDIX C

EARTHWORK SPECIFICATIONS

C1.1 Scope of Work

The work includes all labor, supplies and construction equipment required to construct the building pads in a good, workmanlike manner, as shown on the drawings and herein specified. The major items of work covered in this section include the following:

- Site Inspection
- Authority of Geotechnical Engineer
- Site Clearing
- Excavations
- Preparation of Fill Areas
- Placement and Compaction of Fill
- Trench Backfill
- Observation and Testing

C1.2 Site Inspection

1. The Contractor shall carefully examine the site and make all inspections necessary, in order to determine the full extent of the work required to make the completed work conform to the drawings and specifications. The Contractor shall satisfy himself as to the nature and location of the work, ground surface and the characteristics of equipment and facilities needed prior to and during prosecution of the work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the drawings, or between the drawings and specifications must be brought to the Owner's attention in order to clarify the exact nature of the work to be performed.

2. This *Geotechnical Investigation Report* by Converse Consultants may be used as a reference to the surface and subsurface conditions on this project. The information presented in this report is intended for use in design and is subject to confirmation of the conditions encountered during construction. The exploration logs and related information depict subsurface conditions only at the particular time and location designated on the boring logs. Subsurface conditions at other locations may differ from conditions encountered at the exploration locations. In

addition, the passage of time may result in a change in subsurface conditions at the exploration locations. Any review of this information shall not relieve the Contractor from performing such independent investigation and evaluation to satisfy himself as to the nature of the surface and subsurface conditions to be encountered and the procedures to be used in performing his work.

C1.3 Authority of the Geotechnical Engineer

1. The Geotechnical Engineer will observe the placement of compacted fill and will take sufficient tests to evaluate the uniformity and degree of compaction of filled ground.
2. As the Owner's representative, the Geotechnical Engineer will (a) have the authority to cause the removal and replacement of loose, soft, disturbed and other unsatisfactory soils and uncontrolled fill; (b) have the authority to approve the preparation of native ground to receive fill material; and (c) have the authority to approve or reject soils proposed for use in building areas.
3. The Civil Engineer and/or Owner will decide all questions regarding (a) the interpretation of the drawings and specifications, (b) the acceptable fulfillment of the contract on the part of the Contractor and (c) the matters of compensation.

C1.4 Site Clearing

1. Clearing and grubbing shall consist of the removal from building areas to be graded of all existing pavement, utilities, and vegetation.
2. Organic and inorganic materials resulting from the clearing and grubbing operations shall be hauled away from the areas to be graded.

C1.5 Excavations

1. Based on observations made during our field explorations, the surficial soils can be excavated with conventional earthwork equipment.

C1.6 Preparation of Fill Areas

1. All organic material, organic soils, incompetent alluvium, existing fill soils and debris should be removed from the proposed building areas.
2. After the required removals have been made, the exposed native earth materials shall be excavated to provide a zone of structural fill for the support of footings, slabs-on-grade, and exterior flatwork. All loose, soft or disturbed earth materials should be removed from the bottom of excavations before placing structural fill. As a minimum, the on-site soils in the building area and to five (5) feet beyond

the building limits and appendages shall be removed and recompacted to provide at least two (2) feet or equal to footing width, whichever is greater, of properly compacted fill underneath all slabs and underneath all footings. The fill thickness under structures should not vary.

3. The subgrade in all areas to receive fill shall be scarified to a minimum depth of twelve (12) inches, the soil moisture adjusted to at least two (2) percent above optimum for fine-grained soils and within three (3) percent of optimum moisture content for granular soils, and then compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test method. Scarification may be terminated on moderately hard to hard, cemented earth materials with the approval of the Geotechnical Engineer.
4. Compacted fill may be placed on native soils that have been properly scarified and recompacted as discussed above.
5. All areas to receive compacted fill will be observed and approved by the Geotechnical Engineer before the placement of fill.

C1.7 Placement and Compaction of Fill

1. Compacted fill placed for the support of footings, slabs-on-grade, exterior concrete flatwork, and parking areas will be considered structural fill. Structural fill may consist of approved on-site soils or imported fill that meets the criteria indicated below.
2. Fill consisting of selected on-site earth materials or imported soils approved by the Geotechnical Engineer shall be placed in layers on approved earth materials. Soils used as compacted structural fill shall have the following characteristics:
   a. All fill soil particles shall not exceed three (3) inches in nominal size, and shall be free of organic matter and miscellaneous inorganic debris and inert rubble.
   b. Imported fill materials shall have an Expansion Index (EI) less than 20. All imported fill should be compacted to at least 90 percent of the laboratory maximum dry density (ASTM Standard D1557) at about two (2) percent above optimum moisture for fine-grained soils, and within three (3) percent of optimum for granular soils.
3. Fill soils shall be evenly spread in maximum 8-inch lifts, watered or dried as necessary, mixed and compacted to at least the density specified below. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.
4. All fill placed at the site shall be compacted to at least 90 percent of the laboratory maximum dry density as determined by ASTM Standard D1557 test

method. Granular soils shall be moisture conditioned to within three (3) percent, and fine-grained soils to at least two (2) percent above of optimum moisture content. At least the upper 12 inches of subgrade soils underneath the concrete apron, pavement and parking areas should be compacted to at least 95 percent of the laboratory maximum dry density.

5. Fill exceeding five (5) feet in height shall not be placed on native slopes that are steeper than 5:1 horizontal:vertical (H:V). Where native slopes are steeper than 5:1 H:V, and the height of the fill is greater than five (5) feet, the fill shall be benched into competent materials. The height and width of the benches shall be at least two (2) feet.
6. Representative samples of materials being used, as compacted fill will be analyzed in the laboratory by the Geotechnical Engineer to obtain information on their physical properties. Maximum laboratory density of each soil type used in the compacted fill will be determined by the ASTM Standard D1557 method.
7. Fill materials shall not be placed, spread or compacted during unfavorable weather conditions. When site grading is interrupted by heavy rain, filling operations shall not resume until the Geotechnical Engineer approves the moisture and density conditions of the previously placed fill.
8. It shall be the Grading Contractor's obligation to take all measures deemed necessary during grading to provide erosion control devices in order to protect slope areas and adjacent properties from storm damage and flood hazard originating on this project. It shall be the Contractor's responsibility to maintain slopes in their as-graded form until all slopes are in satisfactory compliance with job specifications, all berms have been properly constructed, and all associated drainage devices meet the requirements of the Civil Engineer.

C1.8 Trench Backfill

The following specifications are recommended to provide a basis for quality control during the placement of trench backfill.

1. Trench excavations to receive backfill shall be free of trash, debris or other unsatisfactory materials at the time of backfill placement.
2. Trench backfill shall be compacted to a minimum of 95 percent of the laboratory maximum dry density as per ASTM Standard D1557 test method.
3. Rocks larger than one (1) inch should not be placed within 12 inches of the top of the pipeline or within the upper 12 inches of pavement or structure subgrade. No more than 30 percent of the backfill volume shall be larger than 3/4-inch in largest dimension diameter, and rocks shall be well mixed with finer soil.

