



CITY OF PHOENIX

SQUAW PEAK WATER TREATMENT PLANT GENERAL PLANT IMPROVEMENTS

VOLUME 2

PART A - MODIFICATIONS AND UPGRADES TECHNICAL SPECIFICATION

DIVISIONS 2-10

INDEX NO. W-886739
JANUARY 1992

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GENERAL PLANT IMPROVEMENTS

PART A - MODIFICATIONS AND UPGRADES
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TECHNICAL SPECIFICATIONS
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SITE WORK
Division 2

SECTION 02050

DEMOLITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required for demolitions, removal and disposal Work.
2. Included, but not limited to, are demolition and removals of existing materials, equipment, or work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner. Demolition includes structural concrete, foundations, walls, doors, windows, structural steel, metals, roofs, masonry, attachments, appurtenances, piping, electrical and mechanical equipment, paving, curbs, walks, fencing, and similar existing facilities.
3. Demolitions and removals which may be specified under other Sections shall conform to requirements of this Section.

B. Related Sections:

1. Section 01010, Summary of Work.
2. Section 01015, Schedule of Completion.
3. Section 01020, Maintenance of Plant Operations.
4. Section 02110, Clearing.
5. Section 02233, Excavation and Backfill.
6. Section 16100, General Provisions.

1.2 SUBMITTALS

- ###### A. Schedule:
- Submit for approval proposed methods, equipment, and operating sequences. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of OWNER'S operations.

1.3 JOB CONDITIONS

A. Protection:

1. Perform all demolition and removal Work to prevent damage or injury to structures, occupants thereof, and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the Work by the placement or storage of materials will not be permitted, and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Erect and maintain barriers, lights, sidewalk sheds, and other necessary protective devices.

4. Repair damage to facilities to remain, or to any property belonging to the OWNER or occupants of the facilities.
- B. Scheduling:
1. Carry out operations so as to avoid interference with OWNER'S operations and work in the existing facilities.
- C. Notification:
1. At least nine (9) days prior to commencement of a demolition or removal, notify ENGINEER in writing of proposed schedule therefor. OWNER will inspect the existing equipment and mark for identification those items which are to remain the property of the OWNER. Do not start removals without the permission of the ENGINEER.

PART 2 - PRODUCTS

(Part 2 omitted this Section)

PART 3 - EXECUTION

3.1 GENERAL

- A. All materials and equipment removed from existing work, shall become the property of CONTRACTOR, except for those materials and equipment which OWNER has identified and marked for his use. All materials and equipment marked by the OWNER to remain his shall be carefully removed by the CONTRACTOR, so as not to be damaged, and shall be cleaned and stored on or adjacent to the site in a protected place specified by the ENGINEER or loaded onto trucks provided by the OWNER.
- B. Identification and tagging system for all materials and equipment shall comply with Paragraph 3.3F of this Section.
- C. CONTRACTOR shall dispose of all demolition materials, equipment, debris, and all other items not marked by the OWNER to remain as his, off the site and in conformance with all existing applicable laws and regulations.
- D. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces shall be repaired and re-finished by the CONTRACTOR with the same or matching materials as the existing adjacent surface or as may be otherwise approved by the ENGINEER.
- E. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.

F. Building Demolition:

1. Unless otherwise approved by ENGINEER, proceed with demolition from the top of the structure to the ground. Complete demolition work above each floor or tier before disturbing supporting members of lower levels.
2. Demolish concrete and masonry in small sections.
3. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.
4. Break up and remove foundations and slabs-on-grade, unless otherwise shown to remain.
5. Locate equipment used for demolition work, and remove demolished materials, so as to not impose excessive loads on supporting walls, floors or framing.
6. Office furnishings including desks, chairs, tables, file cabinets, computers, typewriters, telephones, etc. shall be temporarily relocated by the OWNER to the Temporary Owner's Trailers prior to construction work in the Administration Building. Following completion and acceptance of the Work, these office furnishings shall be relocated by the CONTRACTOR as directed by the OWNER or the ENGINEER.
7. Wall mounted equipment shall be removed unless otherwise indicated on these Plans.
8. Existing doors/windows to be removed to existing rough opening unless indicated on the plans.
9. CONTRACTOR shall coordinate the demolition Work and New Construction with the Work specified in Section TS-1, Technical Specifications - Asbestos Removal.
10. Portable office furniture, computers, typewriters, tables, refrigerators, analytical instruments including incubators, media dispenser, digital balance, autoclave, distillation unit (2nd floor), dishwasher, microwave oven, centrifuge, biohazard refrigerator, water baths, turbidimeter, deionizer, titration equipment, table top instruments, colorimeter, spectrophotometer, jar test equipment, pipettes and glassware equipment, microscope, analytical balance, desiccator, plate count equipment, gas chromatograph, hot air oven, bact. oven, upright incubator, glass door lab cases, and chemical supplies and reagents in the existing laboratory shall be relocated to the new laboratory by the OWNER upon completion of the Construction Work.

3.2 STRUCTURAL REMOVALS

- A. Remove structures to the lines and grades shown unless otherwise directed by the ENGINEER. Where no limits are shown, the limits shall be 2 inches outside the item to be installed. The removal of masonry beyond these limits shall be at the CONTRACTOR'S expense and these excess removals shall be reconstructed to the satisfaction of the ENGINEER with no additional compensation to the CONTRACTOR.

- B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the ENGINEER. Demolished items shall not be used in backfill adjacent to structures or in pipe line trenches.
- C. After removal of parts or all of masonry walls, slabs and like work which tie into new Work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.
- D. The jambs, sills and heads of any new windows, passageways, doors, or other openings cut into new Work or existing work, shall be dressed with new masonry, concrete or metal to provide a smooth, finished appearance.
- E. Where new anchoring materials including bolts, nuts, hangers, welds and reinforcing steel, are required to attach new Work to the existing work they shall be included under this Section, except where specified elsewhere.
- F. Existing floor penetrations, ceiling penetrations, and wall penetrations caused by the demolition Work shall be sealed as shown on the Structural Plans.

3.3 MECHANICAL REMOVALS

- A. Mechanical removals shall consist of dismantling and removing of existing piping, pumps, motors, HVAC and Chemical Feed Equipment and other appurtenances as specified, shown, or required for the completion of the Work. It shall include cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 15.
- B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new Work shall be removed where shown or where it will interfere with new Work. Piping not indicated to be removed or which does not interfere with new Work shall be removed to the nearest solid support, capped and left in place. Chemical and fuel lines and tanks shall be purged and made safe prior to removal or capping. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.
- C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping may be left in place unless it interferes with new Work or is shown or specified to be removed.

- D. Waste and vent piping shall be removed to points shown. Pipe shall be plugged with cleanouts and plugs. Where vent stacks pass through an existing roof that is to remain, they shall be removed and the hole in the roof properly patched and made watertight.
- E. Any changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with Division 15 and local codes. Other plumbing piping and heating piping shall be pressure tested only.
- F. Mechanical equipment/furniture, furnishings, etc. to be removed shall be tagged by the OWNER prior to commencing the work described herein, as follows:
1. Fixed items to be salvaged by the CONTRACTOR and turned over to the OWNER shall be tagged green.
 2. Fixed items to be salvaged by the OWNER prior to commencement of demolition work shall be tagged blue.
 3. All unattached items that are to be salvaged by the OWNER will be relocated by the OWNER prior to commencement of demolition work.
 4. All Laboratory Instruments and Analytical Equipment shall be relocated by the OWNER to the new laboratory when the laboratory is substantially completed and ready for equipment placement.
 5. All items not tagged as noted above shall be removed by the CONTRACTOR and disposed of off-site.
- G. Unless otherwise indicated, wall mounted or ceiling mounted equipment and fixtures shall be removed by the CONTRACTOR to the Limits indicated and penetrations sealed.
- H. Piping shall be removed in its entirety and as indicated herein unless otherwise noted on plans, all remaining penetrations to be sealed off as noted in structural drawings.
1. Existing chemical alum., fluoride, carbon slurry and chlorine solution piping shall be flushed with water after draining and the water drained to the sewer.
 2. Chlorine gas piping shall be purged with air with the chlorine ejectors operating to remove residual chlorine gas. Following air purge chlorine gas piping shall be tested with a portable sniffer prior to disassembly to insure a low chlorine residual level exists.
 3. Existing natural gas piping shall remain in place as shown on the plans. connection of new natural gas yard piping to existing gas piping shall be made only after purging existing gas piping system.
 4. Existing gas fired heaters/boilers shall be depressurized and gas piping purged prior to demolition.
 5. Refrigeration piping shall be properly emptied and contents disposed of prior to demolition work.

- I. Chemical Feeders including associated piping and electrical conduit shall be removed to the limits of existing floor level and existing ceiling slab. Demolition Limits of existing chemical feed equipment shall be to the building wall limits. See Structural Details for plugging existing floor slab, ceiling slab, and wall penetrations.
- J. Existing HVAC Equipment and ductwork shall be removed (unless otherwise indicated) to the Existing Building Wall Limits.
- K. Chemical; Hoppers (Silos) in the existing Plant I and Plant II Buildings shall be emptied by the CONTRACTOR and properly disposed of. Plant II silos contain anhydrous lime. Plant I silos contain both lime and possibly Alum (dry Aluminum Sulfate).

3.4 ELECTRICAL REMOVALS

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures, and miscellaneous electrical equipment all as shown, specified, or required to perform the Work.
- B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.
- C. Distribution switchboards shall be removed or modified as shown. Switchboards to be removed shall be disconnected and dismantled, and all components shall be disposed of off the site. Circuit breakers and other control equipment on modified switchboards that will no longer be used shall be removed unless otherwise shown or specified. All new openings cut into the modified switchboard panels shall be cut square and dressed smooth to the dimensions required for the installation of the new equipment.
- D. Motors shall be disconnected and removed where shown or specified. Motors not designated by the OWNER to be salvaged shall be removed from the site. Motors or other electrical gear designated for reuse shall be stored in enclosed, heated storage.
- E. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged, and stored. Abandoned conduits concealed in floor or ceiling slabs, or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.

- F. Where shown or otherwise required, wiring in the underground duct system shall be removed. All such wiring shall be salvaged and stored as specified. CONTRACTOR shall verify the function of all wiring before disconnecting and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.
- G. Where shown, direct-burial cable shall be abandoned. Such cable shall be disconnected at both ends of the run. Where it enters a building or structure, the cable shall be cut back to the point of entrance. All openings in buildings for entrance of abandoned direct-burial cable shall be patched and made watertight.
- H. Poles and overhead wiring shall be abandoned as shown and specified. Existing substation and poles owned by the power company will be removed by the power company. Poles not owned by the power company shall be completely removed from the site by the CONTRACTOR. The overhead wires shall be salvaged and stored as specified in this section, paragraph 3.1.A. CONTRACTOR shall perform this work after the new service has been completed and energized, and in accordance with the approved schedule. CONTRACTOR also shall make all the necessary arrangements with the power company for the removal of their transformers and metering equipment after the new electrical system has been installed and energized.
- I. Panelboards where shown shall be removed and disposed of off the site. Where shown or specified, they shall be replaced with new panelboards at the same or adjacent locations. All cutting and patching necessary for the removal and replacement of panelboards shall be performed.
- J. Lighting fixtures shall be removed or relocated as shown. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be carefully removed from their present location and rehung where shown.
- K. Wall switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed of off the site as required. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. Any damage incurred shall be repaired.
- L. CONTRACTOR shall provide all materials, equipment, labor, and incidentals required to reroute existing telephone system to the temporary OWNER trailers. After completion of building modifications, CONTRACTOR shall reroute telephone system back to the permanent building.

3.5 ALTERATIONS AND CLOSURES

- A. Alterations shall conform with all applicable Specifications, the Drawings, and the directions and approvals of the ENGINEER.

- B. Where alterations require cutting or drilling into existing floors, walls, and roofs, the holes shall be repaired in an approved manner. CONTRACTOR shall repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the ENGINEER. All repairs shall be smoothly finished unless otherwise approved by the ENGINEER.
- C. Openings in existing concrete slabs, ceilings, masonry walls, floors and partitions shall be closed and sealed as shown or otherwise directed by the ENGINEER. New Work shall be keyed into the existing Work in an acceptable manner. New reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, use the same or matching materials as the existing adjacent surface. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable to the ENGINEER.

3.6 CLEAN-UP

- A. CONTRACTOR shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

+ + END OF SECTION + +

SECTION 02110

CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to perform all clearing and grubbing as shown and specified.
- B. Related Work Specified Elsewhere:
 - 1. Section 02050, Demolitions.
 - 2. Section 02233, Excavation and Backfill.
 - 3. Section 02481, Palm Tree Transplanting.
 - 4. Section 02482, Tree Transplanting.
 - 5. Section 02483, Cactus Transplanting.
 - 6. Section 02490, On-Site Nursery and Maintenance.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: State and local laws and code requirements shall govern the hauling and disposal of trees, shrubs, stumps, roots, rubbish, debris and other matter.
- B. CONTRACTOR shall conform to all applicable requirements of Section 201 of the Uniform Standard Specifications for Public Works Construction by Maricopa Association of Governments (MAG). Where there is a conflict between MAG Standard Specifications and these Specifications, the provisions of these Specifications shall govern.

1.3 JOB CONDITIONS

- A. Protection:
 - 1. Streets, roads, adjacent property and other works and structures shall be protected throughout the entire project. CONTRACTOR shall return to original condition, satisfactory to the ENGINEER, damaged facilities caused by the CONTRACTOR'S operations.
 - 2. Trees, shrubs and grassed areas which are to remain shall be protected by fences, barricades, wrapping or other methods as shown, specified or approved by the ENGINEER. Equipment, stock-piles, etc. shall not be permitted within tree branch spread. Trees shall not be removed without approval of the ENGINEER unless shown or specified.
- B. Salvable Improvements:
 - 1. Unless specified elsewhere carefully remove items to be salvaged and store on premises in approved location, all in accordance with recommendations of specialists recognized in the Work involved.

1.4 GUARANTEE

- A. CONTRACTOR shall guarantee that Work performed under this Section will not permanently damage trees, shrubs, turf or plants designated to remain, or other adjacent work or facilities. If damage resulting from CONTRACTOR'S operations appears during the period up to 18 months after completion of the project he shall replace damaged items at no expense to OWNER.

PART 2 - PRODUCTS

(Part 2 omitted this Section)

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. Limits of clearing shall be all areas within the Contract limit lines except as otherwise shown. Damage outside these limits caused by the CONTRACTOR'S operations shall be corrected at the CONTRACTOR'S expense.
- B. Except as noted below, CONTRACTOR shall remove from the site and satisfactorily dispose of all trees, shrubs, stumps, roots, brush, masonry, rubbish, scrap, debris, pavement, curbs, fences and miscellaneous other structures not covered under other Sections as shown, specified or otherwise required to permit construction of the new Work.
- C. Trees and shrubs shall be trimmed when doing so will avoid removal or damage. Trimmed or damaged trees shall be treated and repaired by persons with experience in this specialty who are approved by ENGINEER. Trees and shrubs intended to remain which are damaged beyond repair or removed, shall be replaced by the CONTRACTOR.
- D. Control air pollution caused by dust and dirt, and comply with governing regulations.

3.2 TOPSOIL REMOVAL

- A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Topsoil shall be substantially free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material.
- B. Strip topsoil which is satisfactory to whatever depths are encountered, and in such manner as to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - 1. Where trees are shown or directed to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system.

- C. Stockpile topsoil in storage piles in areas shown, or where otherwise approved by ENGINEER. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Topsoil in excess of quantity required shall remain property of OWNER.

+ + END OF SECTION + +

SECTION 02211
ROCK EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment, and incidentals as shown, specified or required to do rock excavation for construction of structures and pipelines. Disposal of excess and unsuitable excavated rock material is included.
- B. Related Sections:
 - 1. Section 02233, Excavation and Backfill.
 - 2. Section 03600, Grout.
- C. Definition of Rock:
 - 1. Rock is defined as solid ledge rock or boulders which requires drilling and blasting or jack-hammering for its removal.
 - 2. The following material will not be measured nor allowed for payment as rock excavation:
 - a. Soft, weathered or disintegrated rock which can be removed by normal excavation equipment.
 - b. Loose or previously blasted rock.
 - c. Broken stone in rock fills.
 - d. Any rock which may fall into the excavated trench from outside the limits of excavation specified.
 - e. Boulders which can be removed without drilling and blasting.
 - f. Concrete, asphalt or masonry pavements, walks and gutters.

PART 2 - PRODUCTS

(Part 2 omitted this Section)

PART 3 - EXECUTION

3.1 LIMITS OF ROCK EXCAVATION

- A. Limits of rock excavation shall be as follows:
 - 1. Structures: The limit for all structures shall be bounded by:
 - a. The bottom of the footing, drainage course material, or compacted backfill.
 - b. The original surface of the rock.
 - c. Vertical planes located 12-inches outside the footing.
 - 2. Pipe Trenches: The width of trenches shall be established as the outside diameter of the pipe plus 2 feet-0 inches, exclusive of bells, branches, hubs, spurs or cradles. The sides of the trench shall be considered as vertical.
 - a. The depth of the trench shall be established as a point 6 inches below the outside of the pipe.

- b. The length shall be equal to the laid length of pipe, measured horizontally.
- c. Additional width in pipe trenches at field joints or beyond the lines described above will be considered outside the limits described.

B. Foundation Treatment:

- 1. Rock foundations for concrete or masonry footings shall be excavated to sound material. The rock shall be roughly leveled or cut to steps and shall be roughened. Seams in the rock shall be grouted under pressure as directed by the ENGINEER and included under Section 02211.

3.2 BLASTING

- A. Blasting is not allowed for the Preliminary Treatment Facilities (Part B documents) and is not allowed for the new Raw Water Pump Station (Part A documents).
- B. All blasting operations shall be conducted in strict accordance with existing applicable ordinances and regulations relative to rock blasting and the storage and use of explosives.
- C. Rock excavation adjacent to existing utilities shall be done with utmost care and only after proper notification and coordination with the utility owner and regulatory authority.
- D. Blasting shall be conducted so as not to endanger persons or property nor to damage or weaken adjacent foundations, structures, sheeting, bracing, or other facility. Blasting shall be covered or otherwise suitably confined.
- E. CONTRACTOR shall be wholly responsible for damage caused by his blasting, and shall repair or replace all damage immediately.
- F. CONTRACTOR shall keep records of all blasts including date, location, depth, number, and diameter of drill holes, type and amount of explosive and other pertinent data. Records shall be furnished to the ENGINEER when requested.

3.3 HAND REMOVAL

- A. Where hazardous conditions exist, or clearances with existing piping or structure are very small, or strong possibility of damage to persons or property exists, blasting shall not be used. CONTRACTOR shall remove rock in these areas by hand methods (no blasting).
- B. Hand removal is required for the Preliminary Treatment Facilities (Part B documents) and for the new Raw Water Pump Station (Part A documents).

3.4 DISPOSAL OF EXCAVATED ROCK

- A. Excavated rock may be used in backfill subject to the following limitations:
 - 1. Pieces of rock larger than 12 inches shall not be used in backfilling pipe trenches.
 - 2. Rock backfill shall not be placed within two feet of the outside of pipes.
 - 3. The quantity of rock used in any backfill location shall not be so great as to result in voids.
 - 4. Rock backfill shall not be placed within 18 inches of the surface of finish grade.
 - 5. Excess or unacceptable rock may be disposed of on the site only where shown or approved by ENGINEER. Rock which cannot be disposed of on the site shall be removed and disposed of off the site, at CONTRACTOR'S expense, and in compliance with all applicable federal, state and local regulations.

3.5 UNAUTHORIZED ROCK EXCAVATION

- A. All rock excavation outside the limits described and which is not approved by ENGINEER, together with its removal, disposal and refill will be at CONTRACTOR'S expense.
- B. Unauthorized excavation below pipe or foundation shall be refilled with compacted select fill or concrete, as directed by ENGINEER. Other unauthorized excavation shall be backfilled with material as specified in Section 02233, Excavation and Backfill.

+ + END OF SECTION + +

SECTION 02225

CRUSHED STONE, GRAVEL, AND DRAINAGE MATERIAL

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall furnish and place crushed stone and gravel of the types specified at the locations shown, specified and ordered by the ENGINEER.
 2. CONTRACTOR shall furnish and place drainage material at the locations shown, specified and ordered by the ENGINEER.
- B. Related Work Specified Elsewhere:
1. Section 02233, Excavation and Backfill.
 2. Section 02271, Riprap.
 3. Section 15051, Buried Piping Installation.

1.2 QUALITY ASSURANCE

- A. CONTRACTOR shall conform to all applicable requirements of Section 701 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Government (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.

1.3 SUBMITTALS

- A. CONTRACTOR shall furnish representative samples of the crushed stone, gravel, and drainage material to the ENGINEER and shall advise of the source location.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Crushed Stone or Screened Gravel for Foundations:
1. CONTRACTOR shall furnish and place crushed stone or screened gravel fill under pipe or structures in addition to that required under other Sections.
 2. The material shall be well-graded, clean, screened gravel or crushed stone obtained from an approved source. Maximum size shall be 1-1/2 inches and 95 percent shall be retained on a No. 4 screen.
 3. The Plasticity Index of the fraction passing the No. 40 sieve shall not exceed 5 when tested in accordance with ASTM D 4318.

B. Drainage Material:

1. Drainage material shall consist of hard, durable particles of stone or gravel, screened or crushed to the required size and grading. The material shall be free from vegetable matter, lumps or balls of clay, or other deleterious matter and shall conform to the following gradings when tested in accordance with AASHTO T-27 or ASTM C 136.

<u>Sieve Size (Square Opening)</u>	<u>Percent By Weight Passing Screen</u>
2-inch	100
1-1/2 inch	95 - 100
3/4-inch	50 - 100
3/8-inch	15 - 55
No. 4	0 - 25
No. 8	0 - 5
No. 200	0 - 2

2. Coarse material shall be crushed or wasted and fine material shall be wasted to meet the grading requirements set forth above.
3. Coarse aggregate, retained on the No. 4 sieve, shall have a percentage of wear not greater than 40 percent when tested by the Los Angeles Test, AASHTO T-96 or ASTM C 131.

PART 3 - EXECUTION

3.1 PLACING

- A. Gravel shall be spread in layers of uniform thickness not exceeding 8 inches and shall be thoroughly compacted with suitable power driven tampers or other power driven equipment. The placing of crushed stone or gravel shall conform to applicable requirements of Section 02233 except as noted above.

+ + END OF SECTION + +

SECTION 02233
EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to perform all excavating, backfilling and disposing of earth materials as shown, specified, and required for the purpose of constructing structures, conduits, pipelines, roads, grading, and other facilities required to complete the Work in every respect.
2. All necessary preparation of subgrade for slabs and pavements is included.
3. All temporary means needed to prevent discharge of sediment to water courses because of dewatering systems or erosion are included.
4. All termite treatment and vegetation control as specified herein.
5. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof, including rock which is under Section 02211, Rock Excavation.
6. Work within the rights-of-way of the Flood Control District of Maricopa County (FCDMC) and the Salt River Project (SRP) shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. The CONTRACTOR will be required to coordinate with the FCDMC for the Work on or near the Arizona Canal Diversion Channel (A.C.D.C.) and SRP for Work on or near the Arizona Canal.
7. CONTRACTOR shall not utilize bulldozers or heavy construction equipment near retaining walls or structures without prior approval of the ENGINEER. Precautionary measures, as deemed necessary by the ENGINEER, shall be taken by the CONTRACTOR to protect such structures prior to commencement of the work.

B. Related Work Specified Elsewhere:

1. Section 01410, Testing Laboratory Services.
2. Section 02050, Demolition.
3. Section 02110, Clearing.
4. Section 02211, Rock Excavation.
5. Section 02225, Crushed Stone, Gravel, and Drainage Material.
6. Section 02271, Riprap.
7. Sections 02441, 02480, 02481, 02482, 02483, 02490, Sections on Landscaping.
8. Section 02513, Pavement.
9. Section 15051, Buried Piping Installation.
10. Division 16, Electrical

1.2 QUALITY ASSURANCE

A. Standard Specification and Details:

1. The CONTRACTOR shall conform to all applicable requirements of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as follows:
 - a. Section 205, Roadway Excavation.
 - b. Section 206, Structure Excavation and Backfill.
 - c. Section 211, Fill Construction.
 - d. Section 225, Watering.
 - e. Section 702, Base Materials.
2. If there is a conflict between the MAG Standard Specifications and these Specifications, the provisions of these Specifications shall govern.

B. Testing Services:

1. General: Testing of materials, testing for moisture content during placement and compaction of fill materials, and testing of compaction results for compliance with technical requirements of the Specifications shall be performed by a testing laboratory as designated in Section 01410.
2. Testing Services Include:
 - a. Testing the CONTRACTOR'S proposed materials in the laboratory and/or field for compliance with the Specifications.
 - b. Performing field moisture content and density tests to assure that the specified compaction of backfill materials has been obtained.
 - c. Reporting all test results to the ENGINEER and the CONTRACTOR.
3. Authority and Duties of Testing Agency: Technicians representing and testing laboratory shall inspect the materials in the field and perform tests, and shall report their findings to the ENGINEER and the CONTRACTOR. When the materials furnished or Work performed fails to fulfill Specification requirements, the technician will direct the attention of the ENGINEER and the CONTRACTOR to such failure.
 - a. The technician shall not act as foreman or perform other duties for the CONTRACTOR. Work will be checked as it progresses, but failure to detect any defective work or materials shall in no way prevent later rejection when such defect is discovered, nor shall it obligate the ENGINEER for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve or accept any portion of the Work.
4. Responsibilities and Duties of the CONTRACTOR:
 - a. The use of testing services shall in no way relieve CONTRACTOR of his responsibilities to furnish materials and construction in full compliance with the Drawings and Specifications.

- b. To facilitate testing services, the CONTRACTOR shall:
 - 1) Secure and deliver to the ENGINEER or to the testing agency preliminary representative samples of the materials he proposes to use and which are required to be tested.
 - 2) Furnish casual labor as is necessary to obtain and handle samples at the Project or at other sources of material.
 - 3) Advise the testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.
- c. The CONTRACTOR'S Testing Service must inspect and approve subgrades and fill layers before further construction work is performed thereon.
- d. It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of the CONTRACTOR to control his operations by confirmation tests to verify and confirm that he has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.
- e. The frequency of CONTRACTOR'S confirmation tests shall be not less than as follows and each test location for trenches shall include tests for each layer, type, or class of backfill from bedding to finish grade.
 - 1) For trenches:
 - i. In open fields: 2 every 1,000 linear feet.
 - ii. Along dirt or gravel roads or off traveled right-of-way: 2 every 500 linear feet.
 - iii. Crossing paved roads: 2 locations along each crossing.
 - iv. Under pavement cuts or within 2 feet of pavement edges: 1 location every 400 linear feet.
 - 2) For structural backfill: 1 every 20 cubic yards.
 - 3) In embankment or fill: 1 every 200 cubic yards.
 - 4) Base material: 1 every 50 cubic yards.
- f. Copies of the test reports shall be submitted promptly to the ENGINEER. The CONTRACTOR'S tests shall be performed by a soils testing laboratory acceptable to the ENGINEER.
- g. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
 - 1) 200 linear feet of trench backfill.
 - 2) 10 cubic yards of structural backfill.
 - 3) 100 cubic yards of embankment work.
 - 4) 50 cubic yards of base material.
- h. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
- i. After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified amounts.
- j. Periodic compliance tests will be made by the ENGINEER to verify that compaction is meeting the requirements previously specified at no cost to the CONTRACTOR. For tests in

backfill that has been water settled, the CONTRACTOR shall remove the overburden above the level at which the ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete.

- k. If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the CONTRACTOR. The CONTRACTOR'S confirmation tests shall be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM A 36, Structural Steel.
2. ASTM A 328, Steel Sheet Piling.
3. ASTM C 136, Sieve Analysis of Fine and Coarse Aggregates.
4. ASTM D 422, Particle-Size Analysis of Soils.
5. ASTM D 698, Moisture-Density Relations of Soils, using 5.5 lb (2.5 kg) Rammer and 12-in. (304.8 mm Drop).
6. ASTM D 1556, Density of Soil in Place by the Sand-Cone Method.
7. ASTM D 1557, Moisture-Density Relations of Soils, using 10.0 lb (4.5 kg) Rammer and 18-in. (457 mm) Drop.
8. ASTM D 2922, Nuclear Density Testing.
9. ASTM D 3017, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.
10. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.

1.3 SUBMITTALS

- A. Wherever, under Paragraph 3.3.A.4., sheeting and shoring is necessary, the CONTRACTOR shall prepare Drawings for the following: Sheeting and bracing for excavations over six (6) feet deep. The Drawings shall be prepared by a professional engineer licensed in the State of Arizona. The Drawings shall be submitted to the ENGINEER for record purposes and to establish that the terms of the Specifications are complied with. Calculations shall not be submitted. Drawings submissions will not be checked and will not imply approval by the ENGINEER of the work involved. The CONTRACTOR shall be wholly responsible for designing, installing and operating whatever system is necessary to accomplish satisfactory sheeting, bracing, dewatering and protection.
- B. Test Reports: Submit copies of the following reports directly to ENGINEER from the testing service, with copy to the CONTRACTOR:
 1. Field density tests.
 2. Optimum moisture - maximum density curve for each soil used for backfill.

- C. Samples of all materials, including: select backfill, general backfill, granular embedment, granular fill, and topsoil shall be submitted to the ENGINEER and the testing service. Samples of the proposed material shall be submitted at least fourteen (14) days in advance of its anticipated use.
- D. Submit product and application information for termite treatment and vegetation control.

1.4 JOB CONDITIONS

- A. Subsurface Information: Data on subsurface conditions is included in the Supplementary Conditions. It is not intended as a representation or warranty of continuity of such conditions between soil borings. OWNER will not be responsible for interpretations or conclusions drawn by CONTRACTOR. Data is made available for the convenience of CONTRACTOR.
 - 1. Additional test borings and other exploratory operations may be made by CONTRACTOR at no cost to OWNER.
- B. Existing Structures: Shown on the Drawings are certain surface and underground structures adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the CONTRACTOR. CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from injury by the CONTRACTOR. If they are broken or injured, they shall be restored immediately by the CONTRACTOR at his expense.
- C. Existing Utilities: Locate existing underground utilities in the areas of Work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the ENGINEER immediately for directions as to procedure. Cooperate with OWNER 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 OWNER or others, except when permitted in writing by ENGINEER and then only after acceptable temporary utility services have been provided.
 - 3. 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. Protection of Persons and Property: 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.
 - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

- E. Dust Control: CONTRACTOR shall conduct all of his operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize creation and dispersion of dust. Calcium chloride shall be used to control serious or prolonged dust problems, subject to approval of ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill and Fill Materials - Walls, Foundations and Piping:
1. Materials acceptable for use as backfill against walls, foundations and above piping shall be stockpiled native silty or clayey sand soils obtained from on-site excavations and which are uniformly mixed, contain no organic matter, nor contain rocks or fragments greater than four (4) inches in size and whose Plasticity Index is less than five (5).
 2. Backfill and fill materials from off-site sources shall consist of silty or clayey sand soils which are uniformly mixed, contain no organic matter and which have a Plasticity Index less than five (5). The maximum particle size of imported soils shall be four (4) inches or less if required to satisfy trenching, landscaping, or other requirements. The maximum expansion of off-site materials shall be 1.5 percent as performed on a sample remolded to approximately 95 percent of the maximum dry density as determined in accordance with ASTM D 698 at 2 percent below optimum moisture content under a 100 psf surcharge pressure.
 3. All materials for use as backfill and fill material shall be tested by the laboratory and approved by the ENGINEER.
- B. Select Backfill:
1. Select Backfill for use beneath concrete slabs and asphaltic pavements shall be well graded sand and gravel materials conforming to the requirements of Aggregate Base Course (ABC) as specified in Section 702 of the MAG Specifications.
- C. Embankments:
1. Fill materials for use as embankments, fill under paved areas, basin linings and as miscellaneous landscaping materials exterior to plant facilities, shall consist of soils obtained from on-site excavations or off-site sources which are uniformly mixed, contain no organic material, rocks or fragments greater than four (4) inches in size.
 2. All materials for use as described above shall be tested by the laboratory and approved by the ENGINEER.
- D. Crushed Stone and Gravel:
1. Crushed stone shall be crushed rock or gravel conforming to the requirements of Section 02225.
- E. Sand:
1. Sand for use as embedment material around plastic pipes (PVC, CPVC, FRP Duct, HDPE Duct) shall consist of natural or manufactured granular material.

2. Sand material shall contain no organic material. Sand shall be nonplastic when tested in accordance with ASTM D 4318 and 100 percent shall pass a 1/2-inch screen and no more than 20 percent shall pass a No. 200 screen.
 3. The sand shall be deposited in uniform layers not to exceed six (6) inches in uncompacted thickness. The backfill shall be compacted to not less than 95 percent of laboratory maximum density as determined by ASTM D 698.
 4. All material for sand must be tested and approved by the ENGINEER.
 5. No sand shall be placed without the approval of the ENGINEER.
- F. Drainage Material:
1. Drainage material shall be crushed rock or gravel conforming to the requirements of Section 02225.
- G. Pea Gravel:
1. Pea gravel shall be crushed rock or gravel conforming to the requirements of Section 02225.
- H. Filter Fabric:
1. Filter fabric, where shown on the Drawings, shall be as specified under Section 02271.
- I. Pulverized Material:
1. Pulverized material shall be existing on-site asphaltic paving shown to be demolished or removed on Drawings.
 2. Existing on-site asphaltic paving and a three (3) inch depth of pavement base course shall be pulverized to meet the gradation and plastic index requirements of MAG Standard Section 702, Aggregate Base Course (ABC) material.
 3. Pulverized material shall be used on-site as select fill or backfill. Pulverized material shall be compacted in accordance with requirements for select fill or backfill, as specified herein.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. The portions of the site on which the Work is to be constructed shall be cleared in accordance with Section 02110.

3.2 EROSION CONTROL AND DEWATERING

- A. Erosion Control:
1. As a minimum, the construction procedures outlined herein shall be implemented to assure minimum damage to the environment during construction. CONTRACTOR shall take any and all additional measures required to conform to the requirements of applicable codes and regulations.

2. Whenever possible, access and temporary roads shall be located and constructed to avoid environmental damage. Provisions shall be made to regulate drainage, avoid erosion and minimize damage to vegetation.
3. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion, subject to the ENGINEER'S approval.
4. Temporary measures shall be applied to control erosion and to minimize the siltation of the existing waterways, and natural ponding areas. Such measures shall include, but not be limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods. These temporary measures shall be applied to erodible materials exposed by any activities associated with the construction of this Project.
 - a. Special care shall be taken to eliminate depressions that could serve as mosquito pools.
 - b. Temporary measures shall be coordinated with the construction of permanent drainage facilities and other work to the extent practicable to assure economical, effective, and continuous erosion and siltation control.
 - c. CONTRACTOR shall provide special care in areas with steep slopes. Disturbance of vegetation shall be kept to a minimum to maintain stability.
5. Remove only those shrubs and grasses that must be removed for construction. Protect the remainder to preserve their erosion-control value.
6. Install erosion and sediment control practices where shown and according to applicable standards, codes and specifications. The practices shall be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.
7. Mulching to be used for temporary stabilization.
 - a. Suitable Materials for Mulching:
 - 1) Unrotted straw or salt hay - 1-1/2 to 2 tons/acre.
 - 2) Asphalt emulsion or cutback asphalt - 600 to 1200 gal./acre.
 - 3) Wood-fiber or paper-fiber (hydroseeding) - 1500 lbs./acre.
 - 4) Mulch netting (paper, jute, excelsior, cotton or plastic).
 - b. Straw or salt hay mulches should be immediately anchored using peg and twine netting or a mulch anchoring tool or liquid mulch binders.
8. After stabilization, remove all straw bale dikes, debris, etc., from the site.
9. In the event of any temporary work stoppage, the CONTRACTOR shall take steps any temporary or environmental damage to the area undergoing construction.
10. In the event the CONTRACTOR repeatedly fails to satisfactorily control erosion and siltation, the OWNER reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated. The cost of such work, plus engineering costs, will be deducted from monies due the CONTRACTOR.

11. CONTRACTOR shall prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce on and off-site damage and health hazards. Control may be effected by irrigation in which the site shall be sprinkled with water until the surface is moist. The process shall be repeated as needed.

B. Dewatering:

1. CONTRACTOR shall provide and maintain adequate dewatering equipment to remove and dispose of all surface water, ground water, and leakage from adjacent treatment facilities entering excavations, trenches, or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein is inspected by the ENGINEER and backfill operations have been completed and approved.
 - a. The different working areas on the site shall be kept free of surface water at all times. CONTRACTOR shall install drainage ditches and dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations and fill areas. The diversion and removal of surface water shall be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.
 - b. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the water downstream of the point of discharge shall not be directly discharged. Such waters shall be diverted through a settling basin or filter before being discharged.
 - c. CONTRACTOR will maintain pipe, conduit or channel used for drainage purposes and all such pipes, conduits or channels shall be left clean and free of sediment.
2. CONTRACTOR shall provide, install and operate sufficient trenches, sumps, pumps, hose, piping, wellpoints, deep wells, etc., necessary to depress and maintain the ground water level below the base of the excavations during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained two feet below the lowest subgrade excavation made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water. Dewatering shall be maintained on a 24-hour basis and standby pumping facilities and personnel shall be available on-site.
 - a. Elements of the system shall be located so as to allow a continuous dewatering operation without interfering with the construction of the permanent work. Where portions of the dewatering system are located in the area of permanent construction, CONTRACTOR shall submit details of the methods he proposes to construct the permanent work in this location for the approval of the ENGINEER. Controls of ground water shall continue until the permanent construction provides sufficient dead load to withstand the hydrostatic uplift of the normal ground water, until concrete has attained suffi-

cient strength to withstand earth and hydrostatic loads, until all waterproofing work has been completed and until pipelines are properly jointed. Dispose of all water removed from the excavation in such a manner so as not to endanger any portion of the Work under construction or completed. Convey water from the excavations in a closed conduit. Do not use trench excavations as temporary drainage ditches.

3.3 TEST PITS

- A. Where ordered by the ENGINEER, the CONTRACTOR shall excavate and backfill, in advance of construction, test pits to determine conditions or location of existing facilities. The CONTRACTOR shall perform all work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits.
- B. Payment for this work will be included in the unit or lump sum price bid for the excavation work.
- C. Test pits made by the CONTRACTOR for his own use at his option shall not be paid for.

3.4 EXCAVATION

- A. CONTRACTOR shall perform all excavation required to complete the Work as shown and specified. Excavations shall include earth, sand, clay, gravel, hardpan, boulders not requiring drilling and blasting to remove, decomposed rock, pavements, rubbish and all other materials within the excavation limits, except rock. Where the excavation is in rock, the rock shall be removed as specified under Section 02211, Rock Excavation.
- B. Excavations for structures and pipelines shall be open excavations, shored and braced where necessary to prevent possible injury to workmen and to new and existing structures or pipelines. Sheeting and bracing shall be installed in accordance with Drawings submitted under Article 1.3 above.
- C. Where the structure or pipeline is to be placed below the ground water table, well points, cofferdams or other acceptable methods shall be used to permit construction of said structure or pipeline under dry conditions. Dry conditions shall prevail until fresh concrete has reached sufficient strength to withstand earth and hydrostatic loads and until the pipelines are properly jointed, tested and backfilled. In addition, protect excavation from flooding until all walls and floor framing up to and including grade level floors are in place and backfilling has begun. Water level shall be maintained below top of backfill at all times.
- D. Pumping in excavations shall be done in such a manner to prevent the carrying away of unconsolidated concrete materials, and to prevent damage to the existing subgrade.

- E. The elevation of the bottom of footings shown shall be considered as approximate only and the ENGINEER may order such changes in dimensions and elevations as may be required to secure a satisfactory footing. All structure excavations shall be hand-trimmed to permit the placing of full widths, and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted. When excavations are made below the required grades, without the written order of the ENGINEER, they shall be backfilled with compacted gravel or concrete as directed by the ENGINEER at the expense of the CONTRACTOR.
- F. Excavation shall be extended sufficiently on each side of structures, footings, etc., to permit setting of forms, installation of sheeting or the safe sloping of banks.
- G. Roadways, Structures, and Trench Subgrades:
1. Subgrades for roadways, structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades which are otherwise solid, but which becomes soft or mucky on top due to construction operations, shall be reinforced with crushed stone or gravel. Subgrades shall be scarified to a depth of eight (8) inches and recompact to 95 percent relative compaction. The finished elevation of stabilized subgrades shall not be above subgrade elevations shown.
 2. Where cemented rock, cobbles, or boulders compose a large portion of the foundation material underlying structures, slabs, paved areas, it may not be advisable to scarify the top 8 inches prior to compaction. If the ENGINEER deems it advisable not to scarify the existing natural ground, the CONTRACTOR shall moisten the native soil and compact it as specified.
- H. Stability of Excavations: Slope sides of excavations to comply with codes and ordinances of agencies having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.
1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
 2. Foundations for fill having slopes in excess of one vertical to four horizontal shall be benched or terraced to adequately key the existing ground and the fill built thereon. The slopes of original hillsides and old fills shall be benched a minimum of four (4) feet horizontally as the fill is placed. A new bench shall be started wherever the vertical cut of the next lower bench intersects the existing ground. Material thus cut out shall be recompact along with the new embankment material by the CONTRACTOR at no additional cost to the OWNER.
- I. Pipe Trench Preparation:
1. Potable water pipe and appurtenances shall be laid in trenches separate from those used for sewers. Unless otherwise specified or indicated on the Drawings, potable water pipe shall be laid in trenches having a cover of not less than three (3) feet below

the surface of the ground and located at a distance of not less than ten (10) feet from any parallel sewer trench.

2. No more than 200 feet of trench may be opened in advance of pipe laying.
 3. Trench width shall be minimized to greatest extent practical but shall conform to the following:
 - a. The minimum clear width of the trench for pipe four (4) inches in diameter and over, measured at the top of the pipe, shall be not less than the outside diameter of the pipe plus eighteen (18) inches.
 - b. The maximum clear width of the trench for the pipe, measured at the top of the pipe, shall not exceed the outside diameter of the pipe plus twenty-four (24) inches for pipe sizes up to and including twenty-four (24) inches and shall not exceed the outside diameter of the pipe plus thirty-six (36) inches for pipe sizes over twenty-four (24) inches.
 - c. Trench widths shall be sufficient to provide room for installing, jointing and inspecting piping, but in no case wider at top of pipe than allowed by Section 601 of the MAG Specifications.
 - d. Enlargements at pipe joints may be made if required and approved by ENGINEER.
 - e. Sufficient for sheeting, bracing, sloping, and dewatering.
 - f. Sufficient to allow thorough compacting of backfill adjacent to bottom half of pipe.
 - g. Do not use excavating equipment which requires the trench to be excavated to excessive width.
 4. Depth of trench shall be as shown and specified. If required and approved by ENGINEER depths may be revised.
 - a. Unless otherwise specified or shown, the bottom of the trench for pipes 16 inches in nominal diameter and smaller shall be accurately graded to provide uniform bearing and support for each section of the pipe, on undisturbed soil at every point along its entire length, except for portions of the pipe where it is necessary to excavate for bells and for the proper sealing of pipe joints.
 - b. For all pipe larger than 16 inches in diameter, the CONTRACTOR shall over excavate the bottom of the trench by a minimum of 4 inches, or 1/12 the outside diameter of the pipe, whichever is greater, unless otherwise shown. This overcut shall be filled with bedding material consisting of select material or sand as specified herein.
- J. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
1. Locate and retain soil materials away from edge of excavations.
 2. Dispose of excess soil material and waste materials as specified hereinafter.
- K. Where the existing material beneath the bedding material is considered unsuitable by the ENGINEER, CONTRACTOR shall remove and replace it with select backfill. The additional excavation and select backfill material, when ordered in writing by the ENGINEER, shall be included under Section 02233.

3.5 UNAUTHORIZED EXCAVATION

- A. All excavation outside the lines and grades shown, and which is not approved by the ENGINEER, together with the removal and disposal of the associated material shall be at the CONTRACTOR'S expense. The unauthorized excavation shall be filled and compacted with select backfill by the CONTRACTOR at his expense.

3.6 TERMITE TREATMENT

- A. CONTRACTOR shall apply poison for elimination of termites below all slab-on-grade construction, to provide a chemical barrier to protect the building and contents against attack by subterranean termites.
- B. The application shall be performed by a licensed applicator. Sufficient notice shall be given to permit application to be made not more than 24 hours prior to concrete placement. To avoid surface flow of the toxicant from the application site, treatment shall not be made when soil or fill is excessively wet. Termite treatment shall be applied only after all preparation for slab placement has been completed. There shall be no disturbance of treated areas.
- C. The toxicant shall be applied to the entire surface to be under building slab-on-grade as an overall treatment; interior side of all foundation walls; exterior side of all foundation walls where slabs or walks abut the building; expansion or control joints; and wherever slab will be penetrated by construction features.
- D. Application shall be made during normal working hours, and the ENGINEER shall be notified a minimum of 48 hours in advance so that he may be present during application. The CONTRACTOR shall permit the ENGINEER to sample any and all material used, and to verify the volume and rate of application. The ENGINEER may require, and the CONTRACTOR shall pay for, chemical analysis tests of the materials being applied on the basis of one test for each 10,000 square feet of treated area. Samples and tests may be on both concentrated and the diluted material as it is being applied.
- E. Evidence of subterranean termite activity and damage to the structure resulting from such activity within the guarantee period shall be treated and repaired by the CONTRACTOR at no cost to the OWNER.

3.7 VEGETATION CONTROL

- A. The CONTRACTOR shall provide soil sterilization for unwanted plant life under structures, sidewalks, and pavement. Soil sterilization shall be Karmex 80W, manufactured by DuPont; Diuron 4L, manufactured by Drexel Chemical Corporation; or equal. The weed killer shall be applied according to the manufacturer's published instructions.

3.8 DRAINAGE AND DEWATERING

- A. General:
 - 1. Prevent surface and subsurface water from flowing into excavations and from flooding adjacent areas.

2. Except as otherwise specified or indicated on the Drawings, no existing drainage channel shall be blocked or diverted in such a way that its point of discharge from the project site is diverted from its natural point of discharge.
 3. Remove water from excavation as fast as it collects.
 4. Maintain the ground water level below the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for the permanent work, and to prevent damage to the Work during all stages of construction.
 5. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.
 6. Obtain ENGINEER'S approval before shutting down dewatering system for any reason.
- B. Standby Requirements for Dewatering: Provide standby equipment to insure continuity of dewatering operations.
- C. Disposal of Water Removed by Dewatering System:
1. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed.
 2. Dispose of water in such a manner as to cause no inconvenience to the OWNER, ENGINEER, or others involved in work about the site.
 3. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches.

3.9 SHEETING, SHORING AND BRACING

- A. General:
1. Excavations for structures and pipe lines shall be open excavation, sheeted, shored and braced where necessary to prevent injury to workmen, structures, or pipe lines.
 2. All municipal, county, state and federal ordinances, codes, regulations and laws shall be observed.
 3. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.
 4. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade or Southern Pine No. 2 Dense S3.
 5. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.
 6. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36.
 7. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

8. Unless otherwise shown, specified, or ordered, all materials used for temporary construction shall be removed when work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent Work.
9. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cutoff tops as required and leave permanently in place.
10. The clearances and types of the temporary structures, insofar as they affect the character of the finished Work, and the design of sheeting to be left in place, will be subject to the approval of the ENGINEER; but the CONTRACTOR shall be responsible for the adequacy of all sheeting, shoring, bracing, cofferdamming, etc.
11. Safe and satisfactory sheeting shall be the entire responsibility of the CONTRACTOR.

B. Sheeting Left in Place:

1. Steel sheet piling shown to be left in place or ordered in writing to be left in place by the ENGINEER, shall consist of rolled sections of the continuous interlocking type unless otherwise approved. The type and design of the sheeting and bracing shall conform to the above specifications for all steel work for sheeting and bracing. Steel sheeting installed but not removed shall be new.
2. Steel sheet piling to be left in place shall be driven straight to the lines and grades as shown or directed. The piles shall penetrate into firm materials with secure interlocking throughout the entire length of the pile. Damaged piling having faulty alignment shall be pulled and replaced by new piling.
3. The type of guide structure used and method of driving for steel sheet piling to be left in place shall be subject to the approval of the ENGINEER. Jetting will not be permitted.
4. CONTRACTOR shall cut off piling left in place to the grades shown or ordered by the ENGINEER and shall remove the cut offs from the site.
5. CONTRACTOR shall thoroughly clean wales, braces and all other items to be embedded in the permanent structure, and shall make provisions that the concrete surrounding the embedded element is sound and free from air pockets or harmful inclusions. The provisions shall include the cutting of holes in the webs and flanges of wale and bracing members, and the welding of steel diaphragm waterstops perpendicular to the centerline of brace ends which are to be embedded.
6. Subsequent to removal of the inside face forms, and when removal of bracing is permitted, steel shall be cut back at least 2 inches inside the wall face and the opening patched with cement mortar. The concrete shall be thoroughly worked beneath wales and braces, around stiffeners and in any other place where voids may be formed.
7. Portions of sheeting or soldier piles and breast boards which are in contact with the foundation concrete shall be left in place, together with wales and bracing members which are cast into foundation or superstructure concrete.

- C. Removal of Sheeting and Bracing:
 - 1. Remove sheeting and bracing from excavation unless otherwise ordered in writing by the ENGINEER. Removal shall be done so as to not cause injury to the Work. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure.
 - 2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete until the following conditions are satisfied:
 - a. Concrete has cured a minimum of seven (7) days.
 - b. Wall and floor framing up to and including grade level floors are in place.