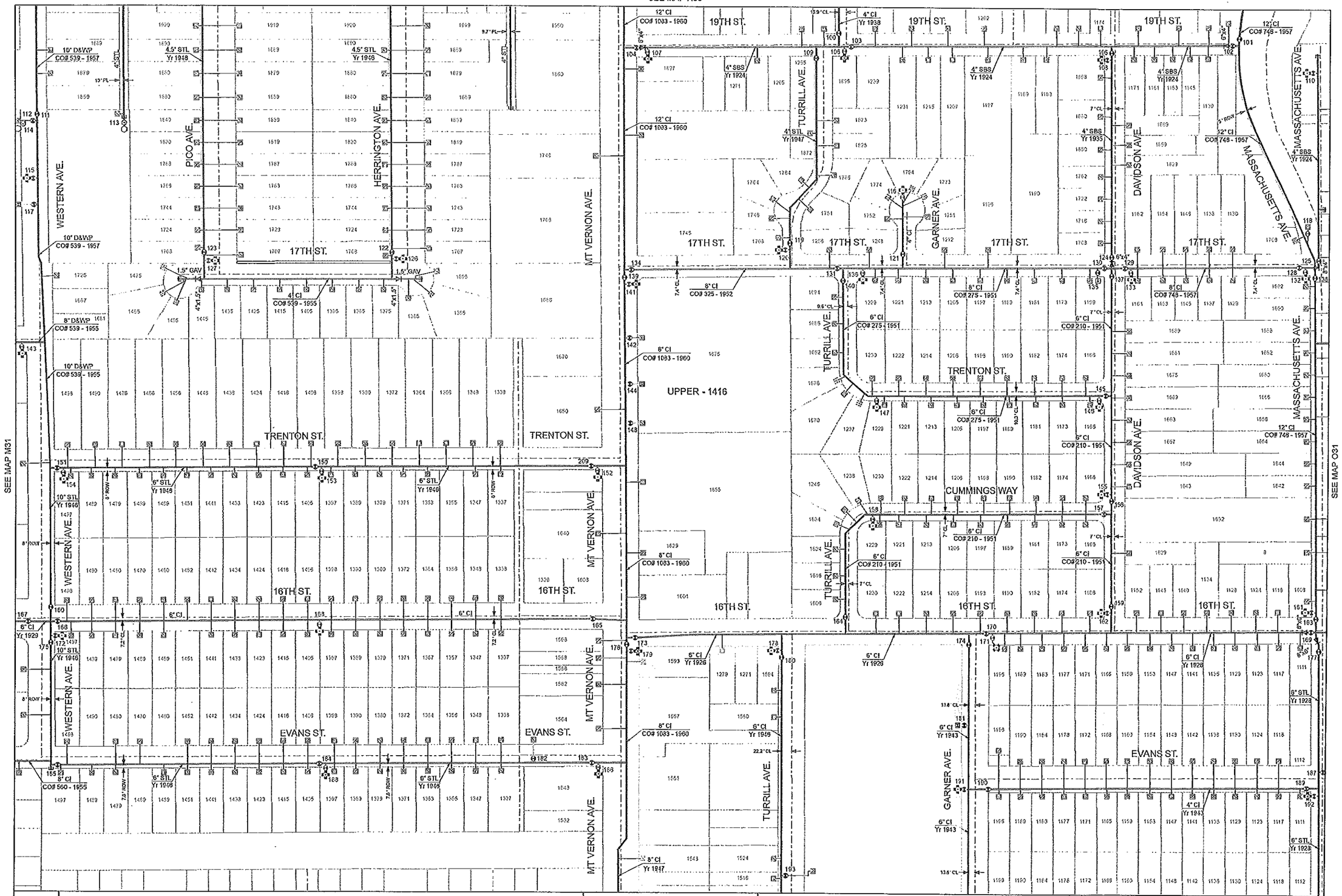
4. The pipe design engineer should select bedding material for the pipe. Bedding materials generally have a Sand Equivalent (SE) greater than or equal to 30, as determined by the ASTM Standard D2419 test method.
5. Trench backfill shall be compacted by mechanical methods, such as sheepsfoot, vibrating or pneumatic rollers, or mechanical tampers, to achieve the density specified herein. The backfill materials shall be brought to within three (3) percent of optimum moisture content for granular soils and above two (2) percent for fine-grained soils, then placed in horizontal layers. The thickness of uncompacted layers should not exceed eight (8) inches. Each layer shall be evenly spread, moistened or dried as necessary, and then tamped or rolled until the specified density has been achieved.
6. The Contractor shall select the equipment and processes to be used to achieve the specified density without damage to adjacent ground and completed work.
7. The field density of the compacted soil shall be measured by the ASTM Standard D1556 or ASTM Standard D2922 test methods or equivalent.
8. Observation and field tests should be performed by Converse during construction to confirm that the required degree of compaction has been obtained. Where compaction is less than that specified, additional compactive effort shall be made with adjustment of the moisture content as necessary, until the specified compaction is obtained.
9. It should be the responsibility of the Contractor to maintain safe conditions during cut and/or fill operations.
10. Trench backfill shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests by the project's geotechnical consultant indicate that the moisture content and density of the fill are as previously specified.

C1.9 Observation and Testing

1. During the process of grading, the Geotechnical Engineer will provide observation of the fill placement operations.
2. Field density tests will be made during grading to provide an opinion on the degree of compaction being obtained by the Contractor. Where compaction of less than specified herein is indicated, additional compactive effort with adjustment of the moisture content shall be made as necessary, until the required degree of compaction is obtained.
3. A sufficient number of field density tests will be performed to provide an opinion to the degree of compaction achieved. In general, density tests will be performed

on each one-foot lift of fill, but not less than one for each 500 cubic yards of fill place.

SEE MAP N30



N31

SCALE: 1" = 200'
NOT FOR CONSTRUCTION USE

0 200 400 Feet

WATER ATLAS BOOK

This Map and accompanying Datasheet represent a visual aid intended to assist San Bernardino Municipal Water Department personnel with the management of Water system facilities. Data provided hereon is not a guarantee of actual field conditions nor a substitute for record drawings and field verification.

April 2011

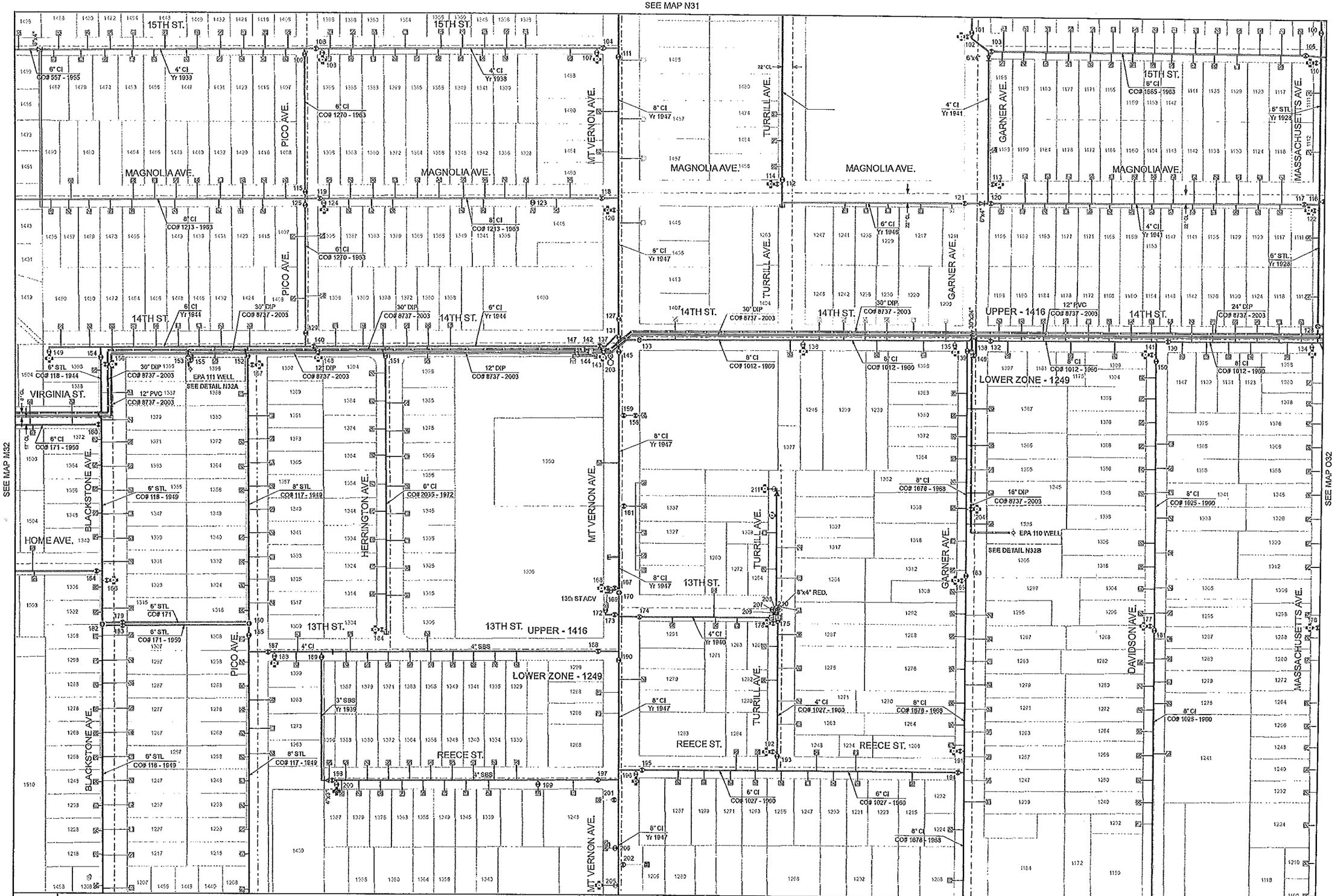
N31

SEE MAP N32

FOR REFERENCE ONLY

R2 (HENRY)