3.10 GENERAL BACKFILL

- A. All backfill required for structures and trenches and required to provide the finished grades shown and as described herein shall be furnished, placed and compacted by the CONTRACTOR. Unless otherwise specified fill may be obtained from on-site sources. If additional materials are required, they shall be furnished from off-site sources at no additional cost to the OWNER. All materials used for filling and backfilling shall be clean soils of acceptable quality and shall be free from boulders, excessive clay, frozen lumps, wood, stumps, sludge or other organic matter or other deleterious materials. Excavated materials meeting these requirements may be used as backfill.
- B. Backfill excavations as promptly as Work permits, but not until completion of the following:
 - 1. Acceptance by ENGINEER of construction below finish grade including dampproofing, waterproofing, and perimeter insulation.
 - 2. Inspection, testing, approval, and recording of locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
- C. Excavation shall be kept dry during backfilling operations. Backfill around structures and piping shall be brought up evenly on all sides.
- D. Levels of backfill against concrete walls shall not differ by more than two (2) feet on either side of walls unless walls are adequately braced or all floor framing is in place up to and including grade level slabs.
- E. All backfilling in pipe trenches which are below structures, other pipes, or paved areas, shall be placed in horizontal layers not exceeding six (6) inches in depth and thoroughly compacted before the next layer is placed. In other pipe trenches, compacted layers shall

be six (6) inches up to the pipe spring line and eight (8) inches thereafter.

- F. Where pipe is laid in rock excavation, provide a minimum of 3-inches of crushed stone or gravel under pipes smaller than 4-inches in diameter and a minimum of 6-inches of crushed stone or gravel under pipes 4-inches in diameter and larger. Fill shall be carefully placed and tamped over the rock before the pipe is laid. After laying pipe, the balance of the backfill shall be placed as described herein.
- G. Except as otherwise specified, bedding material for pipe less than 16-inch nominal size shall be sand, ABC, or select fill material passing the 1-inch screen. Bedding material for pipe form 16-inch and larger shall be as for less than 16-inch nominal size, unless otherwise noted.
- H. PVC, PVDF, and CPVC piping is to be laid with a bank sand embedment. A minimum of 4 inches of sand below and above the pipes and 5 inches on the sides shall be used. After the sand is placed and compacted above the pipes, a compacted embedment of ABC or select fill material passing the 1-inch screen shall be placed and compacted to 90 percent maximum density to a depth of 12 additional inches; minimum.
- I. Prior to the installation of pipes which are to be installed in fill sections, the fill shall be placed, as described herein, until a minimum height of two (2) feet above the pipe is reached, unless otherwise required in other Sections. The fill for the trench width shall be excavated, the pipe installed and backfilled. The remainder of the fill shall then be placed.
- J. Unless otherwise specified or directed by ENGINEER fill shall be placed in horizontal loose lifts not exceeding eight (8) inches in thickness and shall be mixed and spread in a manner assuring uniform lift thickness after placing.
- K. The water content of fill material shall be controlled during placement within the range necessary to obtain the compaction specified. In general, the moisture content of the fill shall be within 3 percent of the optimum moisture content for compaction as determined by laboratory tests. CONTRACTOR shall perform all necessary work to adjust the water content of the material to within the range necessary to permit the compaction specified. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed. No compaction of fill will be permitted with free water on any portion of the fill to be compacted.
- L. No fill shall be placed or compacted in a frozen condition or on top of frozen material. Fill containing organic materials or other unacceptable material shall be removed and replaced with approved fill material.

- M. Compaction of fill shall be performed with equipment suitable for the type of material placed and which is capable of providing the densities required. CONTRACTOR shall select compaction equipment and submit it and his proposed procedure to the ENGINEER for approval.
- N. Fill shall be compacted by at least two coverages of all portions of the surface of each lift by compaction equipment. One coverage is defined as the condition obtained when all portions of the surface of the fill material have been subjected to the direct contact of the compactor.
- O. The effectiveness of the equipment selected by the CONTRACTOR shall be tested at the commencement of compacted fill Work by construction of a small section of fill within the area where fill is to be placed. If tests on this section of fill show that the specified compaction is not obtained, the CONTRACTOR shall increase the amount of coverages, decrease the lift thicknesses or obtain a different type of compactor. No additional cost to the OWNER shall be incurred.
- P. Backfill around structures shall be performed using the specified procedures, except that within ten (10) feet of foundations and underground structures, light compaction equipment shall be used, with the gross weight of the equipment not exceeding 7,000 pounds. Provide equipment that is capable of the required compaction within restricted areas next to structures and around piping.
- Q. The minimum density for general backfill shall be 90 percent of maximum density obtained in the laboratory in accordance with ASTM D 698 Method C including Note 2. This percentage is of standard Proctor density.

R. Compaction Density Requirements:

1. The degree of compaction required for all types of fills shall be as noted and as listed below. Material shall be moistened or aerated as necessary to provide the moisture content that will facilitate obtaining the specified compaction.

<u>Material</u>	<u>Required Density- Percent Compaction (ASTM D698)</u>	<u>Maximum Upcompacted Lift Thick. (in)</u>
Subgrade Soil:		
Below concrete pedestrian slabs	90 min.	-
Below base of footings or mats, structural slabs and tank floors	95 min.	-
Below asphalt paving	95 min.	-
Subbase Fill:		
Below concrete pedestrian slabs	90 min.	8
Below base of footings or mats, structural slabs and tank floors	95 min.	8
Below asphalt concrete paving	95 min.	8
*Structural Backfill:		
More than 5 feet below final grade	100 min.	8
Less than 5 feet below grade	95 min.	8
Base Course:		
Below concrete slabs or mats	95 min.	8
Below asphalt paving	100 min.	8
Trench Backfill above pipe	95 min.	8
Granular Embedment Material	95 min.	6
Sand Embedment Material	95 min.	6

*Structural backfill shall not be used for support of facilities which are susceptible to damage from differential settlement of the fill section relative to walls.

Compaction of on-site or imported soils with low expansive potential shall be accomplished at a moisture content between optimum ± 3 percent. Compaction of subgrade soil and fill materials below asphalt pavement shall be accomplished at a moisture content 2 percent below optimum or lower.

Natural undisturbed soils or compacted soil subsequently disturbed or removed by construction operations shall be replaced with materials compacted as specified above.

2. The testing laboratory shall perform tests necessary to provide data for selection of fill material and control of placement water content.
3. Field density tests, to insure that the specified density is being obtained, will be performed by testing laboratory during each day of compaction work. Field density tests shall be performed to provide one sample for every 500 square feet of compaction under slabs, and tests shall be repeated for each

lift. Pipe trenches shall be tested with one field density test per lift per pipe trench per 200 linear feet of trench. Elsewhere, field density tests shall be performed to provide one sample for every 2,500 square feet of compaction and shall be repeated for each lift.

- S. If the specified densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment, the CONTRACTOR shall perform whatever work is required to provide the required densities. This work shall include complete removal of unacceptable fill areas and replacement and recompaction until acceptable fill is provided.
- T. CONTRACTOR shall repair, at his own expense, after settlement that occurs. He shall make all repairs and replacements necessary within thirty (30) days after notice from the ENGINEER or OWNER.

3.11 EMBANKMENTS

- A. To the maximum extent available, excess earth obtained from structure and trench excavations shall be used for construction of embankments. Additional material shall be obtained from borrow pits as necessary. After preparation of the embankment area, the subgrade shall be leveled and rolled so that surface materials of the subgrade will be compact and well bonded with the first layer of the embankment. All material deposited in embankments shall be free from rocks or stones, brush, stumps, logs, roots, debris, and organic or other objectionable materials. Embankments shall be constructed in horizontal layers not exceeding eight (8) inches in uncompacted thickness. Material deposited by excavating and hauling equipment shall be spread and leveled prior to compaction. Each layer shall be thoroughly compacted by rolling or other method acceptable to the ENGINEER to 95 percent of the maximum density at optimum moisture content as determined by ASTM D 698. If the material fails to meet the density specified, compaction methods shall be altered. Wherever a trench passes through a fill or embankment, the fill or embankment material shall be placed and compacted to an elevation twelve (12) inches above the top of the pipe before the trench is excavated.

3.12 SELECT FILL

- A. Select fill shall be provided in the following locations:
 - 1. Support for structure foundations where CONTRACTOR excavates below design subgrade shall be provided at CONTRACTOR'S expense.
 - 2. Support below and around piping and foundations.
 - 3. Subgrade for roads and pavements.
 - 4. Where shown or directed by ENGINEER.
- B. Subgrade surface shall be level, dry, firm and subject to ENGINEER'S approval. Fill shall not be placed if any water is on the surface of area to receive fill. Fill shall not be placed or compacted in a frozen condition or on top of frozen material.

- C. Fill shall be placed in horizontal loose lifts of eight (8) inches maximum thickness. It shall be mixed and spread in a manner to assure uniform lift thickness after placing.
- D. Each layer of fill shall be compacted before placement of the next lift.
- E. Fill containing lumps, pockets or concentrations of silt or clay, rubble, debris, wood or other organic matter shall not be placed. Fill containing unacceptable material shall be removed and disposed of.
- F. The water content of the fill being compacted shall be above the bulking water content for the material. CONTRACTOR shall wet the fill materials during placement to achieve water contents needed for effective compaction.
- G. Compaction of fill shall be performed with equipment suitable for the type of fill material being placed. CONTRACTOR shall select equipment which is capable of providing the densities required and shall submit the equipment to the ENGINEER for approval.
- H. Vibratory rollers or vibratory plate compactors are suitable for compaction of select fill. Each layer of fill material shall be compacted by at least two complete coverages of all portions of the surface of each lift using approved compaction equipment. One coverage is defined as the condition reached when all portions of the fill lift have been subjected to the direct contact of the compacting surface of the compactor.
- I. The minimum density to be obtained in compacting the select fill shall be 95 percent of maximum density obtained in the laboratory in accordance with ASTM D 698 Method C including Note 2. This percentage is of standard Proctor density. If the field and laboratory tests indicate unsatisfactory compaction, CONTRACTOR shall provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction work shall be performed by the CONTRACTOR at no additional cost to the OWNER until the specified compaction is obtained.
- J. Select fill necessary to replace subgrade materials disturbed and softened as a result of the CONTRACTOR'S operations or to backfill unauthorized excavation shall be provided, placed and compacted at the CONTRACTOR'S expense.

3.13 SLURRY BACKFILL

- A. Slurry backfill shall be placed where called for on the Part B Plans for encasement of pipe and for backfilling.
- B. Slurry backfill shall consist of Type II Portland cement, ABC and water. Minimum cement content shall be 188 pounds of cement per cubic yard of slurry. Slump at time of placement shall not exceed five (5) inches and minimum 28-day compressive strength shall be 100 psi.

3.14 UNCOMPACTED BACKFILL

- A. Compaction of trench backfill above pipe embedment in locations other than those specified will not be required except to the extent necessary to prevent future settlement.
- B. Material above embedments shall be placed so that no excessive or unbalanced load, shock or impact occurs on the pipe or result in displacement of the pipe.

3.15 GRADING

- A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.
- B. Grading 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. Turfed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover areas to within not more than one (1) inch above or below the required subgrade elevations.
 - 2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than one (1) inch above or below the required subgrade elevation.
 - 3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2-inch above or below the required subgrade elevation.
- C. Grading Surface of 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 1/2-inch when tested with a 10 foot straightedge.
- D. Compaction:
 - 1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.16 PAVEMENT SUBBASE COURSE

- A. General: Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.
 - 1. See Section 02513 for paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a twelve (12) inch width of

shoulder simultaneously with compacting and rolling of each layer of subbase course.

- D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.
 - 1. When a compacted subbase course is shown to be six (6) inches thick or less, place material in a single layer. When shown to be more than six (6) inches thick, place material in equal layers, except no single layer more than six (6) inches or less than three (3) inches in thickness when compacted.

3.17 DISPOSAL OF EXCAVATED MATERIALS

- A. Material removed from the excavations which does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away from the project site by the CONTRACTOR and disposed of in compliance with municipal, county, state, federal or other applicable regulations at no additional cost to the OWNER.

3.18 RESTORING AND RESURFACING EXISTING ROADWAYS AND FACILITIES

- A. CONTRACTOR shall place 1-1/2 inches of temporary bituminous pavement immediately after backfilling trenches in paved roadways which are to be retained for permanent use. He shall maintain in good and safe condition during progress of the entire Work, the surface of the paved area over the trench, and promptly fill all depressions over and adjacent to the trench caused by settlement of backfilling. The permanent replacement pavement shall be equal to that of the existing roadways unless otherwise specified.
- B. Pavement, gutters, curbs, sidewalks or roadways disturbed or damaged by the CONTRACTOR'S operations, except areas designated "New Pavement" or "Proposed Pavement", shall be restored by him at his own expense to as good condition as they were previous to the commencement of the Work and in accordance with applicable local and state highway specifications.

+ + END OF SECTION + +

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
 - 1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to place riprap for slopes and ditches at locations shown on the Drawings and ordered by the ENGINEER.
- B. Related Work Specified Elsewhere:
 - 1. Section 02225, Crushed Stone, Gravel and Drainage Material.
 - 2. Section 02233, Excavation and Backfill.
 - 3. Section 03600, Grout.

1.2 MEASUREMENT

- A. The quantity of riprap is the number of square yards in place within the lines, grades and limits shown, specified or ordered. Measurement shall be made along the slope in the final position.

1.3 QUALITY CONTROL

- A. CONTRACTOR shall conform to all applicable requirements of Sections 220 and 703 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Government (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.

1.4 SUBMITTALS

- A. The CONTRACTOR shall furnish representative samples of riprap bedding and riprap to the ENGINEER and shall advise the source locations. If the source location changes during construction, the CONTRACTOR shall resubmit representative samples.
- B. The CONTRACTOR shall submit samples of the filter fabric for approval by the ENGINEER.
- C. Shop Drawings: Submit for approval the Shop Drawings showing the areas to be covered and the method used for holding the fabric to the slopes.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Riprap Bedding:
1. Well-graded mix of sand and gravel with maximum size of three (3) inches and with not more than 20 percent passing the No. 60 sieve.
 2. Sand: Clean, hard, durable particles free from organics or other deleterious matter.
 3. Gravel: Shall be crushed gravel or stone for use on slopes. The material shall be clean, hard, durable material.
- B. Riprap:
1. Riprap shall consist of hard, durable angular field or rough unhewn quarry stone as nearly uniform in section as possible. The stone shall be dense, resistant to the action of air, water and suitable for the purpose intended. Riprap shall be graded rock having a range of individual rock weights as follows:

<u>Weight of stone</u>	<u>Percent smaller by weight</u>
200 pounds	100
160 pounds	80 - 100
100 pounds	45 - 80
50 pounds	15 - 45
20 pounds	5 - 15
5 pounds	0 - 15

Specific gravity shall be between 2.5 and 2.82.

- C. Filter Fabric:
1. Filter fabric shall be a non-woven polypropylene material, needle punched or spunbonded fabric.
 2. Product and Manufacturer: Provide one of the following:
 - a. Celanese Mirafi 140S.
 - b. DuPont Typor, Style No. 3401.
 - c. Or equal.

PART 3 - EXECUTION

3.1 PLACING

- A. Subgrade: The subgrade for riprap bedding shall be prepared to the required lines and grades. It shall be compacted to 90 percent maximum density. All loose material shall be removed in accordance with Section 02233.
- B. Filter Fabric: The filter fabric shall be placed over the entire area to be riprapped in accordance with the recommendations of the filter fabric manufacturer. Filter fabric shall be placed between the subgrade and drainage material as shown on the Drawings.

- C. Riprap Bedding:
1. Bedding shall be placed to a compacted depth of six (6) inches by means approved by the ENGINEER.
 2. Riprap bedding shall be placed to a compacted depth of six (6) inches. Riprap bedding shall be compacted to 90 percent maximum density obtained by the test procedure presented in ASTM D 698.
- D. Riprap:
1. The minimum total thickness of the riprap layer shall be twelve (12) inches except where otherwise indicated.
 2. The stones shall be placed from the bottom of the embankment upward such that the weight of the stone is carried by the underlying material. The larger stones shall be placed in the lower courses.
 3. Open joints shall be filled with spalls.
 4. Riprap may be placed by equipment, however, care shall be taken in placing to obtain a good gradation of material such that the riprap is firm and solid. Surfaces shall be barred to the required alignment and slopes. Large voids shall be filled by hand placement of stone unless otherwise approved by the ENGINEER.
- E. Grouting Riprap:
1. Riprap shall be grouted where shown on the Drawings.
 2. When riprap is properly positioned, stones shall be flushed with water to remove fines, and cement grout, as specified in Section 03600, shall be applied. Stones shall be wet prior to and during grout application. Grout shall be applied in two (2) courses using baffles and diverting equipment. The first course shall completely penetrate the stone voids and shall be applied with the aid of poles or rods to loosen the tight pockets of stone. The second course shall be applied as soon as the first course has jelled. The second course shall be broomed uphill during application, and the entire surface shall be rebroomed to eliminate runs and fill voids.
 3. After grouting is complete, no load shall be permitted on the grouted surface for 24 hours. The grouted surface shall be protected from damage until curing is complete. The grout shall be cured as specified in Sections 03300 and 03600.

+ + END OF SECTION + +

SECTION 02429
DRAINAGE STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to provide all precast, cast-in-place and masonry drainage structures including drain inlets, catch basins, manholes, vaults, headwalls and similar structures as shown, specified, and otherwise required to complete the Work.
- B. General:
1. Structures shall conform in shape, size, dimensions, materials, and other respects to the details shown or as ordered by the ENGINEER.
 2. Cast iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown.
 3. All concrete shall be Class A and shall conform to the requirements specified under Section 03300.
 4. Inverts shall be as shown and shall conform accurately to the size and elevation of the adjoining pipes.
- C. Related Work Specified Elsewhere:
1. Series 02200 Sections on Earthwork.
 2. Section 02601, Manholes.
 3. Section 03300, Cast-In-Place Concrete.
 4. Section 05504, Miscellaneous Metal Fabrications.
 5. Section 05540, Castings.
 6. Series 15000 Sections on Piping.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
1. ASTM C 32, Sewer and Manhole Brick (made from Clay or Shale).
 2. ASTM C 139, Concrete Masonry Units for Construction of Catch Basins and Manholes.
 3. ASTM C 140, Sampling and Testing Concrete Masonry Units.
 4. ASTM C 207, Hydrated Lime For Masonry Purposes.
 5. ASTM C 478, Precast Reinforced Concrete Manhole Sections.
- B. CONTRACTOR shall conform to all applicable requirements of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between the MAG Specification as supplemented by the City of Phoenix and these Specifications, provisions of these Specifications shall apply.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of brick, block, gaskets and accessories, if any, for the structures.

- B. Shop Drawings: Submit for approval Shop Drawings showing design and construction of all precast concrete.

PART 2 - PRODUCTS

2.1 PRECAST PRODUCTS

- A. Where shown or otherwise approved by the ENGINEER precast concrete shall be used for items such as area drains, catch basins, manholes, vaults, splash pads, etc. Layout and details shall be as shown and specified. Design shall be adequate to withstand all loads imposed including earth pressure, vehicle loads (H-20) and construction loading.
- B. Precast concrete sections shall conform to ASTM C 478, where applicable.
- C. Bases shall be cast-in-place concrete unless otherwise shown. A precast or cast-in-place top slab shall be provided, where shown or required. Slab shall be of sufficient strength to safely support an H-20 loading. Cast-in-place concrete shall conform to Section 03300.

2.2 MASONRY STRUCTURES

- A. Where shown, required or otherwise approved by the ENGINEER drainage structures of masonry construction shall be provided.
- B. Masonry shall conform to the following:
 - 1. Brick: Brick shall conform to the requirements of ASTM C 32, Grade SS for sewer brick and Grade MS for manhole brick.
 - 2. Concrete Blocks: Concrete blocks shall be machine-made, solid segmental blocks not less than 8 inches wide and shaped so that the completed structure in which they are used will conform to the details shown or otherwise approved. Blocks shall be of compact texture and like blocks shall be uniform in shape and size.
 - 3. Concrete blocks shall conform to ASTM C 139. Testing of blocks shall be done in accordance with ASTM C 140.
 - 4. Mortar: The mortar shall be composed of portland cement, hydrated lime, and sand, in which the volume of sand shall not exceed three times the sum of the volumes of cement and lime.
 - 5. Cement shall be Type II portland cement as specified for concrete masonry.
 - 6. Hydrated lime shall be Type S conforming to ASTM C 207.
 - 7. The sand shall comply with the Specifications for "Fine Aggregate" for concrete except that all of the sand shall pass a No. 8 sieve.
- C. Bases shall be cast-in-place concrete unless otherwise shown. A precast or cast-in-place top slab shall be provided, where shown or required. Slab shall be of sufficient strength to safely support an H-20 loading. Cast-in-place concrete shall conform to Section 03300.

2.3 CAST-IN-PLACE STRUCTURES

- A. Conform to the requirements of Division 3 for Class B concrete (unless otherwise specified) and appurtenances.
- B. Construct adequately to withstand all loads imposed including earth pressure, vehicle loads (H20) and construction loads.

2.4 MISCELLANEOUS METALS

- A. Metal frames, covers, grates, troughs, steps and similar required items shall be provided as shown and in accordance with the 05504 Sections on Metal Fabrications.

PART 3 - EXECUTION

3.1 LAYING MASONRY

- A. Brick shall be satisfactorily wet when being laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The joints shall not be wider than 3/8-inch, except when the bricks are laid radially, in which case the narrowest part of the joint shall not exceed 1/4-inch.
- B. For concrete block, the vertical keyways shall be completely filled with mortar.
- C. Each layer of brick for the grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.2 GRADING RINGS

- A. Grading rings or brick stacks shall be used for all precast and masonry structures where required. They shall be a maximum of 12 inches in height, constructed on the top slab on which the frame will be placed. The height of the stack shall be such as is necessary to bring the frame to the proper grade.

3.3 PRECAST ITEMS

- A. Precast products shall be placed on a concrete or crushed stone bed, set at the proper grade and carefully leveled and aligned.

3.4 PIPE JOINT IN STRUCTURE BASE

- A. An approved joint shall be provided between each pipe entering and exiting the structure. Joint may be accomplished by the installation in the structure base of the bell end of a short pipe or by other means subject to approval of ENGINEER.

+ + END OF SECTION + +

SECTION 02433

DRAINAGE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, tools, materials, equipment and incidentals as shown, specified and required to furnish and install drainage pipe, fittings and specials to complete the Work.
2. The extent of piping is shown on the Drawings.

B. Related Work Specified Elsewhere:

1. Section 02233, Excavation and Backfill.
2. Section 02225, Crushed Stone, Gravel, and Drainage Material.
3. Section 02429, Drainage Structures.
4. Section 15051, Buried Piping Installation.

1.2 QUALITY CONTROL

A. Standard Specifications and Details: CONTRACTOR shall conform to all applicable requirements of Parts 600 and 700 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between the MAG Specification as supplemented by the City of Phoenix and these Specifications, provisions of these Specifications shall apply.

B. Source Quality Control: The class, name or trademark of the manufacturer, and the date and place of manufacture shall be stenciled on all pipe, fittings and specials. Each type of pipe, fitting and special shall be obtained from no more than one manufacturer.

C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 76, Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
2. ASTM D 1598, Test for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
3. ASTM D 1599, Test for Short-Time Rupture Strength of Plastic Pipe, Tubing and Fittings.
4. ASTM D 2122, Determining Dimensions of Thermoplastic Pipe and Fittings.
5. ASTM D 1784, Rigid Poly(Vinyl Chloride) PVC Compounds and Chlorinated Poly(Vinyl Chloride) CPVC Compounds.
6. ASTM D 1785, Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
7. ASTM D 2467, Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings.

8. ASTM D 2564, Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
9. ASTM D 2774, Underground Installation of thermoplastic Pressure Piping.
10. Standard No. 14, National Sanitation Foundation.
11. American National Standards Institute.

D. Inspection: The quality of all materials, process of manufacture and the finished pipe, fittings and specials shall be subject to the approval of the ENGINEER.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Detailed drawings and data on pipe, fittings, specials, joints, gaskets, and appurtenances including specification sheet and test reports.
 2. Shop Drawings required under Section 15051.
- B. Certificates: Submit certificates of compliance with referenced standards.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Conform to the applicable requirements of Section 01610 and 01620.
- B. Refer to Section 15051.

PART 2 - PRODUCTS

2.1 CONCRETE PIPE AND FITTINGS

- A. Concrete drain pipe shall be reinforced concrete pipe conforming to ASTM C 76.
- B. Pipe shall be minimum Class III, Wall B as per ASTM C 76.
- C. Fittings and specials shall be of the same design as the pipe.
- D. Joints:
1. Joints shall be concrete, bell and spigot, rubber gasket type.
 2. Gasket shall be first-grade natural crude or first-grade synthetic rubber.
 3. Joints shall be designed, that when sections are laid together, they will make a continuous line of pipe with a smooth interior free from irregularities in the flow line.