SEE MAP N31



N32 | SCALE: 1" = 200' NOT FOR CONSTRUCTION USE | 0 200 400 Feet | WATER ATLAS BOOK | This Map and accompanying Datasheet represent a visual aid intended to assist San Bernardino Municipal Water Department personnel with the management of Water system facilities. Data provided hereon is not a guarantee of actual field conditions nor a substitute for record drawings and field verification. | February 2011 | N32

SEE MAP N33

FOR REFERENCE ONLY

R2

Valve Data of Tile N31.xls

Valve No.	Old Valve No.	Main Street	Make	Size	Year	Turns to Open	Located From Property	Located From Curb	Comments	Intersecting Street	Located From Property	Located From Curb	Comments	Remarks	Valve Purpose
N31-100	024-102	TURRILL AVE	REN	4	1936	9		2.5 ENW		19TH ST		7 NN			MAIN VALVE
N31-101	024-012	19TH ST	REN	12	1957	39		12 GN		DAVIDSON ST		286.7 ECL			MAIN VALVE
N31-102	024-014	19TH ST	PS	6	1957	19		8.4 NS		DAVIDSON	282.3 ECL				MAIN VALVE
N31-103	024-059	19TH ST	UNK	4	1924	13		8.2 NS		TURRILL AVE		59.5 ESE			MAIN VALVE
N31-104	024-057	19TH ST	REN	6	1924	20		8.5 NS		MT VERNON AVE		7.6 EE			MAIN VALVE
N31-105	024-045	DAVIDSON ST	UNK	4	1935	14		11.4 EW		19TH ST		9.8 SS			MAIN VALVE
N31-106	024-060	19TH ST	UNK	4	1924	14		6.7 NS		TURRILL AVE		27.2 ESE		F H GATE	HYDRANT VALVE
N31-107	024-055	19TH ST	UNK	4	1924	14		7.5 NS		MT VERNON AVE		10.9 EE		F H GATE	HYDRANT VALVE
N31-108	024-046	DAVIDSON ST	UNK	4	1935	14		8 EW		19TH ST		11 SS		F H GATE	HYDRANT VALVE
N31-109	024-153	TURRILL AVE	CHAP	4	1947	15		2.2 WW		19TH ST		10.2 SS			MAIN VALVE
N31-110	024-224	MASSACHUSETTS AVE	CLOW	4	1997			7 EW		MASSACHUSETTS AVE		131 NN		F H GATE	HYDRANT VALVE
N31-111	032-109	WESTERN AVE	MUEL	10	1955	33		23.9 EW		1859 WESTERN		12 SS		RES	MAIN VALVE
N31-112	032-110	WESTERN AVE	PS	4	1973	14		20.9 EW		1859 WESTERN		12.7 SS		4" SER	SERVICE VALVE
N31-113	032-008	ALLEY	UNK	2		10		1.8 WW		GOODLETT ST		370 SS		2" BLOWOFF	BLOWOFF VALVE
N31-114	032-136	WESTERN AVE	UNK	2	1973			4 EW	CLOSED	1859 WESTERN	14.7 SS		RES	2" BLOW OFF	BLOWOFF VALVE
N31-115	032-107	WESTERN AVE	CRANE	6	1955	16		22 EW		17TH ST	334.1 NN			F H GATE	HYDRANT VALVE
N31-116	024-152	GARNER AVE	REN	4		10		8.3 EW		ST END	3 SFP			F H GATE	HYDRANT VALVE
N31-117	032-111	WESTERN AVE	MUEL	6	1957			22 EW		17TH ST	304.5 NCL			6" SER	FIRE VALVE
N31-118	024-188	MASSACHUSETTS AVE	AVK	2	1992	6			IN METER BOX	17TH ST		21.5 NN		2" DOM SER	SERVICE VALVE
N31-119	024-154	TURRILL AVE	REN	4		9		7.1 EW		17TH ST		10.5 NN			MAIN VALVE
N31-120	024-151	TURRILL AVE	PS	4		14		1.8 EW		17TH ST		1.0 NN		F H GATE	HYDRANT VALVE
N31-121	024-127	GARNER	PS	4		13		7.9 EW		17TH ST		0.4 NN			MAIN VALVE
N31-122	024-148	HERRINGTON AVE	REN	4	1946	10		14.4 WW		17TH ST		12.3 NN			MAIN VALVE
N31-123	032-051	PICO AVE	REN	4	1955	13		15.9 WW		17TH ST		13 NN			MAIN VALVE
N31-124	024-121	DAVIDSON AVE	CRANE	4	1935	13		6 ESW		17TH ST		11.4 NS			MAIN VALVE
N31-125	024-016	MASSACHUSETTS AVE	PS	4	1957	14		6.3 ENW		17TH ST		8.9 NS			MAIN VALVE
N31-126	024-149	HERRINGTON AVE	REN	4	1946	9		13.5 WW		17TH ST		8.4 NN		F H GATE	HYDRANT VALVE
N31-127	032-052	PICO AVE	UNK	4	1955	8		14.9 WW		17TH ST		7.5 NN		F H GATE	HYDRANT VALVE
N31-128	024-030	17TH ST	REN	8	1957	27		7.5 NS		MASSACHUSETTS AVE		15.2 WNW			MAIN VALVE
N31-129	024-036	17TH ST	CRANE	8	1957	26		8 NS		DAVIDSON ST		45.6 EW			MAIN VALVE
N31-130	024-176	17TH ST	CHAP	8	1951	25		8.4 NS		DAVIDSON AVE		9.2 WW			MAIN VALVE
N31-131	024-181	17TH ST	CRANE	8	1951	23		8.4 NS		TURRILL AVE		4.6 WW			MAIN VALVE
N31-132	024-029	17TH ST	PS	6	1957	20		4.9 NS		MASSACHUSETTS AVE		11.9 WW		F H GATE	HYDRANT VALVE
N31-133	024-035	17TH ST	CHAP	4	1957	15		5 NS		DAVIDSON ST		50 EW		F H GATE	HYDRANT VALVE
N31-134	024-188	17TH ST	PS	8		27		7.2 NS		MT VERNON AVE		7.3 WE			MAIN VALVE
N31-135	024-222	17TH ST	AVK	0.75	1993				IN METER BOX	DAVIDSON AVE		17 WW		SAMPLING STA	SAMPLING VALVE
N31-136	024-180	17TH ST	PS	4	1951	13		5.2 NS		TURRILL AVE		8.4 EE		F H GATE	HYDRANT VALVE
N31-137	024-171	DAVIDSON AVE	PS	6	1951	20		9 EW		17TH ST		8.8 SS			MAIN VALVE
N31-138	024-028	MASSACHUSETTS AVE	REN	12	1957	39		4.9 EW		17TH ST		23.6 SS			MAIN VALVE
N31-139	024-109	MT VERNON AVE	MUEL	8		26		9.6 WE		17TH ST		10.3 SS			MAIN VALVE
N31-140	024-162	TURRILL AVE	REN	6	1951	20		5.4 EW		17TH ST		9.7 SS			MAIN VALVE
N31-141	024-093	MT VERNON AVE	CHAP	6		26		7.4 WE		17TH ST		12.4 SS		F H GATE	HYDRANT VALVE
N31-142	024-017	MT VERNON AVE	UNK	2		10		1 EE		17TH ST		133 SS	CLOSED	DOMESTIC	SERVICE VALVE
N31-143	032-105	17TH ST	REN	4	1957	10		10.5 NS		WESTERN AVE		8.1 WNW		F H GATE	HYDRANT VALVE
N31-144	024-068	MT VERNON AVE	PS	6		25		7 WE		17TH ST		240.8 SS	CLOSED	FIRE SER	FIRE VALVE
N31-145	024-172	TRENTON ST	CHAP	6	1951	24		4.7 NS		DAVIDSON AVE		9.8 WW			MAIN VALVE
N31-146	024-184	TRENTON ST	PS	4	1951	14		2.1 NS		DAVIDSON AVE		13.1 WW		F H GATE	HYDRANT VALVE
N31-147	024-183	TRENTON ST	CRANE	4	1951	14		1.6 NS		TURRILL AVE		58.9 EE		F H GATE	HYDRANT VALVE
N31-148	024-227	MT VERNON AVE	MUEL	4				10 WE		TRENTON ST		54 NN		4" FIRE SERV.	FIRE VALVE
N31-149	024-144	TRENTON ST	CRANE	6	1946	18		2 SS	REPLACED BY N31-209	MT VERNON AVE		8.3 WW	REPLACED		MAIN VALVE
N31-150	024-233	TRENTON ST	MUEL	6	2008			1.4 SS		MT VERNON AVE	2.1 W		FH GATE 024-146	MAIN VALVE	MAIN VALVE
N31-151	032-315	TRENTON ST		6	2008					WESTERN AVE					MAIN VALVE
N31-152	024-143	TRENTON ST	CRANE	6	1946	20		5.5 SS		MT VERNON AVE		1.1 WW		F H GATE	HYDRANT VALVE
N31-153	024-146	TRENTON ST	REN	4	1946	9		2.4 SS		MT VERNON AVE		652.3 WW		F H GATE	HYDRANT VALVE
N31-154	032-314	TRENTON ST		6	2008					WESTERN AVE					HYDRANT VALVE
N31-155	024-173	DAVIDSON AVE	REN	4	1951	9		2 EW		CUMMINGS WAY		16.5 NN		F H GATE	HYDRANT VALVE
N31-156	024-174	DAVIDSON AVE	CRANE	6	1951	18		8.1 EW		CUMMINGS WAY		4.7 NN			MAIN VALVE
N31-157	024-175	CUMMINGS WAY	CRANE	8	1951	18		8.1 NS		DAVIDSON AVE		9.8 WW			MAIN VALVE