2.2 PERFORATED PVC (PPVC) PIPE

- A. PPVC Pipe:
1. PPVC pipe shall be Type 1, Grade 1, having nominal wall thicknesses of .406 inches for six (6) inch and .533 inches for eight (8) inch diameter piping. PPVC pipe shall conform to ASTM D 1785. The PPVC pipe shall have six (6) rows of 1/2-inch holes

within a 160° quadrant of the pipe circumference. Longitudinal spacing of rows shall be six (6) inches on center.

2. Fittings: Solvent welded fittings shall conform to ASTM D 2467 for socket type.
- B. Dimensions and Tolerances: Dimensions and tolerances shall be measured in accordance with ASTM D 2122. The eccentricity of the inside and outside circumferences of the pipe walls shall not exceed 12 percent.
- C. Marking: Marking on the pipe shall include the following, spaced at intervals of not more than five (5) feet.
1. Pipe nominal size.
 2. Pipe schedule.
 3. Specification of plastic material.
 4. Type and grade of plastic.
- D. Piping and fittings shall have ultraviolet inhibitor pigment to resist ultraviolet deterioration.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install piping as shown and specified and in accordance with applicable requirements of Section 02233 and Section 15051 and as recommended by the manufacturer.
2. Request instructions from the ENGINEER before proceeding if there is a conflict between Drawings or Specifications and manufacturer's recommendations.
3. Pipe, fittings and accessories that are damaged will be rejected.
4. Install PPVC piping with perforations facing down.
5. Aggregate below the PPVC piping shall be lightly tamped prior to installation of the piping.
6. Provide felt paper over the top of the piping as directed by the ENGINEER.

+ + END OF SECTION + +

SECTION 02441
IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Scope: The work in this section consists of furnishing all materials, equipment, labor and incidentals required to provide a complete, fully functioning, automatic irrigation system, and modify existing systems as shown, and noted on the project plans, specified herein, and directed by the ENGINEER.
- B. Related Sections:
1. Section 02480, Planting.
 2. Section 02481, Palm Tree Transplanting.
 3. Section 02482, Tree Transplanting.
 4. Section 02483, Cactus Transplanting.
 5. Section 02490, On-Site Nursery and Maintenance.

1.2 SYSTEM DESCRIPTION

- A. The irrigation system shall be a complete, automatically operating, system providing 100% irrigation coverage to all plants, existing and new.
- B. The system as shown and noted is diagrammatic. Exact location of the various system components shall be established by the CONTRACTOR in the field at the time of installation, with the approval of the ENGINEER.

1.3 QUALITY ASSURANCE

- A. The CONTRACTOR shall have a minimum of five (5) years of local experience in the installation and modification of irrigation projects of a similar scope and scale. The CONTRACTOR shall assign 1 individual to serve as project supervisor. This person shall have the same experience specified above, and shall be on site at all times during the installation of the irrigation system to supervise the work in this section.
- B. All materials, equipment, and methods of installation shall comply with the following standards:
1. All applicable federal, state, county, and local codes.
 2. American Society of Testing Materials, (A.S.T.M.).
 3. Irrigation Association, (I.A.).
 4. Maricopa County Uniform Standards for Public Works Construction, (M.A.G.).
 5. National Fire Protection Association, (N.F.P.A.).
 6. National Sanitation Foundation, (N.S.F.).

1.4 SUBMITTALS

- A. Qualifications of CONTRACTOR and proposed project supervisor.
- B. Manufacturer's cut sheets for various irrigation system components.
- C. Manufacturer's warranties for various irrigation system components.
- D. Written operating instructions for the irrigation system.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver irrigation system components to the job site in manufacturer's original, undamaged and unopened containers, with labels intact and legible.
- B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends.
- C. Provide secure, locked area for all irrigation system components that can not be immediately installed, to avoid unnecessary delays.
- D. Store and handle materials so as not to cause any damage to components that would hamper their proper functioning or appearance. Repair or replace any damaged components at the discretion of the ENGINEER, at no additional expense to the OWNER.

1.6 PROJECT/SITE CONDITIONS

- A. Irrigation system installation shall not take place when conditions are so dry as to cause excessive dust, or so wet as to cause excessive mud or clodding.

PART 2 - MATERIALS

2.1 INTERIOR COPPER PIPE, FITTINGS, AND CONNECTIONS

- A. Interior water piping, fittings, and connections shall be Type "L", hard tempered copper tubing, conforming to ASTM B88.
- B. Fittings shall be 150 pounds working water pressure, standard solder and type, constructed of wrought copper, bronze, or brass.
- C. Joints shall be made with tin-lead solder, approximately 95-5 composite.

2.2 PLASTIC PIPE, FITTINGS, AND CONNECTIONS

- A. Polyvinylchloride pipe shall be rigid, unplasticized PVC, extruded from virgin parent material, and conforming to ASTM D2241. It shall be rated at 200 PSI upstream from control, and 160 PSI downstream from control.

- B. Polyethylene pipe shall be flexible PE, conforming to ASTM D2239. It shall be rated at 100 PSI minimum working pressure.
- C. Polyvinylchloride fittings shall be schedule 40 PVC molded fittings, suitable for solvent weld, slip joint ring tight seal, or screwed connections, conforming to ASTM D2241.
- D. Size slip fittings socket taper to permit a dry, unsoftened pipe to be inserted no more than half way into the socket. Saddle and cross fittings are not permitted.
- E. Schedule 80 PVC pipe may be threaded.
- F. Use male adapters for plastic to metal connections. Hand tighten male adapters plus one turn with a strap wrench.
- G. Insert fittings shall conform to ASTM D2246.

2.3 IRRIGATION PUMPS, VALVES, HEADS, AND ASSOCIATED EQUIPMENT

- A. Refer to Irrigation Component Schedule and notes on plans.

2.4 ELECTRICAL CONTROL WIRE

- A. Electrical control and ground wire shall be Type UF, 600V, #12 AWG or larger, control wire.
- B. Provide control, or "hot", wires in one color, and all common wires in another color.

2.5 MISCELLANEOUS ACCESSORIES

- A. Drainage fill shall be 1/2" to 3/4" washed pea gravel.
- B. Fill shall be clean soil, free of stones 2" or larger, foreign matter, organic material, and debris. Material excavated to accommodate the irrigation system may be used as fill material upon review and approval of the OWNER's representative.
- C. If required, provide imported fill as needed to complete the work. Obtain all rights, and pay all costs to imported materials.
- D. Valve access boxes shall be tapered, rigid plastic enclosures comprised of fibrous components that are chemically inert and unaffected by moisture, corrosion, UV light, or temperature change. Provide matching, lockable lid.
- E. Excavate to depths required to allow for an additional 2" depth of earth fill, or sand bedding for piping when rock or other unsuitable bearing material is encountered.
- F. Excavate trenches, install piping, and backfill during the same working day. Do not leave open trenches, or partially filled trenches open overnight.

- G. Backfill trenches to match adjacent grades with approved backfill material. Place and compact backfill in layers not to exceed 6" in depth.
- H. Replace asphalt, concrete, and/or masonry with the same materials, using joints, textures, and finishes to match existing adjoining surfaces.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine all final grades and site conditions. Do not start irrigation system installation until any and all unsatisfactory conditions are corrected.

3.2 PREPARATION

- A. Review irrigation system layout requirements with other affected work. Protect all landscaping and other features to remain.
- B. Coordinate locations of sleeves with general contractor and OWNER's representative.

3.3 EXCAVATION AND BACKFILLING

- A. Excavation shall include all materials encountered, except those materials that cannot be excavated by normal mechanical means.
- B. Utilize existing sleeves whenever possible. Provide sleeves for all locations prior to paving installation whenever possible.
- C. Provide new sleeves for all locations where existing sleeves are not indicated. Remove existing asphalt, concrete, and/or masonry where cutting is necessary using core drilling or sawcutting.
- D. Excavate trenches to a sufficient depth and width to allow for proper handling and placement of pipe and fittings.
- E. Excavate to depths required to allow for 18" minimum covers over mainlines, and 12" minimum cover over lateral lines, based on finished grades.

3.4 PLASTIC PIPE INSTALLATION

- A. Install plastic pipe in accordance with manufacturer's installation instructions.
- B. Saw cut plastic pipe. Use a square-in-sawing vice to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
- C. Make plastic to plastic joints with solvent weld joints. Use only solvent recommended by the pipe manufacturer. Install fittings in accordance with pipe manufacturer's instructions.

- D. Make plastic to metal joints with plastic male adapters. Joint compound shall be Permatex Type III.
- E. Make solvent weld joints in accordance with manufacturer's recommendations. Allow joints to set at least 24 hours before pressure is applied to the system.
- F. Maintain pipe interiors free of dirt and debris. Close open ends of pipe by acceptable methods when pipe installation is not in progress.
- G. Clamps shall be stainless steel, worn gear hose clamps with stainless steel screws, or ear type clamps.
- H. Low voltage wire connectors shall be socket seal type wire connectors, and waterproof sealer.
- I. Materials used for patching and finishing shall match cut surface in material and finish. Exercise special care to provide patching at openings in exterior walls that is water tight.

3.5 IRRIGATION HEADS, FITTINGS, VALVES AND ACCESSORIES

- A. Install fittings, valves, sprinkler heads, emitters, risers, and accessories in accordance with manufacturer's recommendations.
- B. Set irrigation heads perpendicular to finished grades.
- C. Provide risers of 1/2" schedule 80 PVC pipe with schedule 40 PVC male adapters.
- D. Install controller as detailed.
- E. Install in-ground control valves in locking valve access box as indicated. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade, and to provide drainage of the box.
- F. Seal threaded connections of control valves with teflon tape or approved plastic joint type compound.
- G. Install drip emitters as per plans and details indicated. Provide all adapters, plugs, and fittings required.

3.6 CONTROL WIRING

- A. Electrical requirements to automatic controllers, (120V), to be complete in every respect, to code, and ready for use in accordance with manufacturer's recommendations.
- B. No running threads will be accepted, use nipples. Conduit system shall be 660V insulation, NEC standard annealed copper wire with a minimum AWG of 12 TW or RW. Protect each controller by a code approved ground connection. Supply to be 120V, 60 cycle, single phase, 2 amps. Use only galvanized steel fasteners in securing controllers in position.

- C. Electrical requirements from automatic controllers, (24V), to remote control valves shall be UF type, UL approved, #14 AWG solid strand copper wire with a minimum 4/64" PVC coating, 600V, 75 degrees centigrade. "Common" wire to be white coated.
- D. Wire connectors for direct burial conductors, (24V), shall be 600V, 60 degrees centigrade, AWG-UF type, waterproof, epoxy or PVC compound filled containers.
- E. Provide de-electric isolation between all connections joining ferrous and non-ferrous metals, or old, (existing), ferrous and new ferrous metals. Submit for approval type intended for use.
- F. Install electric control cable in the piping trenches wherever possible. Place wire in trench adjacent to pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 100' intervals by making 5 to 6 turns of wire around a piece of 1/2" pipe instead of slack. Where necessary, run wire in a separate trench, and provide a minimum cover of 12".
- G. Provide sufficient slack at site connections, at remote control valves, in control boxes, and at all wire splices to allow for raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
- H. Connect each remote control valve to one station of the controller.
- I. Connect remote control valves to a common ground wire system.
- J. Provide tight joints to prevent leak build-up on the joint.

3.7 SLEEVES

- A. Install new sleeves prior to paving installation wherever possible.
- B. Provide 24" cover for sleeves under pavement. Sleeves shall be schedule 40 under pavement.
- C. Remove and replace existing concrete and asphalt surfaces where cutting is necessary. Obtain ENGINEER'S permission before cutting existing concrete and asphalt surfaces. Where piping is shown under paved areas which are adjacent to landscape areas, install the piping in the landscape areas. Replacement paving shall match existing.

3.8 FLUSHING, TESTING, AND ADJUSTMENT

- A. After piping and risers are installed, and before sprinkler heads, bubblers, or emitters are installed, open control valves and flush out system with a full head of water.
- B. Backfill trench and compact to subgrade elevation. Protect pipe from displacement.

- C. Perform system testing upon completion of each section. Make necessary repairs and retest sections as required.
- D. Adjust all electric remote control valves, pressure regulators, and flow stems for system balance and optimum performance.
- E. Test and demonstrate controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements and weather conditions.

3.9 DISPOSAL OF WASTE MATERIAL

- A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavation material, rock, trash, and debris.

3.10 DEMONSTRATION AND ACCEPTANCE

- A. Demonstrate to ENGINEER the proper and satisfactory operation of the entire system.
- B. Instruct the OWNER's designated personnel in the operation of all components in the system.
- C. The OWNER will assume operation of the system upon completion of the ninety (90) day maintenance period.

3.11 CLEAN UP

- A. Perform cleaning throughout installation of the system, and upon completion of the installation, to the satisfaction of the OWNER's representative.
- B. Repair any damage resulting from installation of the irrigation system at no additional cost to the OWNER.

+ + END OF SECTION + +

SECTION 02447

FENCING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to remove existing fence, as required, and to provide new fencing Work as shown and specified.
2. The extent of fencing Work is shown on the Drawings and is specified herein.
3. The types of fencing Work includes the following:
 - a. Galvanized steel systems.
 - b. Gates.
 - c. Miscellaneous supplies and equipment as may be required to furnish complete systems functioning as specified herein.

B. Related Work Specified Elsewhere:

1. Section 02513, Pavement.
2. Section 03300, Cast-In-Place Concrete.
3. Section 09900, Painting.
4. Division 16, Electrical.

C. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the fencing Work.

1.2 QUALITY ASSURANCE

A. Erector Qualifications: Erector must be a firm experienced in the erection of fencing and accessories of the types specified. Erector must be approved by the manufacturer of the fencing.

B. Design Criteria:

1. Comply with the standards of the Chain Link Fence Manufacturer's Institute for "Galvanized Steel Chain Link Fence Fabric" and Federal Specifications RR-F-191/1A, unless otherwise shown or specified.
2. The requirements of this Section shall generally conform to MAG Standard Specifications 420, 771 and 772, except as modified, added to, or changed herein. Where there is a conflict between MAG Standard Specification and this Specification, the provision of this Specification shall apply.

C. Source Quality Control: Provide each type of fence and gate as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings and fastenings.

- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ASTM A 53, Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless.
 2. ASTM A 121, Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
 3. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 4. ASTM A 392, Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 5. ASTM A 491, Specification for Aluminum-Coated Steel Chain-Link Fence.
 6. ASTM A 585, Specification for Aluminum-Coated Steel Barbed Wire.
 7. ASTM C 33, Specification for Concrete Aggregates (Including Tentative Revision).
 8. ASTM C 150, Specification for Portland Cement.
 9. ASTM D 412, Tests for Rubber Properties in Tension.
 10. ASTM D 746, Test for Brittleness Temperature of Plastics and Elastomers by Impact.
 11. ASTM D 792, Tests for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
 12. ASTM D 2240, Test for Rubber Property-Durometer Hardness.
 13. ASTM F 668, Specification for Poly (Vinyl Chloride) (PVC)-Coated Steel Chain Link Fence Fabric.
 14. ASTM G 23, Standard Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.
 15. Chain Link Fence Manufacturer's Institute, Galvanized Steel Chain-Link Fence Fabric.
 16. Federal Specifications, RR-F-191 (latest revision), Fencing, Wire and Post, Metal (Chain-Link Fence Fabric).
 17. Maricopa Association of Governments, Uniform Standard Specifications for Public Works Construction.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. 6-inch square sample of chain link fence fabric.
 2. 6-inch long samples of each framework member, accessory and attachment devices required by the Work.
 3. ENGINEER'S review will be for general appearance, and color only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for chain link fence system including plan layout and details illustrating fence height, location and sizes of posts, rails, braces, gates, footings, hardware list and erection procedures.
 2. Shop Drawings for tubular steel main entry gates including plan layout and details illustrating gate heights, types, footings, hardware list and erection procedures.

3. Shop Drawings including manufacturer's technical data, wiring diagrams, accessories and controls for automatic main gate operators and details of installation.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver material in manufacturer's original packaging with all tags and labels intact and legible.
- B. Handling of Materials: Handle and store material in such manner as to avoid damage.

1.5 WARRANTY

- A. Furnish manufacturer's written ten (10) year warranty against rusting or corrosion of the metal.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Pipe sizes specified are commercial pipe sizes.
- B. Tube sizes specified are nominal outside dimension.
- C. Roll-formed section sizes are the nominal outside dimensions.
- D. Finish for Framework and Appurtenances: Furnish the following finishes for steel framework and appurtenances:
 1. Galvanized finish with minimum weights of zinc as follows:
 - a. Pipe: ASTM A 120, Schedule 40, 1.8 ounce zinc per square foot.
 - b. Hardware and Accessories: ASTM A 153, zinc weight per Table I, Federal Specification RR-F-191/1A.

2.2 FABRIC

- A. Furnish chain link fabric as follows:
 1. One-piece fabric widths.
 - a. No. 9 gage wires.
 - b. Fence height 6-foot 0-inch.
 2. 2-inch mesh.
 3. Top and bottom selvages twisted and barbed.
 4. Galvanized finish with not less than 1.2 ounces zinc per square foot complying with ASTM A 392, Class I.

2.3 POSTS, RAILS, AND BRACES

- A. End, Corner, and Pull Posts: Furnish end, corner, and pull posts of the minimum sizes and weights as follows:
 1. Over 6 feet fabric height: 2.875 inches OD pipe weighing 5.79 pounds per linear foot.

- B. Line Posts: Furnish line posts of the minimum sizes and weights as follows. Space posts 10 feet on centers maximum, unless otherwise shown.
1. Over 6 feet fabric height: 2.375 inches OD pipe weighing 3.65 pounds per linear foot.
- C. Gate Posts: Furnish gate posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
1. Up to 6 feet wide: 2.875 inches OD pipe weighing 5.79 pounds per linear foot.
 2. Over 6 feet and up to 13 feet wide: 4 inches OD pipe weighing 9.10 pounds per linear foot.
 3. Over 13 feet and up to 18 feet wide: 6.625 inches OD pipe weighing 18.97 pounds per linear foot.
 4. Over 18 feet: 8.625 inches OD pipe weighing 24.70 pounds per linear foot.
- D. Top Rail: Furnish top rails, unless otherwise shown, of the following:
1. 1.660 inch OD pipe weighing 2.27 pounds per linear foot.
 2. Furnish in manufacturer's longest lengths, with expansion type couplings, approximately 6 inches long, for each joint. Provide means for attaching the top rail securely to each gate, corner, pull, and end post.
- E. Post Brace Assembly: Furnish bracing assemblies at end and gate posts at both sides of corner and pull posts, with the horizontal brace located at mid-height of the fabric.
1. Use 1.660 inch OD pipe weighing 1.80 pounds per linear foot for horizontal brace and 3/8 inch diameter rod with turn-buckle for diagonal truss.
- F. Tension Wire: Furnish tension wire consisting of galvanized 6 gage coiled spring wire. Locate at bottom of fabric only.
- G. Barbed Wire Supporting Arms: Furnish pressed steel, wrought iron, or malleable iron barbed wire supporting arms, complete with provisions for anchorage to posts attaching 3 rows of barbed wire to each arm. Supporting arms shall be integral with post top weather cap. Provide single 45 degree arm, one for each post where shown.
- H. Barbed Wire: 3 strand, 2 wires per strand, 11 gage wire with 14 gage, 4-point aluminum alloy barbs spaced 3 inches on center galvanized, complying with ASTM A 121, Class 3.
- I. Post Tops: Pressed steel, wrought iron, or malleable iron, designed as a weathertight closure cap, for tubular posts. Furnish one cap for each post unless equal protection is afforded by combination post top cap and barbed wire supporting arm, where barbed wire is required. Furnish caps with openings to permit through passage of the top rail.

- J. Stretcher Bars: One piece lengths equal to full height of fabric, with a minimum cross-section of 3/16 inch by 3/4 inch. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into the post.
- K. Stretcher Bar Bands: Steel, wrought iron, or malleable iron, spaced not over 15 inches on center to secure stretcher bars to end, corner, pull, and gate posts. Bands may also be used with special fittings for securing rails to end, corner, pull and gate posts.

2.4 GATES

- A. Fabricate gate perimeter frames of galvanized tubular members. Provide additional horizontal and vertical members to ensure proper gate operation and for attachment of fabric, hardware and accessories. Space so that frame members are not more than 8 feet apart. Fabricate as follows:
 - 1. 1.90 inch OD pipe weighing 2.72 pounds per linear foot.
- B. Assemble gate frames by butt welding for rigid connections. Use same fabric as for fence. Install fabric with stretcher bars at vertical edges. Bars may also be used at top and bottom edges. Attach stretchers to gate frame at not more than 15 inches on center. Attach hardware by means which will provide security against removal or breakage.
- C. Install diagonal cross-bracing consisting of 3/8-inch diameter adjustable length truss rods on gates where necessary to ensure frame rigidity without sag or twist.
 - 1. Extend the end members of gate frames 1 foot-0 inch above the top member and prepare to receive 3 strands of barbed wire. Provide necessary clips for securing wire to extensions.
- D. Gate Hardware: Furnish the following hardware and accessories for each gate.
 - 1. Hinges: Pressed or forged steel or malleable iron to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6 feet nominal height.
 - 2. Latch: Forked type or plunger-bar type to permit operation from either side of gate, with padlock eye as integral part of latch.
 - 3. Keeper: Provide keeper for all vehicle gates, which automatically engages the gate leaf and holds it in the open position until manually released.
 - 4. Double Gates: Provide gate stops for double gates, consisting of mushroom type or flush plate with anchors. Set in concrete to engage the center drop rod or plunger bar. Include locking device and padlock eyes as an integral part of the latch, using one padlock for locking both gate leaves.

2.5 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Wire Ties: For tying fabric to line posts, use 9 gage wire ties spaced 12 inches on center. For tying fabric to rails and braces, use 9 gage wire ties spaced 24 inches on center. For tying fabric to tension wire, use 11 gage hog rings spaced 24 inches on center. Finish of ties to match fabric finish.
 - 1. Manufacturer's standard procedure will be accepted if of equal strength and durability.
- B. Concrete: Refer to Section 03300, Cast-In-Place Concrete.
- C. Electrical Grounding: Provide grounding rods every 100 feet along the fence. Requirements for grounding are specified in Section 16E.
- D. Provide wire and sealant for vehicle loop detectors that are shown on the Drawings. Also provide lead wire and conduit between vehicle loop detectors and control relays in gate operators.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and conditions under which the fence and gate Work are to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Do not begin fence installation and erection before the final grading is completed, with finish elevations established.

3.3 INSTALLATION

- A. Install chain link fence system according to MAG Section 420.3.1, 420.3.2 and 420.3.3.
- B. Excavation: Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.
 - 1. Unless otherwise indicated, excavate hole depths approximately three (3) inches lower than the post bottom, with bottom of posts set not less than 36 inches below the surface when in firm, undisturbed soil. Spread soil from excavations uniformly adjacent to the fence line, or on adjacent areas of the site, as directed.
 - 2. When solid rock is encountered near the surface, drill into rock at least 12 inches for line posts and at least 18 inches for end, pull, corner, and gate posts. Drill hole at least 1-inch greater diameter than the largest dimension of the post to be placed. If solid rock is below soil overbur-

den, drill to full depth required, except penetration into rock need not exceed the minimum depths specified above.

- C. Setting Posts: Remove loose and foreign materials from sides and bottoms of holes, and moisten soil prior to placing concrete.
 - 1. Center and align posts in holes 3 inches above bottom of excavation.
 - 2. Place concrete around posts in a continuous pour, and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
 - 3. Trowel finish tops of footings, and slope or dome to direct water away from posts. Extend footings for gate posts to the underside of bottom hinge. Set keeps, stops, sleeves and other accessories into concrete as required.
 - 4. Keep exposed concrete surfaces moist for at least seven (7) days after placement, or cure with membrane curing materials, or other acceptable curing method.
 - 5. Grout posts set in sleeved holes, concrete constructions, or rock with grout, as specified in Section 03600, Grout.
- D. Concrete: Provide concrete consisting of portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and clean water. Mix materials to obtain concrete with a minimum 28-day compressive strength 2500 pounds per square inch, using at least 4 sacks of cement per cubic yard, 1-inch maximum size aggregate, maximum 3-inch slump, and 2 percent to 4 percent entrained air.
- E. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28-day compressive strength, but in no case sooner than seven (7) days after placement, before rails, tension wires, barbed wire, or fabric is installed. Do not stretch and tension fabric and wires, and do not hang gates until the concrete has attained its full design strength.
- F. Top Rails: Run rail continuously through post caps or extension arms, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.
- G. Center Rails: Provide center rails. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.
- H. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- I. Tension Wire: Install tension wires by weaving through the fabric and tying each post with not less than 6 gage galvanized wire, or by securing the wire to the fabric.
- J. Stretcher Bars: Thread through or clamp to fabric 4 inches on center, and secure to posts with metal bands spaced 15 inches on center.

- K. Tie Wires: Use U-shaped wires conforming to diameter of pipe. Clasp pipe and fabric firmly with ends twisted at least two (2) full turns. Bend ends of wire to minimize hazard to persons or clothing.
- L. Fasteners: Install nuts for tension band and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust all fencing and gates and leave in good working condition.
- B. Repair or replace any broken or bent components as directed by ENGINEER.

+ + END OF SECTION + +

SECTION 02451

GUARDRAILS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to provide guardrails as shown and specified.
2. The guardrails shall be of the galvanized, corrugated sheet steel beam type with galvanized steel posts supporting the rails.

B. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Provide guardrails as a complete unit produced by a single manufacturer, including necessary erection accessories, fittings, and fastenings.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM A 36, Structural Steel.
2. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated From Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
3. AASHTO M 180, Corrugated Sheet Steel Beams for Highway Guard Rail.

C. Standard Specifications and Details:

1. CONTRACTOR shall conform to all applicable requirements of the Uniform Standard Specifications For Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix as follows:
 - a. Section 415, Flexible Metal Guardrail.
 - b. Standard Detail No. 135, Steel Guard Rail.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval copies of manufacturer's technical data and installation instructions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect the guardrails from abuse so as to prevent nicks, gouges, and dents.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide galvanized steel posts of size and shape as recommended by the manufacturer. Steel shall comply with ASTM A 36 and galvanized in accordance with ASTM A 123.
- B. Provide guardrail complying with AASHTO M 180, Class A, Type 2, and Standard Specifications and Details referenced under paragraph 1.2, Quality Assurance.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Deep Beam guardrail by Syro Steel Co.
 - 2. Flex Beam guardrail by Armco Steel Corp.
 - 3. Anchor guardrail by Anchor Post Products, Inc.
 - 4. Or equal.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Terminal Sections and Ends: Provide terminal sections and buffer ends as shown. Where not shown, provide in accordance with the manufacturer's recommendations.
- B. Concrete: Provide concrete for anchoring posts, complying with Class B concrete specified in Section 03300.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Do not begin guardrail installation and erection before paving or final grading is completed, unless otherwise acceptable to ENGINEER.
- B. Drive posts unless otherwise shown or ordered by the ENGINEER. Accomplish driving with approved equipment and methods that will leave the posts in their final position, free of distortion, burring, or other damage. When posts are driven through bituminous concrete, take care to prevent damage to the paved areas. Fill, compact, and seal depressions and holes caused by driving the posts, with bituminous concrete similar to that damaged.
- C. Excavation: As an alternate to driving posts on unpaved areas or where driving is not possible, excavate holes of widths and spacings shown, for post footings in firm, undisturbed or compacted soil.
 - 1. If not shown, excavate holes to widths as recommended by guardrail manufacturer.
 - 2. Spread soil from excavations uniformly adjacent to guardrail line, or on adjacent areas of the site, as directed by ENGINEER.
 - 3. When rock is encountered, excavate into rock to widths as recommended by the manufacturer.

4. Setting Posts: Remove loose and foreign materials from sides and bottom of holes, and moisten soil prior to placing concrete. Place, trowel, cure and test concrete in accordance with Section 03300.
- D. Where posts cannot be driven or anchored in concrete, use base plates as shown or as ordered by the ENGINEER.
- E. When setting posts, align them to a tolerance of 1/4 inch for plumb and grade.
- F. Rails: Connect rails to posts in accordance with manufacturer's instructions. Install terminal sections or ends.
- G. The buffer ends shall be attached to existing concrete bridge barrier walls with 5/8 inch bolt size self drilling anchors and bolts. The buffer end shall protrude 1'-3" from the end of the barrier wall and be 1'-3" off the roadway surface.

3.2 REPAIR

- A. Repair galvanized coating, damaged in the shop or during field erection, by recoating with manufacturer's recommended repair compound, and applying compound in accordance with his instructions.

+ + END OF SECTION + +

SECTION 02452

JACKING/BORING PIPE INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to excavate, dewater, protect existing structures, install casings by jacking/boring, install pipelines, pipe support structures, grout, and construct bulkheads, as shown and as specified. Also included are demolition, removals and relocations, soil stabilization, and monitoring settlement and cracks in the existing road section. Disposal of excess materials is included.
2. All temporary means needed to prevent discharge of sediment to water courses from dewatering systems are included.
3. No classification of excavated material will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.
4. Work within the rights-of-way of the Flood Control district of Maricopa County (FCDMC) and the Salt River Project (SRP) shall be done in accordance with requirements and provisions of the permits issued by those agencies for the construction within their respective rights-of-way. Such requirements and provisions, where applicable, shall take precedence and supersede the provisions of these Specifications. The CONTRACTOR will be required to coordinate with the FCDMC and SRP for the work on or near structures.
5. The Work within the Section includes, but is not limited to:
 - a. 15-inch sanitary sewer at Arizona Canal with 30-inch casing pipe.
 - b. 12-inch sanitary sewer at 24th Street with 30-inch casing pipe.

B. Installation of casing pipes shall be performed by one of the following methods.

1. Boring method.
2. Jacking method.

C. Coordination:

1. Section 02050, Demolition.
2. Section 02233, Excavation and Backfill.
3. Section 03300, Cast-In-Place Concrete.
4. Section 15051, Buried Piping Installation.
5. Section 15053, Ductile Iron Pipe.
6. Section 15054, Concrete Pipe.
7. Section 15061, Steel Pipe.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Provide steel pipe casing and accessories manufactured by a single firm specializing in the production of the Work and complying with all applicable standards of AREA and AASHTO.

- B. Installer Qualifications:
 - 1. CONTRACTOR shall have a minimum of five (5) years experience in the installation of jacking/boring pipe casings of a similar type; and shall employ only tradesmen with specific skill and experience in this type of work.
 - 2. Tunneling CONTRACTOR shall provide qualifications, names, and complete description of previous projects of similar character to ENGINEER.

- C. Design Criteria:
 - 1. The pipe casings shall provide strength commensurate for the diameter and depth of cover in accordance with the design requirements of AASHTO and AREA and in addition shall be at least equal to the minimum sizes specified.
 - 2. The casing pipes shall be installed in conformity with the line and grade shown on the Contract Drawings.
 - 3. CONTRACTOR shall be wholly responsible for designing, installing and operating the jacking/boring system he selects as is necessary to satisfactorily accomplish all operations.

- D. Permits and Regulations:
 - 1. CONTRACTOR shall obtain all necessary permits for work. He shall also obtain permits as required by local, state and federal agencies for discharging water from excavations.
 - 2. CONTRACTOR shall perform jacking/boring work in compliance with applicable requirements of governing authorities having jurisdiction.

- E. Reference Standards:
 - 1. ASTM C 150, Portland Cement.
 - 2. ASTM C 109, Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50 mm. Cube Specimens).
 - 3. ASTM A 139, Grade B; ASTM A252, Grade 2 for Welded Steel Casing Pipe.
 - 4. American Railway Engineering Association (AREA) Manual.
 - 5. ASTM C-76, Reinforced Concrete Pipe.

1.3 SUBMITTALS

- A. Within ninety (90) days of Notice to Proceed submit for approval the following:
 - 1. Method of installation and evidence of CONTRACTOR's experience in jacking/boring installations.
 - 2. Drawings and details showing the casing pipes proposed. Drawings shall give location of grout holes and all pertinent design criteria.

3. Calculations demonstrating that the casing pipes provide adequate strength commensurate with the dead load, live load and depth of cover.
4. Casing pipes and pipeline installation procedure including equipment and manpower schedule.
5. Details of jacking pit, sheeting and bracing and analysis of soil capacity behind backstop to sustain maximum jacking load. All details and calculations shall be stamped by a professional engineer licensed in Arizona.
6. Description of jacking or boring method; procedure; equipment; manpower schedule; design of leading edge shield and method of directional control; bulkheading procedures and breasting jacks to support excavation face; and a certificate from manufacturer or professional engineer that casing pipe can withstand maximum jacking forces imposed.
7. Pipe alignment daily during jacking operation.
8. Grouting system including equipment, procedure and schedule.
9. Dewatering system.
10. Protection methods.

- B. Record Documents: During progress of the Work, keep an up to date set of Drawings showing field and Shop Drawing modifications. Submit mylar tracings at a scale satisfactory to the ENGINEER that show the actual in-place installation of casing pipes and all piping installed under this Section. The drawings shall show all piping on plans and in sections and grouting details, with all reference dimensions and elevations required to complete record drawings of the Work. Two (2) paper prints shall also be furnished. The tracings and prints shall be furnished not later than thirty (30) days after Substantial Completion of the Work.

1.4 JOB CONDITIONS

- A. Existing Structures: Shown on the Drawings are certain surface and underground structures adjacent to the Work. This information has been obtained from existing record drawings and ground survey. It is shown for the convenience of the CONTRACTOR. CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures. They shall be supported and protected from injury by CONTRACTOR. If they are broken or damaged, they shall be restored immediately by CONTRACTOR at his expense.
- B. Existing Utilities: Locate underground utilities in the areas of Work. Provide adequate means of protection during jacking/boring operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the ENGINEER immediately for directions as to procedure. Cooperate with Owner of the utility service 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 OWNER or others, except when permitted in writing by ENGINEER and then only after acceptable temporary utility services have been provided.

- C. Protection of Persons and Property: Barricade 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.
 - 1. Protect structures, utilities, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by jacking/boring operations.
- D. Subsurface Information:
 - 1. Refer to Section 00800 for availability of soils reports and information.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Casing Pipe:
 - 1. Type: Electrically welded steel pipe.
 - 2. Reference: ASTM A130, Grade 8, or ASTM A252, Grade 2, or ASTM A 36 plate.
 - 3. Size: Diameter shown on the Drawings shall be interpreted to mean the nominal outside diameter of the pipe.
 - 4. Strength: Minimum tensile strength 58,000 psi. Minimum yield strength 35,000 psi.
 - 5. Thickness: 3/4-inch minimum.
 - 6. Finish: None.
 - 7. Joints shall be full penetration butt welded, beveled ends, in accordance with AWWA C 206. Backing rings may be used.
- B. Carrier Pipes:
 - 1. Carrier pipes shall be as shown and specified under Section 15051.

2.2 MIXES

- A. Grout (between carrier and casing pipes):
 - 1. Use 1 part cement to approximately 3 parts sand. Adjust ratio as required to obtain 3,000 psi minimum strength.
- B. Neat cement grout.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR will examine the areas and conditions under which jacking/boring is to be performed and notify the ENGINEER of conditions he may find that are detrimental to the proper and timely completion of the Work. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 PREPARATION

- A. The CONTRACTOR shall provide control points for the casing installations. CONTRACTOR shall protect and safeguard such control points from damage or movement, and utilize the control points to install the casings within the line and grade tolerances specified.

3.3 INSTALLATION

A. General:

1. Method shall be by use of a steel casing pipe installed by jacking or boring.
2. Ground water may be encountered. Adequate methods of dewatering shall be provided to produce satisfactory and safe working conditions.
3. Once jacking/boring is started, the work shall progress continually, 24 hours per day, with a minimum of two (2) shifts per day until the casing is completed.
4. Stabilize soils at the excavation face using chemical grout or other approved means where necessary to advance the excavation without loss of ground.

B. Boring Method:

1. The boring method shall consist of pushing the steel casing pipe into the earth with a boring auger rotating within the pipe to remove the spoil. When augers, or similar devices; are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe. The arrangement shall be removable from within the pipe in the event an obstruction is encountered. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
2. The use of water or other liquids to facilitate casing emplacement and spoil removal is prohibited.
3. Bored installations shall have a bored hole essentially the same as the outside diameter of the pipe. Where voids develop outside of the casing pipe, grouting shall be employed to fill such voids.
4. Conform to requirements of the jacking method below where applicable to boring method.

C. Jacking Method:

1. The method shall be in accordance with applicable requirements of City of Phoenix. This operation shall be conducted without hand mining ahead of the pipe and without the use of any type of boring or drilling equipment. Use of a steel jacking shield is required.
2. Jacking Pits:
 - a. Jacking pits shall be steel sheeted and braced on all sides. Conform with applicable requirements of Section 02233.
 - b. CONTRACTOR shall remove, relocate and replace all pipes, conduits, drains, or other service shown or encountered as necessary to install jacking pits.

- c. All sheeting, shoring and bracing shall be removed unless otherwise approved by ENGINEER.
3. Bracing and backstops shall be so designed and jacks of sufficient rating used so that the jacking can be progressed without stoppage (except for adding lengths of pipe) until the leading edge of the pipe reaches the final position shown on the Drawings.
4. The equipment, jacks, shield, jacking stations, pumps, rails, backstop, bracing, and associated material shall be adequate to successfully complete the jacking work in a timely manner without harm to the new pipe or to surrounding structures and utilities. Use a full circumference open shield. The shield shall have a hood and breasting jacks to support the full face. The shield shall be adequate to safely carry all loads applied to it, including jacking loads, without distortion.
5. Once jacking is started, the work shall progress continually, 24 hours per day, with a minimum of two shifts a day until the entire pipe is jacked into place. Use bentonite to reduce friction. Do not use grease or oil as a pipe lubricant.
6. Monitor pipe alignment and ground and pavement movements at least once each shift during which jacking is performed.
7. Excavate soil within the pipe only to the extent that the pipe is allowed to advance without causing measurable heave of the ground surface.
8. If an obstruction is encountered during the jacking operation which stops the forward motion of the pipe being jacked, and it becomes evident that it is impossible to advance the pipe, the jacking operation shall cease, and the pipe being jacked shall be abandoned in place and filled completely with lean concrete. The pipe location will be changed by the ENGINEER to a different location. The jacking operation shall begin again at the new location. The CONTRACTOR will be paid in accordance with the Extra Work provisions of the Contract for installation of the pipe at the new location.

D. Construction:

1. The CONTRACTOR shall perform all necessary excavation, disposals, mining and boring or boring and jacking to install the casings.
2. Tolerance: Pipe alignment shall not vary vertically or horizontally more than six inches from alignment shown.

E. Drainage and Dewatering:

1. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations.

F. Installation of Carrier Pipes in Casing Pipes:

1. Pipe materials and installation shall conform to requirements of Section 15051.

G. Grouting Procedure for Carrier Pipes:

1. The space between the outside of the carrier pipe and the casing shall be completely filled with grout in one continuous uninterrupted operation in manner to prevent occurrence of any voids between pipe and sleeve.
2. Construct permanent masonry bulkheads at each end of the jacked casings to retain the grout.
3. Grout materials may be mixed at the job site or purchased from a concrete materials supplier and transit-mixed in route.
4. Place grout in a sequence and manner that will preclude voids or pockets of entrapped air or water. Submit procedure to ENGINEER.
5. Regulate pump pressure to a minimum pressure of 75 psi and pump to refusal and in accordance with the approved grouting plan.

3.4 CRACK MONITORING

- A. Prior to beginning of Work CONTRACTOR and ENGINEER shall make a joint survey of all cracks existing in pavement within the immediate vicinity of the Work. All cracks existing shall be noted and recorded and opening measured. Cracks shall be monitored and recorded weekly during the Work.

3.5 DAMAGE TO STRUCTURES

- A. All damage to existing structures and utilities due to jacking/boring work shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

3.6 NON-CONFORMANCE

- A. Cost of additional work and all redesign caused by non-conformance of the CONTRACTOR's work to that specified shall be paid by the CONTRACTOR.

3.7 DISPOSAL OF EXCAVATED MATERIALS

- A. Materials removed from the jacking/boring operations shall be hauled away from the project site by the CONTRACTOR and disposed of in compliance with municipal, county, state, federal or other applicable regulations.

+ + END OF SECTION + +

SECTION 02480

PLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Work in this Section consists of providing all materials, equipment, labor, and incidentals required for the planting of all trees, shrubs, and groundcover as shown on the plans and specified herein.

B. Related Sections:

1. Section 02441, Irrigation System.
2. Section 02481, Palm Tree Transplanting.
3. Section 02482, Tree Transplanting.
4. Section 02483, Cactus Transplanting.
5. Section 02490, On-Site Nursery and Maintenance.
6. Section 02497, Decorative Stone Surfacing.

1.2 COORDINATION

- A. The CONTRACTOR shall review the procedures described under the other Sections, and shall coordinate all Work required for the planting operation with that of other trades.

1.3 QUALITY ASSURANCE

- A. The CONTRACTOR shall assign a least one person to serve as project supervisor. This person shall be thoroughly familiar with the materials, equipment, and techniques of the planting operation, and shall be on site at all times to direct the Work described in this Section.

1.4 SUBMITTALS

- A. The CONTRACTOR shall obtain and submit copies of soil fertility tests and fertilizer recommendations from a certified soils testing firm.

PART 2 - MATERIALS

2.1 GENERAL

- A. Planting areas shall not be cultivated when they are so dry as to cause excessive dust or so wet as to cause the formation of large clods.
- B. Finish grade for these areas shall not vary more than 1 inch from the specified grade and cross-section and shall be smooth uniform surface, free of any abrupt grade changes or depressions. Unless

otherwise specified, finish grade below adjacent paving, curbs, or headers shall be 2".

2.2 PLANTS

- A. Plants shall mean any trees, shrubs, cacti or groundcovers, required to be furnished for the project in accordance with plans and specifications.
- B. All plants shall be first class representative of their normal species or varieties. Unless otherwise specified, plants shall have average or normally developed branch systems and vigorous root systems. Plants shall be free from scale, disfigured knots, sun scale injuries, abrasions of the bark, rough/craggy bark, or other objectionable blemishes. Weak plants will not be accepted. Plants must show appearance of normal health and vigor in strict accordance with these specifications.
- C. Plants with loose or broken rootballs will not be accepted.

2.3 CHEMICAL FERTILIZER

- A. As recommended by the CONTRACTOR'S soil laboratory.

2.4 MULCH

- A. Mulch shall be nitrolized "Forest Magic" or approved equal. It shall be free of any large clumps or other foreign material and shall be mixed evenly with all planting soil as per typical planting detail.

2.5 TREE STAKES, GUYS, AND TIES

- A. Unless otherwise stated on plans, the following criteria shall be used to stake, guy, tie, and brace trees.
 - 1. Stakes:

<u>Trunk Height</u>	<u>Stake Size</u>	<u>Stake Type</u>	<u>Min/Max Exposed</u>
7' or less	8'	Lodge Pole	6'/6'
6'-9'	10'	Lodge Pole, Redwood, Douglas Fir	7'/8'
9' or more	12'	Lodge Pole, Redwood, Douglas Fir	9'/10'

- B. Tree ties shall consist of heavy gauge solid wire (min. 12 gauge) inserted through new 3/8" or 3/4" garden hose.
- C. All trees must be staked or guyed unless written approval is given to exempt any tree.
- D. The ENGINEER has the final approval of all staking, guying and tying procedures.

PART 3 - EXECUTION

3.1 GENERAL

- A. Prior to all Work of this Section, the CONTRACTOR shall carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may commence. In addition, the CONTRACTOR shall verify the location and depth below ground level of all utilities, footing, underground piping and conduit. All existing debris shall be removed from the site.
- B. The CONTRACTOR shall verify that planting may be completed in accordance with the original design and the referenced standards. In the event of discrepancy until all such discrepancies have been fully resolved.
- C. All plants shall be in containers and placed in a cool area protected from sun and drying winds while in temporary storage prior to planting.

3.2 EXCAVATION OF PLANT PITS

- A. Excavation shall be accomplished in such a manner as to provide a 2" drop from all pavements to the finished surface of beds.
- B. Plants pits shall be not less than twice the width and 1½ times the depth of the rootball or container.
- C. CONTRACTOR shall test each plant pit for drainage. If pit does not drain at 6" per hour, minimum, further excavate until impermeable layer is breached.

3.3 PLANTING

- A. Plant material shall be handled with care. Trunks of trees are not to be used as handles when transporting. Chains or ropes are not to be tied onto trunk for lifting.
- B. Unless otherwise instructed on the plans, plant material to be sited shall be placed in the pit so that the relation to finish grade shall be 2" higher (maximum) than before being transplanted. Each plant shall be placed in the center of the pit on prepared backfill materials. Once the plant is properly located, completely backfill with prepared backfill soil.

3.4 BACKFILLING

- A. Prepared backfill material shall consist of the following:
 - 1. 75% Soil
 - 2. 25% Mulch

3. Agriform fertilizer tabs as specified.

- Box plants - 4 tabs
- 15 gal plants - 3 tabs
- 5 gal plants - 2 tabs
- 1 gal plants - 1 tab

B. Sufficiently tamp backfill in 12" lifts to eliminate air pockets. Water in when initial backfilling is complete and add additional backfill as required to fill any noticeable depressions or voids.

3.5 STAKING GUYING AND TYING

- A. All trees that are not considered stable for high wind conditions are to be staked immediately after planting as per typical tree planting detail. If staking is not sufficient to firmly anchor large trees, CONTRACTOR shall guy as needed to prevent damage.
- B. The CONTRACTOR will be required to replace trees that are blown over during the guarantee period.
- C. When two or more stakes are used on a tree, the tops of the stake shall be level. Stakes shall be in a vertical position after installation is completed.

3.6 MAINTENANCE AND GUARANTEE PERIOD

- A. The CONTRACTOR shall maintain all plants for a period of 90 days from date of final acceptance.
- B. Maintenance shall include all watering, weeding, cultivating, spraying, and pruning necessary to keep the plant materials in a healthy growing condition to keep the planted areas neat and attractive throughout the maintenance period.
- C. Provide full coordination with on-site grounds maintenance period application of water to any planted areas where irrigation system modifications have been or need to be made.
- D. Protect all planted areas against damage, including erosion and trespassing, by providing and maintaining proper safeguards.
- E. If any tree, shrub or plant bed settles more than 1½ inches below the established grade, the plants shall be raised to the proper level.
- F. At the end of the maintenance period, all plant material shall be in a healthy growing condition.
- G. During maintenance period, should the appearance of any plant indicate weakness and probability of drying, immediately replace that plant with a new and healthy plant of the same type and size without additional cost to the OWNER.

H. Continue the maintenance period at no additional cost to the OWNER until all previously noted deficiencies have been corrected. When all previously noted deficiencies have been corrected the final inspection shall be made. When final inspection is made and deficiencies are noted, the maintenance period will continue until such deficiencies are corrected at no additional cost to the OWNER.

I. Guarantee plants for one (1) year from date of final acceptance.

+ + END OF SECTION + +

SECTION 02481

PALM TREE TRANSPLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Work in this Section consists of furnishing all materials, equipment, labor and incidentals required to salvage existing palm trees, store and maintain them in a temporary, on site nursery, and plant them in their final locations, as shown on the plans specified herein, and directed by the ENGINEER.

B. Related Sections:

1. Section 02441, Irrigation System.
2. Section 02480, Planting.
3. Section 02482, Tree Transplanting.
4. Section 02483, Cactus Transplanting.
5. Section 02490, On Site Nursery and Maintenance.

1.2 COORDINATION

- A. The CONTRACTOR shall review the procedures described in the other Sections, and shall coordinate all Work required for the palm tree transplanting with that of other trades.

1.3 QUALITY ASSURANCE

- A. The CONTRACTOR shall assign one person to serve as project supervisor. This person shall have at least five (5) years of local experience in transplanting palm trees, and shall be thoroughly familiar with the materials, equipment and techniques of transplanting palm trees. This person shall be on site at all times to direct the Work in this Section.

1.4 SUBMITTALS

- A. Documentation verifying experience of project supervisor.
- B. CONTRACTOR's written guarantee.

PART 2 - MATERIALS

2.1 BINDING MATERIAL

- A. Frond binding material shall be light manila rope or multiple strands of binding twine.

2.2 STRAPS

- A. Straps shall be nylon or fabric straps. Minimum width 4".

2.3 TREE MOVING EQUIPMENT

A. Cranes

1. A lattice type crane, a telescoping crane, or a specially designed tree crane are acceptable palm tree moving equipment.

B. Tree Spades:

1. A Vermeer tree spade is acceptable palm tree moving equipment providing the size of the spade is proportionate to the size of the tree to be moved.

2.4 BACKFILL

- A. Backfill shall be native soil amended with at least 25% clean washed river or concrete sand. In areas where heavy soils persist, backfill shall be 100% sand.

2.5 BRACING

- A. Braces shall be 2 x 4 treated lumber.

PART 3 - EXECUTION

3.1 GENERAL

- A. Palm trees shall be transplanted only when the surrounding soil temperatures are 60° F or greater. (Winter transplanting is not recommended).

3.2 PRUNING

- A. Prior to digging, all dead fronds, certain live fronds, flower stalks and seed pods shall be removed from the trees leaving a minimum crown of 6 to 8 tiers of live fronds on each tree.

3.3 TYING

- A. Remaining live fronds shall be pulled together and loosely, but securely, tied in an upright position to protect the "heart" of the tree.