Valve Data of Tile N31.xls

Valve No.	Old Valve No.	Main Street	Make	Size	Year	Turns to Open	Located From Property	Located From Curb	Comments	Intersecting Street	Located From Property	Located From Curb	Comments	Remarks	Valve Purpose
N31-158	024-178	CUMMINGS WAY	REN	4	1951	10		2.4 NS		TURRILL AVE		36.5 EE		F H GATE	HYDRANT VALVE
N31-159	024-176	DAVIDSON AVE	CRANE	6	1951	18		7.9 EW		16TH ST		10.5 NN			MAIN VALVE
N31-160	032-027	WESTERN AVE	REN	10	1946	33		2.1 ENE		16TH ST		9.8 NNE			MAIN VALVE
N31-161	024-037	MASSACHUSETTS AVE	PS	6	1957	20		2.2 EW		16TH ST		12.1 NN		F H GATE	HYDRANT VALVE
N31-162	024-177	DAVIDSON AVE	REN	4	1951	14		0.9 WW		16TH ST		2.2 NN		F H GATE	HYDRANT VALVE
N31-163	024-038	MASSACHUSETTS AVE	REN	12	1957	30		4.5 EW		16TH ST		9 NN			MAIN VALVE
N31-164	024-179	TURRILL AVE	CRANE	6	1951	18		8 EW		16TH ST		10.2 NN			MAIN VALVE
N31-165	024-054	16TH ST	UNK	0	2008			12.6 NS		MT VERNON AVE		9.2 WW			MAIN VALVE
N31-166	032-028	16TH ST	CRANE	0		18		12.9 NOE		WESTERN AVE		10.9 ENE			MAIN VALVE
N31-167	032-026	16TH ST	CRANE	6	1920	17		24.0 NSW		WESTERN AVE		5.0 WNW			MAIN VALVE
N31-168	024-142	16TH ST	REN	4		9		7.5 NS		MT VERNON AVE		054.0 WW		F H GATE	HYDRANT VALVE
N31-169	024-039	16TH ST	REN	8	1957	26		12.8 NS		MASSACHUSETTS AVE		8.0 WW			MAIN VALVE
N31-170	024-048	16TH ST	PS	6	1926	20	27.3 NFP			GARNER DR	15.6 ECL			5.5' WFP	MAIN VALVE
N31-171	024-047	16TH ST	UNK	4	1926	13	25.0 NFP			GARNER DR	17.6 ECL			F H GATE	HYDRANT VALVE
N31-172	032-024	WESTERN AVE	REN	4	1946	10		3.4 ENE		16TH ST		3.2 SSE		F H GATE	HYDRANT VALVE
N31-173	024-052	16TH ST	UNK	6	1926	23		7.5 NS		MT VERNON AVE		7.1 EE			MAIN VALVE
N31-174	024-040	GARNER DR	UNK	6	1943	10		0.2 EW		16TH ST		0.4 SS			MAIN VALVE
N31-175	032-025	WESTERN AVE	REN	10	1946	33		2.1 ENE		16TH ST		10.5 SSE			MAIN VALVE
N31-176	024-050	MT VERNON AVE	MUEL	8		27		10.4 WE		16TH ST		19.4 SSE			MAIN VALVE
N31-177	024-000	MASSACHUSETTS AVE	UNK	6	1926	26		8.2 EW		16TH ST		12.1 SS			MAIN VALVE
N31-178	024-135	TURRILL AVE	CHAP	4	1940	14		5.0 WW		16TH ST		3.4 SS		F H GATE	HYDRANT VALVE
N31-179	024-051	MT VERNON AVE	CRANE	6		19		7.4 WE		16TH ST		23.8 SSE		F H GATE	HYDRANT VALVE
N31-180	024-130	TURRILL AVE	CRANE	6	1946	20		2 WW		16TH ST		10.7 SS			MAIN VALVE
N31-181	024-200	GARNER	PS	4	1973	15		5.5 EW		EVANS ST		100 NN		4" FIRE SER	FIRE VALVE
N31-182	024-228	EVANS ST	UNK	2	2002			2.2 NS		MT VERNON AVE		107 WW		2" FIRE SER.	FIRE VALVE
N31-183	024-138	EVANS ST	CRANE	6	1946	17		1.8 SS		MT VERNON AVE		8.7 WW			MAIN VALVE
N31-184	024-141	EVANS ST	CRANE	6	1946	17		1.2 SS		MT VERNON AVE	2.5 WFP				MAIN VALVE
N31-185	032-023	EVANS ST	CRANE	6	1946	17		1.8 SS		WESTERN AVE		10.0 EE			MAIN VALVE
N31-186	024-130	EVANS ST	CRANE	4	1946	14		4.6 SS		MT VERNON AVE		1.5 WW		F H GATE	HYDRANT VALVE
N31-187	024-027	EVANS ST	PS	6	1974	21		4 SN		MASSACHUSETTS AVE		8.5 EW			MAIN VALVE
N31-188	024-140	EVANS ST	REN	4	1946	9		1.8 SS		MT VERNON AVE		652.1 WW		F H GATE	HYDRANT VALVE
N31-189	024-026	EVANS ST	REN	4	1943	8		1.7 SS		MASSACHUSETTS AVE		12.2 WW			MAIN VALVE
N31-190	024-125	EVANS ST	CRANE	4	1943	9		2.5 SS		GARNER		50.5 EW			MAIN VALVE
N31-191	024-126	GARNER	CRANE	4	1943	9		3.2 EW		EVANS ST		2.8 SS		F H GATE	HYDRANT VALVE
N31-192	024-025	MASSACHUSETTS AVE	UNK	4	1928	14		6 EW		EVANS ST		11.5 SS		F H GATE	HYDRANT VALVE
N31-193	024-201	TURRILL AVE	PS	3	1974	11		2.2 EW		MAGNOLIA		425.5 NN		3" DOM SER	SERVICE VALVE
N31-194		TURRILL AVE	MUEL	12	2010			6 EW		19TH ST		11.5 NS			MAIN VALVE
N31-195		19TH ST	MUEL	4	2010			8.5 NS		TURRILL AVE		4 EW			MAIN VALVE
N31-196		19TH ST	MUEL	12	2010			3 NS		TURRILL AVE		14 EW			MAIN VALVE
N31-197		19TH ST	MUEL	6	2010			2 NS		TURRILL AVE		37 EGE			HYDRANT VALVE
N31-198		19TH ST	MUEL	6	2010			1.5 NS		DAVIDSON AVE		23 WW			HYDRANT VALVE
N31-199		19TH ST	MUEL	12	2010			3 NS		DAVIDSON AVE		1 EW			MAIN VALVE
N31-200		DAVIDSON AVE	MUEL	12	2010			3 EW		19TH ST		1.5 NS			MAIN VALVE
N31-201		19TH ST	MUEL	6	2010			3 NS		DAVIDSON AVE		14.5 EW			MAIN VALVE
N31-202		19TH ST	MUEL	6	2010			2.5 NS		19TH ST TERMINUS		2.5 WE			HYDRANT VALVE
N31-203		DAVIDSON AVE	MUEL	6	2010			1.5 EW		17TH ST		12 NN			HYDRANT VALVE
N31-204		DAVIDSON AVE	MUEL	12	2010			3 EW		17TH ST		19.5 SN			MAIN VALVE
N31-205		17TH ST	MUEL	12	2010			3 NS		DAVIDSON AVE		14.3 EW			MAIN VALVE
N31-206		17TH ST	MUEL	6	2010			3 NS		MASSACHUSETTS AVE		14.5 WW			HYDRANT VALVE
N31-207		17TH ST	MUEL	12	2010			3 NS		MASSACHUSETTS AVE		0 W			MAIN VALVE
N31-208		MASSACHUSETTS AVE	MUEL	4	2010			8.5 EW		17TH ST		6 NS			MAIN VALVE
N31-209		TRENTON ST	CLOW	6	2008			1.9 SS		MT VERNON AVE		8.2 WW			MAIN VALVE