3.4 DIGGING

- A. Trees shall be dug with a minimum rootball of 36" x 36". As trees are being dug, support with crane and fabric straps to prevent the tree from falling over.
- B. Strap loop shall be placed as close to the rootball as possible to avoid damage to the upper succulent portion of the trunk.

3.5 PLANTING PITS

- A. Planting pits shall be a minimum of 48" x 48". Sides shall be vertical and roughened to prevent glazing.

- B. All planting pits shall be filled with water, allowed to drain completely, and filled with water again. If the hole fails to completely drain within 24 hours, further excavate as necessary to break through the impermeable layer.

3.6 PLANTING

- A. Trees shall be planted with the same orientation they had prior to transplanting.
- B. A 12" mound of moist backfill shall be added to the planting pit and tamped prior to placing the tree.
- C. After the tree is lowered into position, moist backfill shall be added and tamped in place to assure stability of the tree. The final grade shall be the same, or maximum 12" higher than the soil line of the rootball.

3.7 BRACING

- A. Trees shall be supported by at least 3 pieces of 2 x 4 treated lumber extending at least 6' up the trunk.

3.8 WATERING

- A. After planting, deep watering shall be supplied by a drip irrigation system.

3.9 MAINTENANCE AND GUARANTEE

- A. The CONTRACTOR shall maintain all salvaged palm trees in a temporary, on site nursery until the project site is ready for them to be planted in their final locations.
- B. During this period the CONTRACTOR shall see that the plants are receiving regular, deep watering, fertilizing, pest control, all fronds remain tied, and any settling of backfill shall be refilled and tamped to assure stability of the tree and keep it plumb.
- C. After planting palms in their final location, the CONTRACTOR shall maintain the palms for a period of ninety (90) days.
- D. Fronds shall be untied at the end of sixty (60) days in summer months, or after ninety (90) days in winter months. Do not trim the trees for thirty (30) days after untying them.
- E. The CONTRACTOR shall guarantee all newly planted palm trees for one year. At the end of one year, any plant deemed unacceptable by the ENGINEER shall be replaced by the CONTRACTOR with plants of the same species and size at no additional cost to the OWNER.

F. Upon final acceptance of the project, the CONTRACTOR shall provide the OWNER with typewritten instructions for the proper care of all new plantings.

+ + END OF SECTION + +

SECTION 02482
TREE TRANSPLANTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The Work in this Section consists of furnishing all materials, equipment, labor and incidentals required to salvage existing trees as identified in the field and recommended for salvage by the ENGINEER. The CONTRACTOR shall maintain the trees in a temporary on-site nursery, and plant them in their final locations as shown on the plans, specified herein, and as directed by the ENGINEER.
2. The Work includes: all pruning, hand digging, boxing, removal, and transporting.

B. Related Sections:

1. Section 02441, Irrigation System.
2. Section 02480, Planting.
3. Section 02481, Palm Tree Transplanting.
4. Section 02483, Cactus Transplanting.
5. Section 02490, On-Site Nursery and Maintenance.

1.2 COORDINATION

- A. The CONTRACTOR shall review the procedures described under the other sections, and shall coordinate all work required for the tree transplanting operation with that of the other trades.

1.3 QUALITY ASSURANCE

- A. The CONTRACTOR shall have at least five (5) years of local experience in this type of work.
- B. The CONTRACTOR shall assign one individual to serve as supervisor. This person shall have at least five (5) years of local experience in tree transplanting, and be thoroughly familiar with the materials, equipment, and techniques associated with a tree transplanting operation, to direct the work described in this section.
- C. All work in this section shall comply with all applicable federal, state, county, and local codes and ordinances.

1.4 SUBMITTALS

- A. The CONTRACTOR shall verify the local experience of the project supervisor.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Use equipment of adequate size to safely lift plant out of hole and transport to holding area.
- B. Coordinate location of nursery holding area with the general contractor.
- C. Take all necessary precautions to assure holding area is safe and secure.
- D. All digging shall be by hand. The use of back hoes or trenchers will not be permitted.

PART 2 - MATERIALS

2.1 BOXING LUMBER

- A. Horizontal Members:
 - 1. 1" material up to 60" box.
 - 2. 2" material over 60" box.
- B. Vertical Members:
 - 1. 1" material up to 48" box.
 - 2. 2" material over 48" box.
- C. 1" material shall be 1 x 12 #5 pine.
- D. 2" material shall be 2 x 6 or 2 x 12 economy grade.

2.2 BANDING STEEL

- A. Banding steel shall be 3/4" x .025 steel.

PART 3 - EXECUTION

3.1 GENERAL

- A. The procedures outlined are intended to be general guidelines and should not be considered a substitute for the professional judgement of the CONTRACTOR.
- B. In any case where the CONTRACTOR finds it to be impractical or not in the best interest of preserving the plant, the CONTRACTOR shall notify the general contractor and the ENGINEER prior to digging.

3.2 PRUNING

- A. General: The objective of pruning is to remove a certain amount of foliage which is proportionate to the amount of root system to eliminate during the boxing operation, and to provide an aesthetic framework of branches that preserves the size and character of the plant.

- B. Procedure: The CONTRACTOR shall identify the major limbs to be retained, and remove approximately 60% to 80% of the remaining medium and smaller sized branches.

3.3 SIDE BOXING

A. General:

1. After pruning the CONTRACTOR shall determine the size of box to be used based on the following guidelines:

<u>Trunk Diameter</u>	<u>Box Size</u>
0 - 6"	24" - 42"
6" - 12"	48" - 60"
12" - 18"	66" - 84"
18" and up	90" and up

2. Write the box size on flagging tape to alert boxing crew.

B. Procedure:

1. Measure the top of the root ball to be exposed and mark the outline to facilitate digging.
2. Begin digging a trench around the plant using the outline established in the previous step as the inside dimensions.
3. Carefully cut roots flush with the side of the rootball as they are encountered.
4. As trench progresses, gradually cut the rootball inward to accommodate the taper of the box.
5. When trench reaches the depth of the box, place box sides in trench and check fit around rootball. Trim rootball as necessary.
6. Attach box sides around rootball with nails.
7. Secure box sides with banding.
8. Pack dirt tightly into any space between box sides and rootball.
9. Water thoroughly and repack dirt as needed for 1 to 2 weeks before bottoming.

3.4 PLACING SUPPORTING TOPWOOD

- A. General: The objective of this procedure is to minimize movement of the plant and its root system during transportation.

B. Procedure:

1. Measure 2 x 4 or 2 x 6 wood to fit the width of box and cut.
2. Place wood on each side of trunk. Nail wood to tree trunk and box sides.
3. Place cross members and additional supporting wood as necessary based on size and orientation of tree.
4. Nail 1" material across top of rootball (at least 2 boards in each direction).

3.5 BOTTOMING

- A. General: The objective of the bottoming operation is to cut the remaining roots while minimizing loss of soil from the bottom of rootball.

B. Procedure:

1. Place stake a safe distance from trench in the direction plant is to be tipped. Attach "come along" and one end of chain. Wrap other end of chain around box and secure. Cinch chain until taut.
2. Gradually undercut beneath the rootball. Cut tap roots cleanly as encountered.
3. Frequently test tautness of chain. When possible begin to tip box over in direction of stake. When box begins to tip, place safety brace against bottom of box to prevent box from falling in case of stake or chain failure.
4. As box is tipped back, nail bottom strips to box sides. When tree is fully tipped and bottom completely covered, nail boards across others. Depending on soil conditions, pre-assembled bottoms may be feasible.
5. Place banding underneath cross members.
6. Lower box down to its original orientation.
7. Bring banding up along sides and over top of box. Tighten banding and secure with crimper.

3.6 REMOVAL AND TRANSPORTATION

A. General: The goal of this operation is to move boxed plant to holding area without damaging box or plant.

B. Procedure:

1. Determine equipment needed based on accessibility, estimated weight of plant and distance to holding area.
2. If using backhoe or front loader, place chain around box and secure to bucket of machine. Tilt bucket back and lift out of hole.
3. If using crane, place two cables cross-wire around box and attach to hook. Lift out of hole.
4. Move plants to a secured temporary on site nursery. Coordinate location of nursery with general contractor.

3.7 TEMPORARY STORAGE AND MAINTENANCE

A. General: The objective here is to provide optimum conditions for the plants to overcome transplant shock and maintain viability throughout the storage period.

B. Procedure:

1. Attach plants to drip watering system. Soak thoroughly according to regular schedule based on weather conditions.
2. After first few soakings, check rootball for excessive run-off caused by cavities in soil and holes in box sides. Repack soil and repair box as necessary.
3. Apply slow-release fertilizer every twenty-five (25) days throughout maintenance period.
4. Check for insect activity at least once a week. Use foliar systemic spray for sucking insects such as thrips and mites. Use trunk spray for wood bores.

5. Maintain all salvaged plants in temporary, on site nursery until plants are installed in permanent locations as shown on landscape plan.
6. After planting in final locations, maintain plants for ninety (90) days.

3.8 GUARANTEE

- A. The CONTRACTOR shall guarantee all trees salvaged during this operation for a period of one (1) year.
- B. At the end of the one (1) year, any tree that is in poor health or dead, as determined by the landscape architect, shall be replaced by the CONTRACTOR with a tree of the same size and species.
- C. Provide OWNER with written instructions for the proper care of all new plantings.

+ + END OF SECTION + +

SECTION 02483
CACTUS TRANSPLANTING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Scope: The Work in this Section consists of furnishing all materials, equipment, labor and incidentals required to salvage Saguaro cactus, and various species of smaller cactus and succulents, transport, store and maintain them in a temporary on site nursery, plant them in their final locations as shown on the project plans, specified herein, and as directed by the ENGINEER.
- B. Related Sections:
 - 1. Section 02441, Irrigation System.
 - 2. Section 02480, Planting.
 - 3. Section 02481, Palm Tree Transplanting.
 - 4. Section 02482, Tree Transplanting.
 - 5. Section 02490, On Site Nursery and Maintenance.

1.2 QUALITY ASSURANCE

- A. The CONTRACTOR shall have a minimum of five (5) years of local experience in the salvaging of cactus on projects of similar scope and scale.
- B. The CONTRACTOR shall assign one individual to serve as project superintendent. This individual shall have the same five (5) years of local experience in salvaging cactus, and shall be on the site at all times during the salvage operation to supervise the work in this section.
- C. The CONTRACTOR shall be responsible for obtaining any and all permits required to perform the work in this section, at no additional cost to the OWNER.

1.3 SUBMITTALS

- A. Documentation of CONTRACTOR's and project superintendent's experience.
- B. CONTRACTOR's written guarantee.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. The CONTRACTOR shall utilize the proper equipment during the transplanting operation to assure that no cactus is damaged during digging, lifting, transport, storage, or placement.
- B. Equipment used to move Saguaro cactus shall have a permanently attached, carpet wrapped cradle.

PART 2 - MATERIALS

2.1 SOIL SULPHUR

- A. Commercially available soil sulphur.

2.2 WOOD BRACING

- A. 2 X 6 construction grade.

2.3 STEEL BANDING

- A. 3/4" x .025 steel.

2.4 CARPETING

- A. Sufficiently thick and plush to provide protection to the cactus.

2.5 DUSTING SULPHUR

- A. Commercially available dusting sulphur.

PART 3 - EXECUTION

3.1 INSPECTION

- A. The CONTRACTOR shall inspect all cactus designated to be salvaged by the landscape architect. If for any reason the CONTRACTOR feels that salvaging the cactus would be either detrimental to the cactus, or not in keeping with the OWNER's best interest, he shall notify the landscape architect immediately for clarification.

3.2 PREPARATION

- A. Prior to removing any cactus from its natural location, the CONTRACTOR shall verify that the site to receive the salvaged cactus, be it an on site nursery, or a final planting location, is ready to receive the cactus.

3.3 ARM BRACING

- A. On multi-armed Saguaros, brace each arm with a sufficient length of carpeted 2 x 6 as required to minimize swaying.
- B. Fill gaps between the arms and main trunk with foam rubber.
- C. Wrap the entire mass.
- D. This procedure is not necessary on small Saguaro spikes, or the various species of smaller cactus.

3.4 REMOVAL AND TRANSPORT

- A. After the arm bracing has been completed, measure out the outline of the top of the rootball, (2' x 2' for cactus under 4' and under, and 3' x 3' for cactus over 4'). Mark the outline of the ground to facilitate digging.
- B. Using the proper equipment, begin digging a trench along one side of the rootball using the outline established in the previous steps as a guide.
- C. When the trench reaches the proper depth, position transport equipment adjacent to cactus, and secure Saguaro to carpeted cradle. Dig trenches on remaining 3 sides.
- D. Slowly lift and tilt cactus hand cutting remaining roots as encountered. Do not skin off feeder roots.
- E. When all roots have been severed, lift cactus out of the ground and dust all exposed roots and cuts with dusting sulphur.
- F. Transport cactus to new location. During transport, cactus are not to be laid flat, but are to remain in a slightly tilted position.

3.5 TEMPORARY STORAGE AND/OR PLACEMENT

- A. Prepare pit to receive cactus by mixing 5 - 6 oz. of soil sulphur with native soil backfill mix.
- B. Position cactus so that it sits 6" - 12" deeper than it was in its natural condition.
- C. Gradually backfill pit in 6' lifts, hand tamping soil as it is placed, but taking care not to damage the cactus in the process. Treat any cuts with additional dusting sulphur.
- D. Remove arm bracing.

3.6 BRACING

- A. Brace Saguaro with 0 - 3 arms with 3 braces. Use 4 braces on Saguaro with 4 or more arms.
- B. Carpet top of braces that are to come in contact with the cactus.
- C. Braces should be approximately 2/3 the height of the Saguaro.
- D. Tie braces together with 3/4" banding steel, and clamp.
- E. Saguaro should remain braced for approximately one (1) year, after being placed in final location.

3.7 MAINTENANCE

The CONTRACTOR shall maintain plants in a temporary on site nursery until the site is ready for them to be installed in their final locations. After final planting, maintain plants for a period of ninety (90) days.

3.8 GUARANTEE

- A. The CONTRACTOR shall guarantee, in writing, that all cactus salvaged during this operation shall be health, undamaged, and thriving for a period of one (1) year.
- B. Any cactus that shows signs of damage, poor health, or deterioration as determined by the landscape architect, at the end of this period shall be replaced at no additional cost to the OWNER.

+ + END OF SECTION + +

SECTION 02490

ON SITE NURSERY AND MAINTENANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Scope: The Work in this Section consists of furnishing all materials, equipment, labor and incidentals required to establish an on-site nursery and provide ongoing maintenance of the plants stored therein.
- B. Related Sections:
 - 1. Section 02441, Irrigation System.
 - 2. Section 02480, Planting.
 - 3. Section 02481, Palm Tree Transplanting.
 - 4. Section 02482, Tree Transplanting.
 - 5. Section 02483, Cactus Transplanting.

1.2 SYSTEM DESCRIPTION

- A. The on-site nursery as described by this section shall be a secured area of sufficient size to temporarily store all plants to be salvaged from the project site. It shall be equipped with an acceptable source of water, and irrigated by a temporary drip irrigation system.

1.3 QUALITY ASSURANCE

- A. The CONTRACTOR shall have a minimum of five (5) years of local experience in the establishing and running of an on-site nursery on projects of similar scope and scale.
- B. The CONTRACTOR shall assign personnel, (1 individual per 500 plants), to operate the nursery. These individuals shall have the same five years of local experience, and shall be well versed in the techniques of proper pruning, fertilizing, spraying, and irrigating.

1.4 SUBMITTALS

- A. Documentation of the CONTRACTOR's and nursery personnel's experience in this type of work in the form of resumes, past project descriptions, client reference, etc.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. The nursery shall be set up so that plants of similar species, and cultural requirements are grouped together. The CONTRACTOR shall take the necessary precautions to assure the plants are secure and safe from threats of theft, vandalism, or obvious environmental damage.

1.6 PROJECT/SITE CONDITIONS

- A. Coordinate the location of the on-site nursery with the general contractor. The nursery shall not be located in an area which is obviously prone to high winds, extreme heat, or flooding.

PART 2 - MATERIALS

2.1 WATER

- A. Available on site. Coordinate with ENGINEER and OWNER.

2.2 FERTILIZER

- A. Ammonium phosphate 16-20-0, in warm months.
- B. Calcium nitrate in cool months.

2.3 INSECTICIDE

- A. Malathion for mites, white flies.
- B. Lindane for Metallic Beetles, Bamboo Beetles, and Flathead Wood Borers.

2.4 OTHER

- A. "Liquid Snow" and "Liquid Cloud" - use only if directed by ENGINEER.

PART 3 - EXECUTION

3.1 WATERING

- A. Irrigate plants on a consistent schedule according to the season, and the specific water requirements of the particular species of plant.
- B. Continually inspect boxes of plants for excessive running off and cavities, and fill as necessary.
- C. Spray all cactus once a week with a fine mist in warmer months.

3.2 FERTILIZER

- A. Fertilize plants on a consistent schedule, at least once a month, according to manufacturer's recommendations.

3.3 INSECT CONTROL

- A. Check for insect activity at least once a week. Apply insecticide according to manufacturer's recommendations, as required.

3.4 PRUNING

- A. Continuously prune any dead branches from the plants.
- B. Cuts shall be made flush with the trunk or major branch.
- C. The CONTRACTOR shall be responsible for maintaining the aesthetic integrity of the plant, and shall replace any plant deemed unacceptable by the ENGINEER, at no additional cost to the OWNER.

3.5 WEEDING

- A. Maintain the entire nursery area in a weed free condition.
- B. All weeding shall be done by hand, no chemical control will be allowed.

3.6 CLEAN UP

- A. At the end of the plant storage and maintenance period, remove all traces of the on-site nursery to the satisfaction of the ENGINEER.

+ + END OF SECTION + +

SECTION 02497
DECORATIVE STONE SURFACING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide decorative stone surfacing as shown and specified.
 2. The types of decorative stone surfacing Work required include the following:
 - a. Decomposed granite.
 3. The extent of the decorative stone surfacing is as shown on the Drawings.
- B. Review installation procedures under other sections and coordinate the installation of items that must be installed with the decorative stone surfacing.
- C. Related Work Specified Elsewhere:
1. Section 02233, Excavation and Backfill.
 2. Section 02441, Irrigation System.
 3. Section 02480, Planting.

1.2 QUALITY ASSURANCE

- A. Source Quality Control: Supply decomposed granite from a single source.

1.3 SUBMITTALS

- A. Samples: Make available for inspection and approval prior to placement of the material a representative sample of stone from the intended supply source.
- B. Shop Drawings: Submit for approval the name of intended decomposed granite source.

PART 2 - PRODUCTS

2.1 MATERIALS

- a. Decomposed Granite:
1. Decomposed granite shall be 1/2-inch minus desert gold supplied from a single supply source, for a uniform appearance throughout the project. It shall be free from lumps or balls of clay and shall not contain any calcareous coatings, caliche, organic matter, or foreign substances.

PART 3 - EXECUTION

3.1 GENERAL

- A. Decomposed granite shall be installed upon completion, and ENGINEER'S approval of all fine grading, irrigation, and planting elements.
- B. The areas to receive decomposed granite shall be relatively smooth. All rocks larger than 1-1/2-inches shall be removed and disposed of by the CONTRACTOR.
- C. Prior to placing decomposed granite, all areas to receive it shall be sprayed with a pre-emergent herbicide according to the manufacturer's recommendations. Do not spray herbicide on any areas designated to receive seeding.

3.2 PLACEMENT

- A. Install decomposed granite to all areas designated on the plans to a depth of two inches.
- B. The top surface of the 2-inch decomposed granite layer shall be a minimum of two inches below any adjacent pavement or other elements.
- C. After placing, all slope areas which have received decorative stone surfacing shall be watered down and rolled with a hand roller to assure adequate compaction of the material. A second application of pre-emergent herbicide shall be applied according to the manufacturer's recommendations.

+ + END OF SECTION + +

SECTION 02513

PAVEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install hot mix, hot-laid bituminous paving with aggregate base course as shown on the Drawings.
2. The Work includes the following:
 - a. Preparation of subgrade.
 - b. Base and surface courses.
 - c. Pavement overlay.
 - d. Asphalt chip seal.
 - e. Pavement replacement.
 - f. Asphalt emulsion slurry seal coat.
 - g. Testing as specified.

B. Related Work Specified Elsewhere:

1. Section 01410, Testing Laboratory Services.
2. Section 02233, Excavation and Backfill.
3. Section 02529, Concrete Curbs, Gutters and Sidewalks.

1.2 QUALITY ASSURANCE

A. Testing Services:

1. General: Testing of materials and of compaction requirements for compliance with technical requirements of the Specifications shall be the duty of a testing laboratory provided by the OWNER, as described in Section 01410. Determination and testing of the proposed design mix for the hot-mix course shall be performed by a testing laboratory provided by the CONTRACTOR.
2. Testing Services: The OWNER'S testing laboratory will:
 - a. Test the CONTRACTOR'S proposed materials in the laboratory and field for compliance with the requirements of these Specifications.
 - b. Perform field density tests to assure that the specified compaction of base course materials has been obtained.
 - c. Report all test results to the ENGINEER and the CONTRACTOR.
3. Authority and Duties of OWNER'S Testing Laboratory: Technicians representing the testing laboratory shall inspect the materials in the field and perform compaction tests, and shall report their findings to the ENGINEER and the CONTRACTOR. When the materials furnished or work performed by the CONTRACTOR fails to fulfill Specifications requirements, the technician will direct the attention of the ENGINEER and the CONTRACTOR to such failure.
 - a. The technician shall not act as foreman or perform other duties for the CONTRACTOR. Work will be checked as it progresses, but failure to detect any defective work or materials shall not in any way prevent later rejection when

such defect is discovered, nor shall it obligate the ENGINEER for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve or accept any portion of the Work.

4. Responsibilities and Duties of CONTRACTOR: The use of testing services shall in no way relieve the CONTRACTOR of his responsibility to furnish materials and construction in full compliance with the Drawings and Specifications. To facilitate testing services, the CONTRACTOR shall:
 - a. Secure and deliver to the ENGINEER and the testing laboratory representative samples of the materials he proposes to use and which are required to be tested.
 - b. Furnish such casual labor as is necessary to obtain and handle samples at the project or at other sources of material.
 - c. Advise the testing laboratory and ENGINEER sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

B. Standard Specifications and Details:

1. CONTRACTOR shall conform to all applicable requirements of the Uniform Standard Specifications For Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix as follows:
 - a. Section 321, Asphalt Concrete Pavement.
 - b. Section 322, Asphalt Concrete Overlay.
 - c. Section 330, Asphalt Chip Seal.
 - d. Section 332, Asphalt Emulsion Slurry Seal Coat.
 - e. Section 334, Preservative Seal.
 - f. Section 702, Base Materials.
 - g. Section 710, Asphalt Concrete.
 - h. Section 712, Liquid Asphalt.
 - i. Section 713, Emulsified Asphalt.
 - j. Section 718, Preservative Seal.
2. If there is a conflict between the MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.

C. Reference Standards: Comply with the applicable provisions and recommendations of the following, unless otherwise shown or specified.

1. ASTM C 117, Standard Method of Test For Materials Finer than No. 200 Sieve in Mineral Aggregates By Washing.
2. ASTM C 136, Sieve or Screen Analysis of Fine And Coarse Aggregates.
3. ASTM D 698, Moisture-Density Relations of Soils, Using 5.5 lb (2.5 kg) Rammer and 12-in. (304.8 mm) Drop.

1.3 SUBMITTALS

A. Design Information: Submit the following design information and certificates:

1. Design Mix: The design mix for the plant hot mix surface course based upon the aggregate to be furnished, shall be determined by

a testing laboratory provided by the CONTRACTOR and submitted to the ENGINEER and the OWNER for approval. The design mix data submitted shall include the percentage of asphalt cement to be used per unit weight of dry aggregate. The design mix, upon acceptance by the ENGINEER, shall be the basis for the field mix to be used in asphalt pavement construction.

2. Materials certificates certifying compliance with Specifications.
3. Test Reports.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate Base: Aggregate base material shall consist of crushed aggregate conforming to Section 702 of the MAG Specifications, with the following gradation:

<u>Sieve Size (U.S. Std.)</u>	<u>Percent Passing (By Weight)</u>
1-1/8-inch	100
#4	38-65
#8	25-60
#30	10-40
#200	3-12

- B. Select Material: Select fill shall be a processed natural material conforming to Section 702 of the MAG Specifications. The material shall be Type C-3/4 and well graded when tested in accordance with ASTM C 136 and C 117.
- C. Bituminous Prime Coat: Prime coat material shall be a rapid curing paving asphalt conforming to Section 712 of the MAG Specifications.
- D. Surface Course: Surface course material shall be a hot mix asphalt concrete, consisting of a mixture of mineral aggregate and paving asphalt conforming to Section 710 of the MAG Specifications. Gradation of the aggregate shall comply with Type C-3/4 of Table 710.
1. The job mix formula shall be as follows:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>	<u>JOB MIX TOLERANCE</u>
1"	100	---
3/4"	93	±7%
1/2"	83	±7%
3/8"	73	±7%
#4	57	±7%
#8	43	±5%
#30	23	±5%
200	5	±2%

Percent Asphalt Cement:	5.8 ± 0.4%
Asphalt Cement:	Ar-4000 or AC-20
Temperature: Mixing and Placing:	280 ⁰ F ± 25 ⁰ F

Type II Portland Cement or equal, will be added by dry weight of the mineral aggregate, 1.5%.