Valve Data of Tile N32.xls

Valve No.	Old Valve No.	Main Street	Make	Size	Year	Turns to Open	Located From Property	Located From Curb	Comments	Intersecting Street	Located From Property	Located From Curb	Comments	Remarks	Valve Purpose
N32-100	024-023	MASSACHUSETTS	UNK	6	1928	26		7.9 EW		15TH ST		12.1 NN			MAIN VALVE
N32-101	024-042	GARNER DR	PS	6	1943	20		5.4 EW		15TH ST		3.5 NN		F H GATE	MAIN VALVE
N32-102	024-124	GARNER	CRANE	6	1943	13		6.1 EW		15TH ST		10.5 NN			HYDRANT VALVE
N32-103	024-041	15TH ST	PS	6	1968	21		4 NS		GARNER DR		44 EW			MAIN VALVE
N32-104	024-103	15TH ST	CRANE	4	1938	9		7.7 NS		MT VERNON		9.1 WW			MAIN VALVE
N32-105	024-022	15TH ST	MUEL	6	1936	21		4 NS		MASSACHUSETTS		15.6 WW			MAIN VALVE
N32-106	024-106	15TH ST	CHAP	4	1938	14		7.2 NS		PICO		10.8 EE			MAIN VALVE
N32-107	024-104	15TH ST	CHAP	4	1938	14		4.2 NS		MT VERNON		12.2 WW		F H GATE	HYDRANT VALVE
N32-108	024-105	15TH ST	CHAP	4	1938	14		5 NS		PICO		12.9 EE		F H GATE	HYDRANT VALVE
N32-109	024-191	PICO AVE	CHAP	6	1963	25		4.6 EW		15TH ST		2 SS			MAIN VALVE
N32-110	024-021	MASSACHUSETTS	UNK	4	1928	14		6.5 EW		15TH ST		11.7 SS		F.H. GATE	HYDRANT VALVE
N32-111	024-155	MT VERNON	REN	8		27		25.3 EW		15TH ST		10 SS			MAIN VALVE
N32-112	023-108	TURRILL	REN	6	1946	20	5.1 EFP			MAGNOLIA	7.5 NFP				MAIN VALVE
N32-113	023-184	GARNER	CRANE	4	1941	8		8.7 EE		MAGNOLIA		1.9 NN		F H GATE	HYDRANT VALVE
N32-114	023-109	TURRILL	REN	4	1946	9	2.2 EFP			MAGNOLIA	22.5 N		CL	F H GATE	HYDRANT VALVE
N32-115	023-257	PICO ST	PS	6	1963	20		3.7 EW		MAGNOLIA		11.2 NS			MAIN VALVE
N32-116	023-065	MAGNOLIA	PC	6	1974	21		4.2 NS		MASSACHUSETTS		8.1 EW			MAIN VALVE
N32-117	023-151	MAGNOLIA	CRANE	4	1941	9		1.5 SS		MASSACHUSETTS		12.4 WW			MAIN VALVE
N32-118	023-130	MAGNOLIA	MUEL	8	1962	24		8.1 NS		MT VERNON		11.1 WW			MAIN VALVE
N32-119	023-135	MAGNOLIA	MUEL	8	1962	26		8 NS		PICO		9.3 EE			MAIN VALVE
N32-120	023-163	MAGNOLIA	CRANE	4	1941	9		1.8 SS		GARNER			ON E PL		MAIN VALVE
N32-121	023-200	MAGNOLIA	REN	6	1946	20		1.7 SS		GARNER			ON W PL		MAIN VALVE
N32-122	023-066	MASSACHUSETTS	UNK	4	1960	13		9.3 EW		MAGNOLIA		10 SS		F H GATE	HYDRANT VALVE
N32-123	023-326	MAGNOLIA AVENUE	MUEL	4	2006			7.1 NS		MT VERNON		132 WW		4" FIRE SERVICE	FIRE VALVE
N32-124	023-134	MAGNOLIA	MUEL	6	1967			7 NS		PICO		12 EE		F H GATE	HYDRANT VALVE
N32-125	023-256	PICO ST	PS	6	1963	20		3.7 EW		MAGNOLIA		5.2 NS			MAIN VALVE
N32-126	023-132	MT VERNON	CRANE	6	1947	20		21.9 EW		MAGNOLIA		10.4 SS		F H GATE	HYDRANT VALVE
N32-127	023-127	MT VERNON	REN	8	1947	27		25.3 EW		14TH ST		10.8 NNW			MAIN VALVE
N32-128	023-061	MASSACHUSETTS	UNK	6	1928	25		7.2 EW		14TH ST		10.2 NN		UPPER/LOWER	ZONE VALVE
N32-129	023-255	PICO ST	CHAP	6	1963	27		4.3 EW		14TH ST		12 NN			MAIN VALVE
N32-130	023-071	14TH ST	CHAP	8	1960	27		26.6 SN		DAVIDSON		10.9 EE			MAIN VALVE
N32-131	023-128	MT VERNON	REN	8	1947	27		25 EW		14TH ST		10.8 SNW			MAIN VALVE
N32-132	023-090	14TH ST	REN	8	1960	27		27.0 SN		GARNER		11.9 EE			MAIN VALVE
N32-133	023-125	14TH ST	REN	8	1960	27		13.2 NS		MT VERNON		9.0 EE		UPPER/LOWER	ZONE VALVE
N32-134	023-060	14TH ST	CHAP	6	1960	27		30 SN		MASSACHUSETTS		21.0 WW		F H GATE	HYDRANT VALVE
N32-135	023-092	14TH ST	REN	4	1960	19		30.3 SN		GARNER		25 WW		F H GATE	HYDRANT VALVE
N32-136	023-093	14TH ST	REN	4	1960	9	11.6 NFP			GARNER		371.3 WW		F.H. GATE	HYDRANT VALVE
N32-137	023-129	14TH ST	REN	6	1944	21		12.7 NS		MT VERNON		5.9 WW			MAIN VALVE
N32-138	023-362	14TH STREET	UNK	16	2003			21.5 WE		GARNER AVENUE		9.5 SS		RAW WATER MAIN (CONNECTOR LINE)	MAIN VALVE
N32-139	023-091	GARNER	CRANE	8	1968	17		4 EW		14TH ST		8.6 SSW			MAIN VALVE
N32-140	023-191	14TH ST	REN	6	1944	21		13.2 NS		PICO	2.4 WFP				MAIN VALVE
N32-141	023-073	DAVIDSON	MUEL	4	1960	14		5.1 EW		14TH ST		52.5 SN		F H GATE	HYDRANT VALVE
N32-142	023-298	14TH STREET	UNK	20	2003			10.5 NS		MT VERNON AVENUE		9.5 WW		RAW WATER MAIN	MAIN VALVE
N32-143	023-190	14TH ST	CHAP	4	1944	14		9.9 NS		MT VERNON		9.3 WW		F H GATE	HYDRANT VALVE
N32-144	023-301	14TH STREET	UNK	6	2003			7 NS		MT VERNON AVENUE		5.5 WW		RAW WATER MAIN	AIRRELEASE VALVE
N32-145	023-126	MT VERNON	REN	8	1947	27		24.9 EW		14TH ST		4.8 SSW			MAIN VALVE
N32-146	023-303	14TH STREET	UNK	12	2003			9.5 SS		GARNER AVENUE		18 WE		RAW WATER MAIN (WELL FLUSH LINE)	MAIN VALVE
N32-147	023-299	14TH STREET	UNK	12	2003			5 NS		MT VERNON AVENUE		15.5 WW		RAW WATER MAIN (DRAIN LINE)	MAIN VALVE
N32-148	023-192	14TH ST	REN	4	1944	9		10.3 NS		PICO			ON E PL	F H GATE	HYDRANT VALVE
N32-149	031-053	14TH ST	PS	4	1944	14		10 NS		WESTERN	14 E		END OIST	F H GATE	HYDRANT VALVE
N32-150	023-072	DAVIDSON	MUEL	8	1960	26		8 EW		14TH ST		50 SN			MAIN VALVE
N32-151	023-264	14TH ST	PS	6	1972	21		12.2 NS		HERRINGTON		7.6 EW			MAIN VALVE
N32-152	023-212	PICO ST	CRANE	6	1940	16		3.3 WW		14TH ST		3.2 SS			MAIN VALVE
N32-153	023-296	14TH STREET	UNK	16	2003			10 SS		PICO STREET		130 WW		RAW WATER MAIN (CONNECTOR LINE)	MAIN VALVE