- E. Tack Coat: The tack coat shall be per MAG Section 329 unless directed otherwise by the ENGINEER.
- F. Preservative Seal: The preservative seal shall be per MAG Section 334 unless directed otherwise by the ENGINEER.

2.2 MATERIALS TESTING

- A. All base course materials shall be tested and approved prior to delivery to the site. Samples of materials proposed for use as surface and base course material shall be submitted to the ENGINEER and the testing laboratory. Samples of the materials shall be submitted at least ten (10) days in advance of its anticipated use.
- B. No surface or base course material shall be placed without the ENGINEER'S approval of the samples and the mix design.

PART 3 - EXECUTION

3.1 SUBGRADE PREPARATION

- A. Preparation of the subgrade including compaction shall be completed for the full width of the roadway or parking area.
 - 1. In each case, the top 12 inches of the subgrade beneath the aggregate base course shall be compacted to at least 95 percent of the maximum density obtained in the laboratory in accordance with the test procedure presented in ASTM D 698, Method A. In addition, the stability of the subgrade shall be such that when materials for construction above the subgrade are deposited on the subgrade no rutting or displacement of the subgrade will occur.
- B. The finished surface of the subgrade, after compaction, shall be smooth and not vary more than 3/4-inch when tested with a 10-foot straightedge, nor vary more than 3/4-inch from true grade as established by grade stakes or forms.
- C. No materials shall be placed on subgrades which are muddy or have water thereon.

3.2 CONSTRUCTION OF ROADWAYS

A. General:

1. The pavement for bituminous-surfaced roads and parking areas shall consist of a 3-inch (unless otherwise shown or specified) surface course composed of aggregates and bituminous material mixed hot in a central plant, constructed on an aggregate base course prime coated with a rapid curing paving asphalt.
2. The roadways shall be constructed to the lines, grades, and typical sections shown on the Drawings.

B. Base Course:

1. The base course for bituminous-surfaced roads and parking areas shall consist of a 6 inch compacted base course, unless otherwise shown or specified. The upper 3 inches of the base course shall be Aggregate Base Material conforming to the requirements of Paragraph 2.1.A. The lower 3 inches shall be either Aggregate Base or Select Material as specified in Paragraph 2.1.B. The base course material shall be spread in two layers such that when compacted with a 10-ton roller, the finished thickness shall be 6 inches. Variation in profile shall not exceed 3/8 inch in 10 feet.
2. Stabilized roads shall consist of a base course of 6-inch compacted Aggregate Base Material. The material shall be spread in two layers such that when compacted with a 10-ton roller, the finished thickness shall be 6 inches. Variation in profile shall not exceed 3/8 inch in 10 feet.
3. Select Material shall be placed at a moisture content that falls in the range of laboratory optimum moisture content within plus or minus one percent.
4. Compaction of the Select Material and Aggregate Base Material shall be not less than 100 percent of the maximum density obtained in the laboratory in accordance with the test procedure presented in ASTM D 698, Method A.

C. Tack Coat (Bituminous-Surfaced Areas Only):

1. The tack coat shall be applied to clean, slightly damp or dry aggregate base course with a pressure distributor of approved design at an application rate of 0.1 gal./sq./yd.

D. Prime Coat:

1. The prime coat shall be per MAG Standard Specifications Section 315. Prime coat shall be applied at a rate of 0.3 to 0.4 gallons per square yard.

E. Surface Course:

1. Surface course shall be constructed in accordance with MAG Standard Specification Sections 321 and 710.
2. The surface course mixture shall be transported to the site of paving and placed as soon as possible after mixing.
3. The placement of the surface course shall be completed over the full width of the section under construction on each day's run.

4. The mixture shall be laid on the prepared surface with an approved finishing machine which has an edging attachment and which will lay the wearing course true and level to the required profile. Variations from this profile shall not exceed 1/4 inch in 10 feet after rolling. The mixture shall be spread at such thickness as to produce a 3-inch thick course (unless otherwise shown or specified) when well compacted with a suitable roller until 92 percent of theoretical maximum density is obtained.
- F. Preservative Seal: Preservative Seal shall be per MAG Standard Specification Sections 334 and 718.
- G. Construction Joints:
1. Construction joints shall be made in such a manner as to ensure a neat junction, thorough compaction and bond throughout.
 2. A transverse joint extending over the full width of the strip being laid and at right angles to its centerline shall be constructed at the end of each day's work and at any other times when the operations of placing the hot mixture are suspended for a period of time which will permit the mixture to chill. The forward end of a freshly laid strip shall be thoroughly compacted by rolling before the mixture has become chilled. When work is resumed, the end shall be cut vertically for the full depth of the layer.
- H. Joining of Pavements: When new pavement is to join existing or previously laid pavement, the existing pavement shall be neatly and carefully edged to allow for overlapping and feathering of the new surface course material. A tack coat of bituminous prime coat material shall be placed at the interface of new and existing material.
- I. Curing:
1. The pavement shall not be opened to traffic until directed by the ENGINEER. Construction traffic on the pavement shall be held to a minimum and shall be acceptable to the ENGINEER.

3.3 PAVEMENT OVERLAY

- A. General:
1. Pavement overlay shall be as specified herein. Pavement to receive overlay shall be as shown.
 2. Pavement overlay shall meet the requirements of MAG Section 322, Asphalt Concrete Overlay.
- B. Materials:
1. Tack coat and asphalt concrete mix shall be per MAG Sections 321 and 710.
- C. Asphalt Concrete:
1. Asphalt concrete pavement overlay shall be 1-inch in thickness and conform to MAG Type E-3/8.
 2. Pavement to receive overlay shall be prepared and cleaned in accordance with MAG standards.

3. Existing curbed pavement to receive overlay shall be milled as follows:
 - a. Remove, by milling, existing pavement to a depth of 1-inch at curb and uniformly slope to a depth of 0-inches at center line or crown of existing pavement.
4. Overlay placement shall be per MAG Section 322.

3.4 ASPHALT CHIP SEAL

- A. General:
 1. Asphalt chip seal shall be as specified herein and in accordance with MAG Section 330. Pavement to be chip sealed shall be as shown.
- B. Materials:
 1. Asphalt chip seal materials shall be per MAG Sections 330, 711, 712, 713, and 716.
- C. Application:
 1. Surface preparation, application, and construction shall be per MAG Section 330.

3.5 SEAL COAT

- A. Asphalt Emulsion Slurry Seal Coat shall be as per MAG Section 332.

3.6 PATCHING

- A. As directed by the ENGINEER, remove and replace all defective areas. Cut-out such areas and fill with fresh asphalt concrete. Compact to the required density.

3.7 PAVEMENT REMOVAL AND REPLACEMENT

- A. Replacement of street, driveway, alley entrance, and other type pavements shall be of the same material as the existing pavement, constructed in accordance with the applicable requirements indicated on the Drawings and specified in the Specifications.
- B. Asphalt pavement replacement shall be of the same thickness as the adjacent pavement and shall match as nearly as possible the adjacent pavement in texture, unless otherwise indicated on the Drawings.
- C. Existing asphalt pavements to be removed for trenches or other underground construction or repair, unless otherwise noted or shown on the Drawings, shall be cut by a wheel cutter, clay spade, or other device capable of making a neat, reasonably straight and smooth cut without damaging adjacent pavement that is not to be removed. The cutting device operation shall be subject to the approval of the ENGINEER.

- D. The existing pavement shall be cut and trimmed after placement of required ABC and just prior to placement of asphalt concrete for pavement replacement, and the trimmed edges shall be painted with a light coating of asphalt cement or emulsified asphalt immediately prior to constructing the new abutting asphalt pavements. No extra payment will be provided for these items, and all costs incurred in performing this work shall be incidental to pipe laying or pavement replacement.
- E. Asphalt pavement replacement shall conform to the contour of the original pavement. A 10-foot straightedge shall be laid parallel to the center line of the trench when the trench is running parallel to the street, and across the pavement replacement when the trench crosses the street at an angle. Any deviation in the cut pavement replacement and the old pavement greater than 1/4-inch in 10 feet (10-foot straightedge) shall be removed and corrected.
- F. Existing asphalt pavement shown to be demolished, removed, or pulverized on the Drawings shall be pulverized with a 3-inch depth of pavement base course. Pulverized material shall meet the gradation and plastic index requirements of MAG Standard Specification Section 702, Aggregate Base Course (ABC) Material. Pulverized material shall be used on-site as select fill or backfill material. Pulverized material shall meet the requirements of select fill and backfill, as specified in Section 02233.

3.8 TRAFFIC LINE PAINT

- A. Traffic lines shall be painted on pavement surfaces where specified and shown on Drawings. Surfaces are to be free of contaminants that may interfere with adhesion. Thinning and coverage shall be as recommended by the manufacturer, but coverage shall not exceed 400 square feet per gallon. Traffic lines shall be a uniform 4-inch width with the edges straight and even. Traffic shall be restricted from the area until the paint has dried.
- B. Traffic line paint shall be a yellow chlorinated rubber traffic paint with glass beads - 39506 by Glidden, Vin-L-Stripe traffic paint W-801 by Dunn-Edwards, or equal.

3.9 CLEANING AND PROTECTION

- A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled bituminous materials and all foreign matter.
- B. Protect newly finished pavement until it has become properly hardened by cooling.

+ + END OF SECTION + +

SECTION 02529

CONCRETE CURBS, GUTTERS AND SIDEWALKS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide concrete curbs, gutters and sidewalks as shown and specified.
 2. The thickness and extent of curb, gutter and sidewalk are shown on the Drawings.
- B. Related Work Specified Elsewhere:
1. Section 02233, Excavation and Backfill.
 2. Section 02225, Crushed Stone and Gravel.
 3. Section 03251, Concrete Joints.
 4. Section 03200, Concrete Reinforcement.
 5. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Standard Specifications and Details:
1. CONTRACTOR shall conform to all applicable requirements of Section 340 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. If there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provision of these Specifications shall govern.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM D 1190, Concrete Joint Sealer, Hot Poured Elastic Type.
- C. Installer's Qualifications: Minimum of two (2) years installing curbs, gutters and sidewalks.

1.3 SUBMITTALS

- A. Samples: Submit for approval sample, manufacturer's product data, test reports and material certifications as required in referenced Sections for concrete Work.
- B. Certificates: Manufacturer's certifications that sealer meets Specification requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars and Welded Wire Fabric: Deformed steel bars and smooth wire fabric shall comply with requirements of Section 03200, Concrete Reinforcement.
 - 1. Furnish wire fabric in flat sheets, not rolls.
- B. Concrete Materials: Comply with requirements of applicable sections of Division 3 - Concrete Work Sections for formwork, concrete materials, admixtures, bonding materials, curing materials and others as required.
- C. Expansion Joint Material: Comply with requirements of Section 03251, Concrete Joints, for preformed expansion joint fillers.

2.2 CONCRETE MIX, DESIGN AND TESTING

- A. Comply with requirements of applicable provision of Section 03300, Cast-In-Place Concrete, for concrete mix design, sampling and testing, and quality control.
- B. Design the mix to produce concrete having properties of compressive strength, slump range and air content as specified in Section 03300.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that earthwork is completed to correct line and grade.
- B. Check that subgrade is smooth, compacted, and free of frost and excessive moisture.
- C. Do not commence work until conditions are satisfactory, and approved by ENGINEER.

3.2 POROUS FILL

- A. Porous Fill Under Sidewalk: Furnish fill consisting of crushed stone, gravel, sand, or other approved material. Properly wet and compact fill to the thickness shown.

3.3 FORM CONSTRUCTION

- A. Set forms to line and grade. Install forms over full length of curb, gutter and sidewalk.

3.4 REINFORCEMENT

- A. Locate, place, and support reinforcement as specified in Section 03200, unless otherwise shown. Size of reinforcement shall be as shown; if not shown, use welded wire fabric 6x6xW1.4 each way.

3.5 CONCRETE PLACEMENT

- A. General: Comply with the requirements of Section 03300 for mixing and placing concrete, and as specified.
- B. Place concrete for curbs and gutters using methods which prevent segregation of the mix. Consolidate concrete along the face of forms with an internal vibrator.
- C. For sidewalks, place concrete in one course, monolithic construction, for the full width and depth of walks.
- D. Machine Formed: Automatic curb, gutter and sidewalk machine may be used for forming, at CONTRACTOR'S option. Concrete shall have properties as specified in Section 03300, except that maximum slump shall be 2-1/2 inches and air content shall be two percent of design. Machine forming shall produce curbs, gutters and sidewalks to the required cross-section, lines, grades, finish and jointing, as specified for conventionally formed concrete. If results are not acceptable, remove and replace at CONTRACTOR'S expense.

3.6 JOINTS

- A. General: Construct expansion, contraction, and construction joints with faces perpendicular to surface of the curb, gutter and sidewalk. Construct transverse joints at right angles to the Work centerline and as shown.
- B. Contraction Joints: Provide these joints at 10 feet on centers for curbs and gutters and 10 feet on centers for sidewalks.
- C. Construction Joints: Place joints at locations where placement operations are stopped for a period of more than 1/2-hour, except where such pours terminate at expansion joints.
- D. Expansion Joints: Provide 1/2 inch expansion joint filler where Work abuts structures; at returns; and at 100 foot spacing for straight runs. If curb, gutter, and sidewalk are not poured monolithically, provide expansion joints where each abuts the other.
 - 1. Place top of expansion joint material not less than 1/2 inch or more than 1-inch below concrete surface. Apply joint sealer on top of expansion joint material flush with concrete surface, and in accordance with manufacturer's instructions.

3.7 CONCRETE FINISHING

- A. Smooth the exposed surface by screeding and floating.
- B. Work edges of gutter and sidewalks, back top edge of curb and transverse joints and round to 1/4-inch radius.
- C. Complete surface finishing by drawing a fine-hair broom across surface, perpendicular to line of traffic.

3.8 CURING

- A. Protect and cure finished concrete curbs, gutters and sidewalks, complying with applicable requirements of Section 03300.

3.9 REPAIR AND CLEANING

- A. Repair or replace broken or defective curbs, gutters and sidewalk as directed by the ENGINEER.
- B. Sweep Work and wash free of stains, discolorations, dirt and other foreign material.

+ + END OF SECTION + +

SECTION 02601

MANHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to provide all precast, cast-in-place, masonry manholes shown, specified and otherwise required to complete the Work.
- B. General:
1. Structures shall conform in shape, size, dimensions, material, and other respects to the details shown or as ordered by the ENGINEER.
 2. Cast-iron frames, grates and covers shall be the standard frame and grate or cover unless otherwise shown and shall be as specified in Section 05540.
 3. Concrete shall be Class A except where otherwise specified and shall conform to the requirements specified under Section 03300.
 4. Inverts shall conform accurately to the size and elevation of the adjoining pipes. Side inverts shall be curved and main inverts, where direction changes, shall be laid out in smooth curves of the longest possible radius which is tangent to the centerlines of adjoining pipelines.
- C. Related Work Specified Elsewhere:
1. Section 02233, Excavation and Backfill.
 2. Section 03300, Cast-In-Place Concrete.
 3. Section 05504, Miscellaneous Metal Fabrications and Wood Baffles.
 4. Section 05540, Castings.
 5. Division 15, Sections on Piping.

1.2 QUALITY ASSURANCE

- A. Reference Standards:
1. ASTM C 32, Sewer and Manhole Brick (made from Clay or Shale).
 2. ASTM C 139, Concrete Masonry Units for Construction of Catch Basins and Manholes.
 3. ASTM C 140, Sampling and Testing Concrete Masonry Units.
 4. ASTM C 207, Hydrated Lime for Masonry Purposes.
 5. ASTM C 478, Precast Reinforced Concrete Manhole Sections.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of brick and all accessories required for the manholes.
- B. Shop Drawings: Submit for approval Shop Drawings of design and construction details of all precast concrete.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

- A. Precast manholes shall conform to the details shown. Manhole bases may be precast unless cast-in-place is required by the Drawings.
- B. Except where otherwise specified manhole sections shall conform to ASTM C 478.
- C. Precast manhole bases shall be of approved design and of sufficient strength to withstand the loads to be imposed upon them. An approved joint shall be provided to receive the pipe sections forming the barrel.
- D. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
- E. Unless a larger size is required by the Drawings, the barrel of precast manholes shall be constructed of 48-inch diameter standard reinforced concrete manhole sections. The barrel shall be constructed of various lengths of pipe in combination to provide the correct height with the fewest joints. Wall sections shall not be less than 5 inches thick.
- F. Joints shall be as approved by ENGINEER. The joint sealing compound shall be Quik-seal, a preformed cold-applied ready-to-use plastic joint sealing compound supplied by Quikset Utility Vaults; Ram-Neck by K. T. Snyder Company; or equal. All joints shall be sealed watertight.
- G. A precast or cast-in-place slab or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the access hatches or cast iron frame and cover. The slab or cone shall be of acceptable design and of sufficient strength to safely support an H-20 loading. Concrete slabs shall be not less than 6 inches thick.

2.2 MISCELLANEOUS METALS

- A. Metal frames, covers, steps, toe pockets and similar required items shall be provided as shown and in accordance with Section 05504.

PART 3 - EXECUTION

3.1 LAYING MASONRY

- A. Brick shall be satisfactorily wet when being laid and each brick shall be laid in mortar so as to form full bed, end and side joints in one operation. The joints shall not be wider than 3/8-inch, except when the bricks are laid radially, in which case the narrowest part of the joint shall not exceed 1/4-inch.

- B. For concrete block, the vertical keyways shall be completely filled with mortar.
- C. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.2 PLASTERING

- A. The outside of grading rings shall be neatly plastered with 1/2-inch of cement mortar as the Work progresses.

3.3 MANHOLE BASES

- A. Cast-in-place bases shall be placed on suitable foundations after the pipes are laid. They shall be cast monolithically to at least 12 inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed. Base walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected. Concrete for cast-in-place bases shall be Type "A". Special care shall be taken in placing the concrete around the bottom of the pipes to obtain a waterproof structure. An approved bell shall be cast in the base to receive the pipe sections forming the barrel.
- B. Precast bases shall be set on a concrete or crushed stone foundation as shown. Precast bases shall be set at the proper grade and carefully leveled and aligned.

3.4 PRECAST MANHOLE SECTIONS

- A. Set sections vertical with sections in true alignment.
- B. Install sections, joints and gaskets in accordance with manufacturers recommendations.
- C. Lifting holes shall be sealed tight with a solid rubber plug driven into hole and the remaining void filled with 1 to 2 cement-sand mortar.

3.5 MANHOLE FRAMES AND COVERS

- A. The elevations at which manhole frames and covers shall be set shall conform to the requirements indicated on the Drawings. Where the cover is in existing pavement or in the traveled way of the existing road shoulder, the cover shall be placed flush with the existing surface. Where the structure is outside the limits of the traveled shoulder but not in the roadside ditch, the structure shall be placed 1/10-foot or more above the existing ground surface. Where the manhole cover falls in the existing roadside ditch or right of way, the manhole cover shall be placed approximately 1-1/2 feet above the existing ground surface. Manhole frames shall be set at the required grade and shall be securely attached to the top precast manhole shaft unit. After the frames are securely set in the place provided herein, covers shall be installed and all necessary cleaning and

scraping of foreign materials from the frames and covers shall be accomplished to assure proper fit.

3.6 DROP MANHOLES

- A. Drop manholes shall be constructed at the location and in conformance with the details indicated on the Drawings. Materials and construction of drop manholes shall conform in all respects to the applicable provisions of these Specifications for standard precast manholes (including frames and covers), with modifications for the addition of drop inlets as indicated on the Drawings. The inside diameter of the drop inlet pipe shall be the same diameter as the intercepted sewer unless otherwise indicated on the Drawings or specified in the Specifications. Fittings for drop manholes shall be furnished and set in the manner indicated on the Drawings. The drop tee and other fittings shall be of vitrified clay pipe or as otherwise specified or indicated on the Drawings.

3.7 MANHOLE WATERTIGHTNESS

- A. All manholes shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER'S approval.

3.8 FLEXIBLE PIPE JOINT AT MANHOLE BASE

- A. An approved flexible joint shall be provided between each pipe entering and exiting manhole. This may be accomplished by the installation in the manhole base of the bell end of a pipe or by other means subject to approval of the ENGINEER. Joints shall be similar to the approved pipe joints. The joint into the manhole base shall be completely watertight.

3.9 PIPE STUBS

- A. Pipe stubs shall be furnished and installed at manholes at the locations and in conformance with details indicated on the Drawings and as herein specified. All stubs shall be plugged with a vitrified clay stopper or brick plug as indicated on the Drawings. Unless otherwise indicated on the Drawings, vitrified clay stoppers shall be used to plug stubs up to and including 21 inches, and brick plugs shall be used on stubs greater than 21 inches.

+ + END OF SECTION + +

TECHNICAL SPECIFICATIONS

ASBESTOS ABATEMENT
SQUAW PEAK WATER TREATMENT PLANT
INDEX NO. W-886739 / WO# 60123

ASBESTOS ABATEMENT SPECIFICATIONS ARE THE RESPONSIBILITY OF THE CITY OF PHOENIX, ENGINEERING AND ARCHITECTURAL SERVICES DEPARTMENT. ALL QUESTIONS REGARDING THESE SPECIFICATIONS SHOULD BE DIRECTED TO THE CITY.

.01

SUMMARY OF WORK

- A. These specifications cover the abatement of exposure to hazards from building components containing asbestos materials. It is the intent of these documents to show all of the work necessary to complete the project.
- B. The Contractor shall furnish all labor, materials, services, insurance and equipment necessary for the total removal of all asbestos containing materials (ACM) in the designated areas. The Contractor will visit the project site to assess the exact amounts of ACM present as well as the physical difficulty involved in its complete removal.
- C. The Contractor shall seal off all critical areas such as doors, windows, openings and any other areas that may allow the escape of contaminants to the outside air. He shall also seal all work areas with plastic barriers, erect decontamination facilities, and install negative air pressure differential systems as required by these specifications.
- D. The Contractor shall conduct comprehensive personal air monitoring of his on-site personnel, and shall dispose of all asbestos wastes and debris in a safe and approved manner.
- E. The Contractor shall have full responsibility and liability for compliance with all applicable Federal, State, and local government regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

.02

POTENTIAL ASBESTOS HAZARD

- A. The disturbance or dislocation of asbestos containing materials may cause asbestos fibers to be released into a building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. The Contractor shall apprise all workers, supervisory personnel, subcontractors, and consultants who will be at the job site of the seriousness of the hazard and of the proper work procedures that must be followed.
- B. Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos containing materials, the Contractor shall take appropriate continuous measures as necessary to protect all building occupants from the potential hazard of exposure to airborne asbestos. Such measures shall include the procedures and methods described in these specifications, and compliance with regulations of applicable Federal, State, and local government agencies.

Accredited or Accreditation: When used in reference to a person or laboratory means accredited in accordance with Section 206 of Title II of the Toxic Substances Control Act (TSCA).

Aerosol: A system consisting of particles, solid or liquid, suspended in air.

Air Cell: Insulation normally used on pipes and duct work that is comprised of corrugated cardboard frequently composed of asbestos combined with cellose or refractory binder.

Air Monitoring: The process of measuring the fiber content of a specific volume of air.

Amended Water: Water to which a surfactant has been added to decrease the surface tension to 35 dynes or less.

Asbestos: The asbestiform varieties of serpentinite (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite. For purposes of determining respiratory and worker protection, both the asbestiform and non-asbestiform varieties of these minerals as well as any of these minerals that have been chemically treated and/or altered shall be considered as asbestos.

Asbestos Containing Materials (ACM): Any material containing more than 1.0% by weight of asbestos of any type or mixture of types.

Asbestos Containing Building Material (ACBM): Surfacing ACM, thermal system insulation ACM, or miscellaneous ACM that is found in or on interior structural members or other parts of a building.

Asbestos Containing Waste Material: Any material which is or is suspected of being, or any material contaminated with, an asbestos containing material which is to be removed from a work area for disposal.

Asbestos Debris: Pieces of ACBM that can be identified by color, texture, or composition; or dust, if that dust is determined by an accredited inspector to be ACM.

Authorized Visitor: The Owner, the Owner's Representative, the testing lab's personnel, the Project Engineer/Architect, emergency personnel, or a representative of any Federal, State, or local governmental regulatory agency having jurisdiction over the project.

Barrier: Any surface that seals off the work area to inhibit the movement of fibers.

Breathing Zone: A hemisphere forward of the shoulders with a radius of approximately 6 to 9 inches.

Ceiling Concentration: The concentration of an airborne substance that shall not be exceeded.

Certified Industrial Hygienist (CIH): An industrial hygienist certified in Comprehensive Practice by the American Board of Industrial Hygiene.