Valve Data of Tile N32.xls

Valve No.	Old Valve No.	Main Street	Make	Size	Year	Turns to Open	Located From Property	Located From Curb	Comments	Intersecting Street	Located From Property	Located From Curb	Comments	Remarks	Valve Purpose
N32-154	031-076	BLACKSTONE	CRANE	6	1949	16		5.3 WW		14TH ST		9.4 SS			MAIN VALVE
N32-155	023-297	14TH STREET	UNK	12	2003			11.5 SS		PICO STREET		136 WW		RAW WATER LINE (DRAIN CONNECTOR LINE)	MAIN VALVE
N32-156	031-075	BLACKSTONE	CRANE	4	1949	14		4.4 WW		14TH ST		11 SS		F H GATE	HYDRANT VALVE
N32-157	023-211	PICO ST	CRANE	4	1949	9		2.3 WW		14TH ST		9.7 SS		F H GATE	HYDRANT VALVE
N32-158	023-272	MT VERNON	AVK	2	1972	0.5			IN METER BOX	14TH ST		137 SSE		2" DOM SER	SERVICE VALVE
N32-159	023-271	MT VERNON	UNK	2	1972	8			IN METER BOX	14TH ST		137 SSE		2" DOM SER	SERVICE VALVE
N32-160	031-083	VIRGINIA	PS	6	1959	20		1.9 SS		BLACKSTONE		9.9 WW			MAIN VALVE
N32-161	023-131	MT VERNON	REN	4		13		36.6 WE		13TH ST		215 NNE		SERVICE	SERVICE VALVE
N32-162	023-202	TURRILL	UNK	2	1940	7		2.2 WW		SN EDGE RES 132	2			BLOW OFF GATE	HYDRANT VALVE
N32-163	023-080	GARNER	PS	8	1968	27		4 EW		FIRE HYDRANT	5.5 N		GATE 08 SEC 23		MAIN VALVE
N32-164	031-084	HOME AVENUE	PS	6	1950	20		1.7 SS		BLACKSTONE		9.3 WW			MAIN VALVE
N32-165	023-068	GARNER	PS	6	1968	21		2.8 EW		REECE		400 NN		F H GATE	HYDRANT VALVE
N32-166	031-073	BLACKSTONE	CRANE	4	1949	9		4.5 WW		HOME AVENUE		12.5 SS		F H GATE	HYDRANT VALVE
N32-167	023-267	MT VERNON	PS	6	1972	21		23.9 EW		13TH ST		5.1 NNE		CLA-VALVE STA.	MAIN VALVE
N32-168	023-266	MT VERNON	PS	6	1972	21		3.7 EW		13TH ST		5.1 NNE		CLA-VALVE STA.	HYDRANT VALVE
N32-169	023-268	MT VERNON	PS	6	1972	21		7.7 EW		13TH ST		4.3 NNE			MAIN VALVE
N32-170	023-270	MT VERNON	PS	8	1972			25 EW		13TH ST		2 NNE		UPPER/LOWER	ZONE VALVE
N32-171	023-133	TURRILL	CRANE	4	1946	13	22.2 WCL			13TH ST		9.4 NN			MAIN VALVE
N32-172		MT VERNON AVE		8	1978					13TH ST					MAIN VALVE
N32-173	023-269	MT VERNON	UNK	6	1978			24 EW		13TH ST		2.5 NOE			MAIN VALVE
N32-174	023-116	13TH ST	CHAP	4	1940	15		1.3 SS		MT VERNON AVE		9.8 EE			MAIN VALVE
N32-175	023-251	TURRILL	PS	4	1960	14		13 EW		13TH ST		8.3 SS			MAIN VALVE
N32-176	023-055	MASSACHUSETTS	PS	6	1968	21		2.8 EW		14TH ST		633 SS		F H GATE	HYDRANT VALVE
N32-177	023-070	DAVIDSON	REN	4	1960	10		4.4 EW		BASELINE		659 NN		F H GATE	HYDRANT VALVE
N32-178	023-171	THIRTEENTH	PS	4	1960	14		10.7 SS		TURRILL AVE		12.2 EW		F H GATE	HYDRANT VALVE
N32-179	031-086	BLACKSTONE	PS	6	1950	20		10.8 EE		HOME AVE		122.2 SS			MAIN VALVE
N32-180	023-105	PICO ST	REN	8	1949	27		3.5 WW		THIRTEENTH		44.3 NN		UPPER/LOWER	ZONE VALVE
N32-181	023-098	DAVIDSON	REN	8	1960	27		7.3 EW		BASELINE		655.5 NN			MAIN VALVE
N32-182	031-085	BLACKSTONE	PS	6	1949			1.5 WW		HOME AVENUE		123.3 SS		UPPER/LOWER	ZONE VALVE
N32-183	031-087	BLACKSTONE	PS	6	1950	20		10.8 EE		HOME AVENUE		123.6 SS			MAIN VALVE
N32-184	023-265	HERRINGTON	PS	6	1972	21		6.7 EW		13TH ST		21.9 NN		F H GATE	HYDRANT VALVE
N32-185	023-210	PICO ST	REN	8	1949	26		3.7 WW		13TH ST		9.4 NN			MAIN VALVE
N32-186	023-122	13TH ST	UNK	4		14		7.6 NS		MT VERNON		9 WW			MAIN VALVE
N32-187	023-209	13TH ST	CRANE	4		10		8 NS		PICO ST		7.0 EE			MAIN VALVE
N32-188	023-208	13TH ST	CHAP	4		14		5.5 NS		PICO ST		10.5 EE		F H GATE	HYDRANT VALVE
N32-189	023-137	13TH ST	CHAP	3	1939	10		3.4 SS		PICO		137.4 EE			MAIN VALVE
N32-190	023-123	MT VERNON	REN	8	1947	27		25.6 EW		13TH ST		10.5 SSW			MAIN VALVE
N32-191	023-065	GARNER	PS	6	1968	21		3.4 EW		REECE ST		14.5 NN		F H GATE	HYDRANT VALVE
N32-192	023-250	TURRILL AVE	REN	4	1960	10		10.6 EW		REECE ST		10.5 NN			HYDRANT VALVE
N32-193	023-118	TURRILL AVE	REN	4	1960	10		13.3 EW		REECE ST		6 NN			MAIN VALVE
N32-194	023-087	REECE ST	PS	6	1968	21		7 NS		GARNER		3.1 EW			MAIN VALVE
N32-195	023-119	REECE ST	REN	6	1960	19		8 NS		MT VERNON AVE		10.9 EE			MAIN VALVE
N32-196	023-120	REECE ST	REN	6	1960	20		5.9 NS		MT VERNON AVE		8.5 EE		F H GATE	HYDRANT VALVE
N32-197	023-330	REECE ST	CLOW	4	2003			6.2 NS		MT VERNON AVE		10.2 WW			MAIN VALVE
N32-198	023-178	REECE ST	CHAP	4		14		8.1 NS		END OF ST	0.7 WFP				MAIN VALVE
N32-199	023-225	REECE ST	CRANE	3	1950	10		7.5 NS		MT VERNON AVE		155 WW		DOM SER	SERVICE VALVE
N32-200	023-136	REECE ST	UNK	4		14		6.6 NS		END OF ST	26 E			F H GATE	HYDRANT VALVE
N32-201	023-294	MT. VERNON AVENUE	UNK	6	2000			24 EW		REECE ST		38 SS			FIRE VALVE
N32-202	023-289	MT. VERNON AVE.	UNK	4	1995			26.3 EW		BASE LINE ST		113 NN		4" FIRE SER	FIRE VALVE
N32-203	023-300	14TH STREET	REN	12	2003			4.5 NS		MT VERNON AVE		4.5 EW		RAW WATER MAIN	BLOWOFF VALVE
N32-204		GARNER AVE		6						14TH ST					HYDRANT VALVE
N32-205	023-346	MT. VERNON AVENUE	CLOW	6	2006			23.3 EW		BASELINE		74.3 NN		FIRE HYDRANT	HYDRANT VALVE
N32-206	023-347	MT. VERNON AVE.	MUEL	1.5	2005				(IN METER BOXES)	BASELINE STREET		152.3 NN		1.5" DOM/IRR SVC	SERVICE VALVE
N32-207		13TH ST	CLOW	8	2006			7.6 NS		TURRILL AVE		6 EW		8" INLINE	MAIN VALVE
N32-208		13TH ST	CLOW	8	2006			7.6 NS		TURRILL AVE		8.8 EW		8" INLINE	MAIN VALVE
N32-209		TURRILL AVE	CLOW	8	2006			10 EW		13TH ST		6.5 NS		8" INLINE	MAIN VALVE
N32-210		TURRILL AVE	CLOW	8	2006			10 EW		13 TH ST		9 NS		8" INLINE	MAIN VALVE

Valve Data of Tile N32.xls

Valve No.	Old Valve No.	Main Street	Make	Size	Year	Turns to Open	Located From Property	Located From Curb	Comments	Intersecting Street	Located From Property	Located From Curb	Comments	Remarks	Valve Purpose
N32-211		TURRILL AVE	CLOW	6	2005			9 DW		13TH ST		248 NN		6" FH	HYDRANT VALVE

EXHIBIT 4

MITIGATION MONITORING AND REPORTING PROGRAM FOR ROOSEVELT II ELEMENTARY SCHOOL

February 2008

MITIGATION MONITORING AND ROOSEVELT II ELEMENTARY SCHOOL

This Mitigation Monitoring and Reporting Program (MMRP) was formulated based on the analysis contained in the Initial Study/Mitigated Negative Declaration (IS/MND) for the proposed Roosevelt II Elementary School (proposed project). This MMRP is in compliance with Section 15097 of the CEQA Guidelines, which requires that the Lead Agency "adopt a program for monitoring or reporting on the revisions which it has required in the project and the measures it has imposed to mitigate or avoid significant environmental effects." The MMRP lists mitigation measures recommended in the Draft IS/MND and identifies mitigation monitoring requirements. These requirements are provided only for mitigation measures that would reduce or avoid significant impacts of the proposed project.

The Mitigation Monitoring Matrix presents the mitigation measures identified for the proposed project. Each mitigation measure is numbered according to the topical section to which it pertains. The first column of Mitigation Monitoring Matrix provides the mitigation measures that were identified in Draft IS/MND. The columns entitled "Party Responsible for Implementing Mitigation" and "Implementation Timing" identify the party responsible for carrying out the required actions and the approximate time period over which the actions will be implemented, respectively. The columns entitled "Party Responsible for Monitoring," "Action by Monitor," and "Monitoring Timing" identify the party ultimately responsible for ensuring that the mitigation measure is implemented, the steps for monitoring the action identified in the mitigation measure, and the approximate timeframe for the oversight agency to ensure implementation of the mitigation measure, respectively.

Mitigation Monitoring Matrix

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
5.1 AESTHETICS					
5.1-1 Prior to the start of building construction, a landscape plan depicting both perimeter (both on- and off-site roadway setback areas) and on-site landscaping shall be reviewed and approved by the Director, San Bernardino City Unified School District (SBCUSD) Facilities Department. The landscape plan shall include, but not be limited to, a list of plants, size, location, irrigation plan, hardscape, and any other information deemed necessary. The landscape plan shall also indicate compliance with requirements for screening and street corner treatment standards.	District Director	Prior to construction	District Director	The District shall prepare a landscape plan	Prior to construction
5.1-2 Prior to the start of building construction, a signage program for the project perimeter areas that are prominently visible from off-site areas shall be reviewed and approved by the Director, San Bernardino City Unified School District (SBCUSD) Facilities Department. The signage plan shall include, but not be limited to, the number, location, type, size, and lighting characteristics of the signs and any other information deemed necessary.	District Director	Prior to construction	District Director	The District shall prepare a signage program	Prior to construction
5.1-3 Prior to the start of building construction, a detailed lighting plan shall be reviewed and approved by the Director, San Bernardino City Unified School District (SBCUSD) Facilities Department. The lighting plan shall include specifications indicating that all lighting fixtures have been designed to include shades or hoods, directional lenses, or other techniques to minimize light spillover onto adjacent and nearby properties and reflection into the night sky. Fixtures	District Director	Prior to construction	District Director	The District shall prepare a lighting plan	Prior to construction

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
shall include directional light mounts and nonglare hoods to reduce the potential light and glare impacts on surrounding properties.					
5.4 BIOLOGICAL RESOURCES					
5.4-1 Prior to any demolition or construction activity, the San Bernardino City Unified School District (SBCUSD) shall verify that the following provisions are incorporated into project plans for the purpose of protecting nesting birds within the study area during construction. Tree and vegetation removal shall be restricted to outside the likely active nesting season (February 1–September 1) for those bird species present or potentially occurring within the project area. That time period is inclusive of most birds' nesting periods, thus maximizing avoidance of impacts to any nesting birds. If construction must be completed during the breeding season listed above, surveys conducted by a qualified biologist for nesting birds shall be conducted at least 15 days prior to demolition or construction activities. Should an occupied nest be detected, the SBCUSD shall consult with the California Department of Fish and Game (CDFG) to determine an appropriate means for reducing impacts to nesting birds prior to tree removal. If nesting birds are observed within the vicinity, a buffer from the nest shall be established. The size of the buffer is dependent on the species and shall be determined by a qualified biologist. The buffer shall be delineated by roping the boundaries of construction and shall remain in place until the nest is abandoned or the young have fledged.	District Director	Prior to any demolition or construction	District Director or qualified biologist	Restrict tree and vegetation removal; if necessary, contract with qualified Biologist	Prior to any demolition or construction; 15 days prior to any demolition or construction

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
5.5 CULTURAL RESOURCES					
5.5-1 In the event that any prehistoric, historic, or paleontological resources are encountered during grading or construction, all activities in the immediate area of the find shall be halted, and a qualified archaeologist and/or paleontologist shall be contacted to assess the find and make appropriate mitigation recommendations pursuant to California Environmental Quality Act (CEQA) Guidelines and the requirements of the San Bernardino Municipal Code.	District Director or designee	Concurrent with grading and construction	District Director or designee	Monitor for resources; contract with qualified archaeologist and/or paleontologist	Ongoing with grading and construction
5.5-2 In the event that human remains are encountered during grading or construction activities, State Health and Safety Code Section 7050.5 states that no further disturbance shall occur until the County Coroner has made a determination of origin and disposition pursuant to State Public Resources Code Section 5097.98. The County Coroner shall be immediately notified of the find. If the remains are determined to be Native American, the County Coroner shall notify the Native American Heritage Commission (NAHC), which will determine and notify a Most Likely Descendant (MLD). With the permission of the landowner or his/her authorized representative, the MLD may inspect the site of the discovery. The MLD shall complete the inspection within 24 hours of notification by the NAHC. The MLD may recommend scientific removal and nondestructive analysis of human remains and items associated with Native American burials.	District Director or designee	Concurrent with grading and construction	District Director or designee	Monitor for resources; notify County Coroner	Ongoing with grading and construction
5.6 GEOLOGY AND SOILS					
5.6-1 Prior to any grading or construction activities, a comprehensive Geologic Hazards Assessment shall be completed and submitted to San	District Director	Prior to any grading or construction	District Director	The District shall review and approve a comprehensive Geologic Hazards Assessment	Prior to construction

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
Bernardino City Unified School District (SBCUSD) for their review and approval. The Final Geologic Hazards Assessment and Soil Analysis Report shall verify the assumptions in the Phase I Geologic Hazards Report and shall contain a detailed analysis of seismic, soils, and other potential natural hazards at the site. SBCUSD shall ensure that the contractor implements any recommendations in the Final Report.		activities			
5.7 HAZARDS AND HAZARDOUS MATERIALS					
5.7-1 At least 10 days prior to any demolition work for proposed improvements, the District shall notify and submit fees to the South Coast Air Quality Management District (SCAQMD) in compliance with SCAQMD Rule 1403, Asbestos Emissions from Demolition/Renovation Activities. Contractors shall adhere to the requirements of SCAQMD Rule 1403 during all construction and demolition activities.	District Director	At least 10 days prior to demolition	District Director or designee	Submit fees to the South Coast Air Quality Management District (SCAQMD) in compliance with SCAQMD Rule 1403	Prior to any demolition on site
5.7-2 Prior to any demolition work for proposed improvements, a certified asbestos consultant shall conduct an asbestos survey of the existing building materials. If asbestos-containing material (ACM) is found, it shall be removed and disposed of by a licensed and certified asbestos abatement contractor in accordance with requirements outlined by the local County Health Department.	District Director	Prior to any demolition on site	District Director or designee	The District shall contract with a State-certified asbestos professional to conduct an asbestos survey	Prior to structure disturbance
5.7-3 Prior to any grading or construction activities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall review and approve a Supplemental Investigation Report that documents whether elevated concentrations of benzene are present on site. In addition, the Supplemental Investigation Report shall document that soil samples have been obtained to measure benzene levels. If benzene is found, impacted soils shall be	District Director	Prior to any grading or construction	District Director or designee	The District shall review and approve a Supplemental Investigation Report for the presence of benzene; removal by a licensed contractor if necessary	Prior to any grading or construction activities

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
removed and disposed of by a licensed contractor. In addition, confirmation samples shall be collected to verify that any remaining impact from benzene is below human health screening levels.					
5.7-4 Prior to any grading or construction activities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall confirm that the site has been tested for lead. If lead-impacted soils are found on site, the soils shall be removed and disposed of off site by a licensed contractor. In addition, confirmation samples shall be collected to verify that any remaining impact from lead is below regulatory levels.	District Director	Prior to any grading or construction activities	District Director or designee	The District shall test the site for lead-impacted soils; removal by a licensed contractor if necessary	Prior to any grading or construction activities
5.7-5 Prior to any grading or construction activities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall confirm that the site has been tested for potential lead-based paint residue. Such testing shall be conducted in accordance with Department of Toxic Substances Control (DTSC) Interim Guidance for Evaluating Lead-based Paint and Asbestos Containing Materials, 2001. The results shall be documented in a Supplemental Investigation Report.	District Director	Prior to any grading or construction activities	District Director or designee	The District shall test the site for lead-based paint residue and document results in a report	Prior to any grading or construction activities
5.8 HYDROLOGY AND WATER QUALITY					
5.8-1 The San Bernardino City Unified School District (SBCUSD or District) shall comply with the requirements of the State General Construction Activity National Pollution Discharge Elimination System (NPDES) Permit. Prior to any grading or construction activities, the construction contractor shall demonstrate to SBCUSD that coverage has been obtained under the State General Construction Activity NPDES Permit by providing a copy of the Notice of Intent (NOI) submitted to the State Water Resources	District Director	Prior to any grading or construction activities	District Director or designee	The District shall comply with the NPDES Permit requirements	Prior to any grading or construction activities

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
Control Board (SWRCB) and a copy of the subsequent notification of the issuance of a Waste Discharge Identification (WDID) number or other proof of filing. In accordance with the permit, a Stormwater Pollution Prevention Plan (SWPPP) shall be prepared for the project. Implementation of the SWPPP shall reduce the discharge of pollutants to the maximum extent practical using management practices, control techniques and systems, design and engineering methods, and such other provisions as are appropriate. A copy of the SWPPP shall be kept at the project site and shall be available to the District upon request.					
5.8-2 Prior to occupancy of the school facilities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall verify standard Source Control BMPs after completion of project construction. These best management practices (BMPs) shall be consistent with the SBCUSD Storm Water Management Plan (SWMP). These BMPs shall include but are not limited to the following: • Education of students and staff on general housekeeping practices that contribute to the protection of storm water quality • Implementation of a landscape management plan that is consistent with the City's water conservation and pesticide/fertilizer guidelines • Trash management and litter control procedures to reduce pollution of drainage water • Regular scheduled inspection and cleaning of on-site catch basins	District Director	Prior to occupancy of school facilities	District Director or designee	The District shall verify Source Control BMPs and consistency with the District's SWMP	Prior to occupancy

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
5.8-3 Prior to any grading or construction activities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall verify that the final Hydrology Report shall indicate that the planned retention basin can adequately drain within 72 hours after a storm event and that no standing water will remain after such conditions. Site-specific best management practices (BMPs) shall include measures to ensure that the retention basin is inspected and cleared of debris on a regular basis, consistent with the SBCUSD Storm Water Management Plan (SWMP).	District Director	Prior to any grading or construction activities	District Director or designee	District shall verify that the Hydrology Report addresses drainage and maintenance of the planned retention basin	Prior to any grading or construction activities
5.9 LAND USE					
5.9-1 Prior to the displacement of individuals or families on site, San Bernardino City Unified School District (SBCUSD) shall prepare a Relocation Report in accordance with the State Relocation Guidelines contained in Government Code 7260, et seq., and Title 25 California Code of Regulations, Section 6000, et seq. The Relocation Plan shall summarize the relocation needs of the households on site, the available comparable housing resources, and SBCUSD relocation advisory resources, including a description of potential relocation payments, in order to provide relocation assistance to impacted families and individuals. The Relocation Plan shall contain a relocation assistance component to enable eligible owner-occupants or tenants to move from their current home to a comparable replacement home of their choice. The relocation assistance component shall include and outline the personal advisory assistance and financial assistance offered by SBCUSD to eligible homeowners and tenants to locate alternative dwellings. SBCUSD's assistance to displaced residents shall be provided to the extent required by the State	The District	Prior to the displacement of individuals or families	The District	The District shall prepare a Relocation Report in accordance with the State Relocation Guidelines	Prior to the displacement of individuals or families

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
Relocation Guidelines and shall be delineated in the Relocation Plan prepared for the project.					
5.11 NOISE					
5.11-1 Prior to any facilities demolition or construction activities, the San Bernardino City Unified School District (SBCUSD) Director shall verify that the SBCUSD contract with the project construction contractor states, "Hours of construction should be limited to between 7:00 a.m. and 7:00 p.m., Monday through Saturday, and shall not be permitted on Sundays and federal holidays." SBCUSD shall include provisions in builder contracts, which stipulate that noise control measures at all construction sites shall be ensured through the provision of mufflers and the physical separation of machinery maintenance areas from adjacent uses.	District Director	Prior to any facilities demolition or construction activities	District Director or contractor	The District shall verify builder's contracts contain limitations on hours of construction	Prior to any facilities demolition or construction activities
5.11-2 Prior to any facilities demolition or construction activities, the San Bernardino City Unified School District (SBCUSD) Director shall verify that construction contractors and Roosevelt school officials have met and agreed to measures to minimize construction noise impacts during school hours.	District Director	Prior to any facilities demolition or construction activities	District Director or designee	The District shall ensure that contractors and Roosevelt school officials coordinate regarding noise impacts	Prior to any facilities demolition or construction activities
5.11-3 Prior to occupancy of the school facilities, the San Bernardino City Unified School District (SBCUSD) Facilities Management Director shall verify that mechanical ventilation systems such as air conditioning have been installed for school buildings that are located within 301 ft of the centerline of Mt. Vernon Avenue to ensure that the windows and doors can remain closed for a prolonged period of time.	District Director	Prior to occupancy	District Director or designee	The District shall verify installation of mechanical ventilation systems as required	Prior to occupancy

Mitigation Measure	Party Responsible for Implementing Mitigation	Implementation Timing	Party Responsible for Monitoring	Action by Monitor	Monitoring Timing
5.12 POPULATION AND HOUSING					
5.12-1 Prior to the displacement of individuals or families on site, San Bernardino City Unified School District (SBCUSD) shall prepare a Relocation Report in accordance with the State Relocation Guidelines contained in Government Code 7260, et seq., and Title 25 California Code of Regulations, Section 6000, et seq. The Relocation Plan shall summarize the relocation needs of the households on site, the available comparable housing resources, and SBCUSD relocation advisory resources, including a description of potential relocation payments, in order to provide relocation assistance to impacted families and individuals. The Relocation Plan shall contain a relocation assistance component to enable eligible owner-occupants or tenants to move from their current home to a comparable replacement home of their choice. The relocation assistance component shall include and outline the personal advisory assistance and financial assistance offered by SBCUSD to eligible homeowners and tenants to locate alternative dwellings. SBCUSD's assistance to displaced residents shall be provided to the extent required by the State Relocation Guidelines and shall be delineated in the Relocation Plan prepared for the project.	The District	Prior to the displacement of individuals or families	The District	The District shall prepare a Relocation Report in accordance with the State Relocation Guidelines	Prior to the displacement of individuals or families