Demolition: The wrecking or taking out of any building component, system, finish, or assembly of a facility together with any related handling operations.

Disposal Bag: A properly labeled 6-mil thick polyethylene plastic bag forming a leak-tight container used for transporting asbestos waste from the work area to the disposal site.

Encapsulant: A material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent release of fibers.

Bridging Encapsulant: an encapsulant that forms a discrete layer on the surface of an in-situ asbestos matrix

Penetrating Encapsulant: an encapsulant that is absorbed by the in-situ asbestos matrix without leaving a discrete surface layer.

Removal Encapsulant: a penetrating encapsulant specifically designed to minimize fiber release during removal of asbestos containing materials.

Encapsulation: Treatment of ACM with an encapsulant.

Enclosure: The construction of an air-tight, impermeable, permanent barrier around asbestos containing material to control the release of asbestos fibers into the air.

Filter: A media component used in respirators to remove solid or liquid particles from inspired air.

Friable Asbestos Materials: Material that contains more than 1.0% of asbestos by weight, and which can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

Glovebag: A sack (typically constructed of 6-mil thick transparent polyethylene or polyvinylchloride plastic) with inward projecting long-sleeve gloves, and which is designed to enclose an object from which ACM is to be removed.

HEPA Filter: A High Efficiency Particulate Air (HEPA) filter capable of trapping and retaining 99.97% of asbestos fibers greater than 0.3 microns in diameter.

HEPA Filter Vacuum Collection Equipment (or vacuum cleaner): Vacuum collection equipment (or vacuum cleaner) containing a high efficiency particulate air (HEPA) filter system capable of collecting and retaining asbestos fibers. Filters should be of 99.97% efficiency for retaining fibers of 0.3 microns or larger.

High Efficiency Particulate Air Filter: Same as HEPA Filter, and refers to a filtering system capable of trapping and retaining 99.97% of all monodispersed particles 0.3 microns or larger in diameter.

Negative Pressure Respirator: A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere, and negative during inhalation in relation to the air pressure of the outside atmosphere.

Negative Pressure Ventilation System: A pressure differential and ventilation system.

Personal Monitoring: Sampling of the asbestos fiber concentration within the breathing zone of an employee.

Pressure Differential and Ventilation System: A local exhaust system, utilizing HEPA filtration, capable of maintaining a pressure differential with the inside of the work area at a lower pressure than any adjacent area, and which cleans recirculated air or generates a constant air flow from adjacent areas into the work area.

Protection Factor: The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer.

Repair: Returning damaged ACBM to an undamaged condition or to an intact state so as to prevent fiber release.

Respirator: A device designed to protect the wearer from inhalation of harmful atmospheres.

Surfactant: A chemical wetting agent added to water to improve penetration, thus reducing the quantity of water required for a given operation or area.

Time Weighted Average (TWA): The average concentration of a contaminant in air during a specified period of time.

Visible Emissions: Any emissions containing particulate asbestos material that are visually detectable without the aid of instruments. This does not include condensed, uncombined water vapor.

Wet Cleaning: The process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops, or other cleaning utensils which have been dampened with amended water or diluted removal encapsulant. After wet cleaning, all utensils used are thoroughly decontaminated or provided with disposal as asbestos contaminated wastes.

Work Area: The area where asbestos related work or removal operations are performed. This area is defined and/or isolated to prevent the spread of asbestos dust, fibers, or debris, and entry is precluded to unauthorized personnel. The work area is a Regulated Area as defined by OSHA Regulations, 29 CFR 1926.58.

ASBESTOS INSURANCE AND PATENT INDEMNITY PROVISIONS

- A. The Contractor shall provide proof that he currently has and shall continue to maintain one-million dollars (\$1,000,000.00) of asbestos-specific insurance with "occurrence" claim provisions that protects the Contractor, and indemnifies and holds harmless the City of Phoenix and the City's representatives, agents, and employees from claims that may arise out of or result from the Contractor's activities under this contract, whether those activities are performed by him, his subcontractor, or by anyone directly or indirectly employed by him or his subcontractor, or by anyone for whose acts the Contractor or his subcontractor is liable. For purposes of meeting these requirements, Non-Rated or Offshore insurance companies are not acceptable.

- B. The Contractor shall also submit proof of coverage under the Workmen's Compensation Insurance System of the State of Arizona, or other similar benefit acts.

- C. The Contractor shall submit a policy of general liability insurance for personal injury, occupational illness, disease, or death, and property damage with "occurrence" claim provisions. "Claims-made" provisions or "modified occurrence" provisions (eg. "sunset clauses") are not acceptable for meeting asbestos or liability requirements. The minimum acceptable limits of coverage are:
 - \$1,000,000.00 Combined Single Limit for Bodily Injury and Property Damage, or
 - \$500,000.00 Bodily Injury and \$250,000.00 Property Damage (each occurrence).

- D. The Contractor agrees to obtain any licenses or other authorization attendant to the lawful use of any processes, materials, or services that are subject to patent, copyright, trade secret, or other intellectual restrictions or laws. The Contractor agrees to defend any action, at its own expense, and to indemnify and hold harmless the City and its officers, agents, and employees (collectively the "City") from any action, including damages, expenses, and attorney's fees, based on a claim that the work, materials, services, or methods employed by the Contractor or a subcontractor in performing this Contract infringes any patents, copyrights, licenses, trade secrets, or other intellectual property rights asserted by one not a party to this Contract, whether or not such assertion is valid or in error. The Contractor shall have the right to control the defense of all such claims, lawsuits, or other proceedings including the right to settle the same. The City shall not become obligated to expend funds or provide materials or services as a result of such defense or settlement beyond that which the City is obligated to provide under a written agreement.

In no event shall the Contractor settle any such claim, lawsuit, or other proceeding affecting this Contract without the City's written approval. If as a result of any claim of infringement against any patent, copyright, license, trade secret, or other intellectual property right, the Contractor's performance under this Contract is substantially and materially impaired, the City may at its option obtain substitute material, services, or property that is not subject to claims of infringement of any patents, copyrights, licenses, trade secrets, or other intellectual property rights. The Contractor shall indemnify and hold harmless the City for any expenses or liability associated with the substituted performance.

SPECIAL REQUIREMENTS

- A. Prior to submitting a bid, it shall be the Contractor's responsibility to visit the project site, and investigate and satisfy himself as to: a) conditions affecting the work, including but not limited to physical conditions of the site, availability of water and utilities, accessibility, storage and handling of equipment and materials, or other factors that may affect the performance of abatement activities; b) the location, character, and quantities of asbestos-containing materials, as well as the location, character, and quantities of other surface and subsurface materials or obstacles that will be encountered, in so far as this information can be determined by visual and physical observations of the site, including exploratory work performed by the City of Phoenix or the City's designated environmental consultant as well as information presented in these specifications. Any failure by the Contractor to acquaint himself with available information does not relieve the Contractor from the responsibility of properly estimating the cost and degree of difficulty of successfully performing the abatement work. Information made available by the City or its representative(s) is informational only. Neither the City nor its representative(s) is responsible for any conclusions or interpretations made by the Contractor on the basis of this information. Submittal of a bid by the Contractor constitutes agreement that these requirements have been met, and sufficient information is available to bid the project.
- B. With his bid, Contractor shall provide evidence that he and his workers have attended training courses within the last twelve (12) months dealing with the occupational safety and health hazards associated with asbestos removal. At a minimum, this training must have met the requirements of OSHA as set forth in 29 CFR 1926.58.
- C. The Contractor shall be required to furnish evidence before the start of work that the full-time General Superintendent at the job site is an accredited Asbestos Abatement Supervisor in accordance with EPA regulations, Asbestos Hazard Emergency Response Act (AHERA), Asbestos Containing Materials in Schools, 40 CFR Part 763, Subpart E, Appendix C.
- D. Before the start of work, the Contractor shall submit a fully executed and signed copy of the Certificate of Worker's Acknowledgement found at the end of this section, (see Attachment A), for each worker who is to be at the job site or enter the work area.
- E. Before the start of work, the Contractor shall submit certification, signed by an officer of the abatement contracting firm and notarized, that exposure measurements, medical surveillance, and worker training records are being kept in accordance with OSHA requirements set forth in 29 CFR 1926.58.

- F. Before the start of work, the Contractor shall submit the name and address of the landfill where the asbestos waste material will be provided with disposal. This submittal shall include the name of the landfill contact person and a phone number.
- G. Before the start of work, the Contractor shall submit a detailed plan of the asbestos removal and disposal procedures proposed for use in complying with the requirements of these provisions. The plan shall include a detailed description of the methods to be used to control airborne emissions of asbestos, the location and layout of the decontamination units, the sequencing of the asbestos work, the performance methods for the removal work, the method of packaging asbestos waste and debris, and the method of transporting packaged asbestos waste to the landfill. This plan must be approved by the Project Engineer prior to the start of work.
- H. The Contractor is responsible for obtaining all signatures needed on landfill disposal documents and waste manifests. Arrangements for obtaining the Project Owner's signature on these types of documents must be made by the Contractor at least twenty-four (24) hours prior to transporting the asbestos waste to ensure that no delay in transporting or disposal of the waste will occur.
- I. Notice is hereby given that the Natale Reduced Pressurization and Filtration System is covered by U. S. Patent No. 4,604,111. The unauthorized use of the Natale System for asbestos containment and removal represents a patent infringement. It is the responsibility of the Contractor to select the pressure differential system, if any, required by these specifications, and to avoid any direct or indirect patent infringements. Information on the Natale Reduced Pressurization and Filtration System, and the depth and scope of the aforementioned patent can be obtained by contacting:

Lawrence Michaels, Esq.
Lawrence Michaels and Associates
Suite 600
1700 Walnut Street
Philadelphia, Pennsylvania 19103
(215) 848-3700

MANVILLE PROPERTY DAMAGE TRUST SETTLEMENT

- A. The City of Phoenix is a claimant to the Manville Property Damage Trust Settlement. In order for the City to file properly executed claims with the Trust, and receive partial reimbursement for the costs of this project, it is necessary for the Contractor to submit the following information to the City prior to the start of work:
1. For each type of asbestos containing material (ACM), provide an estimate of the amount of ACM to be removed and the cost. This should be submitted in the following format:
 - a) the units of surface treatment measured in square feet, and its cost.
 - b) the units of linear insulation (ie. pipe lagging) measured in linear feet, and its cost.
 - c) the units of surface area insulation (ie. thermal insulation) measured in square feet, and its cost.
 - d) the units of linear miscellaneous ACM (ie. transite pipe) measured in linear feet, and its cost.
 - e) the units of surface area miscellaneous ACM (ie. asbestos floor tiles) measured in square feet, and its cost.
 2. Copies of the certifications of the laboratory analyst, industrial hygienist, air monitoring technician, and/or consultant performing the Contractor's project monitoring and laboratory testing activities.
 3. Copies of the AHERA certification for the Contractor's General Superintendent who will supervise abatement activities at the job site.
- B. The above-requested information should be sent to the following address:
- R. Blane Work
Environmental Engineer
Engineering and Architectural Services Department
125 East Washington Street
Phoenix, Arizona 85004
- C. All of the above-requested information is necessary for the City to file properly executed claims with the Trust. Consequently, the Contractor's first payment request will not be processed until all the information requested has been received by the Engineering and Architectural Services Department.

REGULATIONS

- A. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes and regulations have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

The Contractor shall assume full responsibility and liability for compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State, and local regulations.

- B. Federal requirements which govern asbestos work or hauling and disposal of asbestos waste materials include, but are not limited to, the following:

1. OSHA: U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), including:

Respiratory Protection
Title 29, Part 1910, Section 134
Code of Federal Regulations

Construction Industry
Title 29, Part 1926, Section 58
Code of Federal Regulations

Access to Employee Exposure and Medical Records
Title 29, Part 1910, Section 2
Code of Federal Regulations

Hazard Communication
Title 29, Part 1910, Section 1200
Code of Federal Regulations

Specifications for Accident Prevention Signs and Tags
Title 29, Part 1910, Section 145
Code of Federal Regulations

2. DOT: U.S. Department of Transportation

Hazardous Substances
Title 49, Parts 171 and 172
Code of Federal Regulations

3. EPA: U.S. Environmental Protection Agency

National Emission Standard for Hazardous Air Pollutants
(NESHAPS)

National Emission Standard for Asbestos
Title 40, Part 61, Subpart A and Subpart M
Code of Federal Regulations

- C. State and local regulations which govern asbestos abatement work, or hauling and disposal of asbestos waste materials include, but are not limited to, the following: By reference, the EPA National Emission Standard for Hazardous Air Pollutants (NESHAPS), National Emission Standard for Asbestos, Title 40, Part 61, Subparts A and M, of the Code of Federal Regulations.

.08 STANDARDS

- A. Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

The Contractor shall assume full responsibility and liability for compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site.

- B. Standards which apply to asbestos abatement work or hauling and disposal of asbestos waste materials include, but are not limited to, the following:

1. American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018
(212) 354-3300

Fundamentals Governing the Design and
Operation of Local Exhaust Systems
Publication Z9.2-79

Practices for Respiratory Protection
Publication Z88.2-80

2. American Society for Testing and Materials (ASTM)
1916 Race Street
Philadelphia, PA. 19103
(215) 299-5400

Safety and Health Requirements Relating to
Occupational Exposure to Asbestos
E 849-82

SCOPE OF WORK

- A. Work under these provisions shall be the removal of asbestos containing materials (ACM) from designated structures and areas at the City of Phoenix Squaw Peak Water Treatment Plant, 2202 East Maryland Avenue, Phoenix, Arizona, by competent persons who are trained, knowledgeable, and qualified in the techniques of abatement, handling, and disposal of asbestos containing materials and asbestos contaminated materials, and the subsequent cleaning of contaminated areas, and who comply with all applicable Federal, State, and local government regulations. These competent persons shall be both capable and willing to perform the work of these provisions.
- B. A preliminary asbestos survey of these structures and areas has been performed. The purpose of the survey was to identify and sample suspect asbestos containing building and roofing materials. The level of detail of the survey was limited to readily accessible suspect ACM, and was not designed to confirm the presence or absence of ACM in locations other than those that were sampled. Tables summarizing the laboratory results for all samples collected and an estimate of ACM quantities and types identified are included in Attachment B to these specifications. Schematic diagrams showing all sample locations are included in Attachment C. Please note, these attachments and the information contained therein are provided for your information only.
- C. The Contractor shall locate and remove all ACM from the designated structures and areas. It shall be the Contractor's responsibility to visit this project site prior to bidding, and to assess the exact amounts and types of ACM present, as well as the physical difficulty involved in its complete removal. Submittal of a bid by the Contractor constitutes agreement that this requirement has been met.
- D. The Contractor shall furnish all labor, materials, services, insurances, and equipment necessary to perform the removal operation in accordance with applicable Federal, State, and local government regulations.
- E. The Contractor shall post all notices required by the applicable Federal, State, and local regulations.
- F. The Contractor shall maintain two (2) legible copies of each applicable Federal, State, and local government regulation. One copy of each shall be maintained and available at the job site, and one copy of each shall be maintained on file at the Contractor's office.

H. Pursuant to the requirements of NESHAPS, Asbestos Regulations (40 CFR Part 61, Subpart M) and applicable State and local regulations, the Contractor shall submit written notification at least ten (10) days prior to the start of work to the following agencies:

1. Asbestos NESHAPS Contact
Air Management Division
U. S. Environmental Protection Agency
215 Fremont Street
San Francisco, CA. 94105
2. Arizona Department of Environmental Quality
Office of Air Quality
Permits and Compliance Unit
2005 North Central Avenue
Phoenix, AZ. 85004
3. Maricopa County Department of Health Services
Division of Public Health
Bureau of Air Pollution Control
P.O. Box 2111
Phoenix, AZ. 85001

I. The following information shall be included in the notification sent to the agencies listed above:

1. Name and address of the project owner.
2. A description of the facility being renovated, including the size, age, and prior use.
3. An estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet for pipe, and in square feet for other facility components.
4. The location of the facility being renovated.
5. The scheduled start and completion dates of the renovation.
6. The nature of the planned renovation and the method(s) to be used.
7. Procedures to be used to comply with the requirements of NESHAPS Asbestos Regulations (29 CFR Part 61, Subpart M).
8. The name and location of the waste disposal site where the asbestos waste material will be deposited.

J. A copy of the notice sent to the above listed agencies should also be sent to the Project Engineer.

WORKER PROTECTION

- A. The Contractor shall select and provide, at no cost to his employees, appropriate respirators as specified by requirements set forth in OSHA, 29 CFR 1926.58, and the American National Standard Practices for Respiratory Protection, ANSI Z88.2-1980. The Contractor shall ensure that each employee uses the respirator provided.
- B. Regardless of the airborne fiber levels, the Contractor shall ensure that the minimum level of respiratory protection used shall be a half-face, air-purifying respirator with high efficiency filters. At no time shall a single-use, disposable, or a quarter-face respirator be used for any purpose.
- C. Pursuant to the requirements of OSHA regulation 29 CFR 1926.58, the Contractor shall maintain a sufficient supply of respirator filter elements to allow each employee the opportunity to change filter elements several times during the work day. At no time should the same filter elements be used longer than one (1) work day. The filter elements should be stored at the job site in the change room, and should be totally protected from exposure to asbestos prior to their use.
- D. The Contractor shall ensure that the respirator issued to each employee exhibits the least possible facepiece leakage, and is properly fitted.
- E. The Contractor shall submit a copy of his written respiratory protection program manual as required by OSHA Regulation 29 CFR 1926.58 to the Project Engineer.
- F. Before beginning work with any material for which a Material Safety Data Sheet (MSDS) has been submitted, the Contractor shall provide his workers with the required protective equipment. He shall require that this equipment be used at all times when using the MSDS material.
- G. The Contractor shall:
1. Provide disposable full-body coveralls and disposable head covers, and require that they be worn at all times by all workers in the work area. Provide a sufficient number for all required changes for all workers in the work area.
 2. Provide disposable latex boot covers with non-skid soles, and where required, OSHA-approved foot protectives for all workers. Boot covers may not be worn out of the work area for any reason. Dispose of used boot covers as asbestos-contaminated waste.

3. In lieu of boot covers or where required by OSHA regulations, provide work boots with foot protectives for all workers. Provide the boots at no cost to the workers. Paint the uppers of all boots red with waterproof enamel, and do not allow the boots to be removed from the work area for any reason after being contaminated with asbestos. Dispose of the boots as asbestos-contaminated waste at the end of the work.
 4. Provide head protectives (hard hats) as required by OSHA for all workers. Label the hats with the same labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress which may potentially cause head injury. The hard hats provided should be of the type having plastic strap suspension. At the end of the work, clean and decontaminate hats, and bag for storage in a properly labeled disposal bag.
 5. Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury. (Note: goggles are not required if a full-face respirator is being used.) Goggles shall be thoroughly cleaned and decontaminated before being worn from one work area to another. At the end of the work, clean and decontaminate goggles, and bag for storage in a properly labeled asbestos disposal bag.
 6. Provide work gloves to all workers, and require that they be worn at all times in the work area. Do not remove gloves from the work area. Dispose of gloves as asbestos-contaminated waste at the end of work.
- H. Respirators, disposable coveralls, head covers, and footwear covers shall be provided by the contractor to any official representative of the State, or City who inspects the job site.
- I. The Contractor shall provide a Personnel Decontamination Unit consisting of a serial arrangement of connected spaces as follows: Changing Room, Drying Room or Airlock, Shower Room, and Equipment Room. This unit shall be located as close to the work area as possible, and its cost shall be incidental to the cost of the project.
- J. Without exception, all workers shall:
1. Remove all street clothes in the Changing Room of the Personnel Decontamination Unit, and put on new disposable coverall, new head cover, boot covers (if applicable), and clean respirator. Proceed through the Shower Room to the Equipment Room, put on work boots if needed, and enter the work area.

2. When exiting the work area, remove gross contamination from clothing with a HEPA vacuum. Proceed to the Equipment Room, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots. DO NOT remove the respirators.
 3. Still wearing the respirator, proceed to the showers. Showering with soap and water is mandatory. Care must be taken to follow reasonable procedures when removing the respirators to avoid asbestos fibers while showering.
 4. After thoroughly showering with soap and water and rinsing, rinse down the Shower Room walls and floor with water before exiting.
 5. Proceed from the shower to the Changing Room, and change into street clothes or into new disposable work items.
- K. DO NOT eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the work area. To perform these activities, workers shall follow the decontamination procedure described above, change into street clothes or new work items, and exit the regulated area.

WORK AREA PREPARATION

- A. The Contractor shall provide a Personnel Decontamination Unit consisting of a serial arrangement of connected rooms or spaces as follows:

Changing Room: Provide a room that is physically and visually separated from the rest of the building for the purpose of changing into protective clothing. Separate the room from the building and adjacent spaces with airtight walls. Provide sheet plastic flapped doorways from the building to the Changing Room, and from the Changing Room to the Drying Room. Locate the Changing Room so that access to the work area is through the Drying Room.

Drying Room: Provide a room as an airlock and place for workers to dry after showering. Separate this room from the rest of the building and adjacent rooms with airtight walls. Provide sheet plastic flapped doorways to the Changing Room and to the Shower Room.

Shower Room: Provide a completely watertight operational shower to be used for transit by cleanly dressed workers going to the work area from the Changing Room, or for showering by workers headed out of the work area after undressing in the Equipment Room. Separate this room from the rest of the building and adjacent rooms with airtight walls. Provide sheet plastic flapped doorways to the Drying Room and the Equipment Room. Equip the shower drain lines with a primary filter followed by a secondary filter. Provide the primary filter with a filter element that passes particles of 20 microns or smaller, and provide the secondary filter with a filter element that passes particles of 5 microns or smaller. Dispose of these filter elements as asbestos contaminated waste after the work is completed.

Equipment Room: Provide a room to serve as a contaminated area where used protective clothing, footwear, and equipment contaminated with asbestos can be deposited, and to serve as a worker transit area to and from the work area. Separate this room from the work area, the building, and adjacent rooms with airtight walls. Provide sheet plastic flapped doorways to the Shower Room and the work area. To prevent overburdening this area with asbestos contaminated debris tracked from the work area, provide a drop cloth layer of clear plastic sheeting on the floor for every shift change expected. Roll the drop cloth of plastic from the Equipment Room into the work area after each shift change, and replace with a new layer before the next shift change.

- B. The Contractor shall provide an Equipment Decontamination Unit consisting of a serial arrangement of rooms as follows:

Wash Room: Provide a Wash Room for the cleaning of bagged or containerized asbestos containing waste materials passed from the work area. Separate this room from the work area with a single flapped door of 6-mil thick polyethylene plastic sheeting. Provide a drop cloth layer of plastic on the floor for every load out operation. Roll this layer of plastic from the Wash Room into the work area after each load out.

Holding Room: Provide a room as a drop location for bagged or containerized asbestos containing materials passed from the Wash Room. Separate this room from adjacent rooms with single flapped doorways fabricated from 6-mil thick sheet plastic.

Clean Room: Provide a Clean Room to isolate the Holding Room from the building exterior. If possible, locate this room to provide direct access to the building exterior from the Holding Room. Separate this room from the adjacent rooms and the building exterior with flapped doorways of 6-mil thick polyethylene plastic sheeting.

- C. The Contractor shall establish emergency and fire exits from the work area. Emergency procedures shall have priority.
- D. The Contractor shall post warning signs at each entrance to the work area. These signs shall inform of the dangers of exposure to asbestos, and shall meet the sign requirements specified in Section (k) of OSHA Regulation 29 CFR 1926.58.
- E. The Contractor shall shut down, lock out, and tag out all heating, ventilation, and air conditioning (HVAC) systems bringing air into or out of the work area.
- F. Within the building interior, the Contractor will prepare and isolate the work area as described in the following procedures:
 - 1. The Contractor shall completely isolate the work area from other parts of the building so as to prevent asbestos containing dust or debris from passing beyond the work area. Should an area beyond the work area become contaminated, the contractor shall clean and decontaminate the contaminated area in accordance with procedures described in the section of these provisions entitled DECONTAMINATION OF WORK AREA, after first extending critical and primary isolation barriers to include the contaminated area. The Contractor shall perform all such required cleaning or decontamination at no additional cost to the City of Phoenix.
 - 2. The Contractor shall provide critical barriers to completely separate the work area from other parts of the building and the outside. Close all openings with polyethylene sheet plastic, at least 6-mil thick, and seal all cracks with duct tape.

- a. Individually seal all ventilation openings, lighting fixtures, doorways, windows, convectors, speakers, and other openings into the work area with duct tape and/or 6-mil thick polyethylene plastic sheeting, taped securely in place with duct tape. Maintain this seal until all work, including project decontamination, has been completed.
 - b. Provide sheet plastic barriers, at least 6-mil thick, as required to seal openings completely from the work area into adjacent areas. Seal the perimeter of all sheet plastic barriers with duct tape.
 - c. Mechanically support sheet plastic independently of duct tape so that the duct tape seals do not support the weight of the plastic.
3. All furniture and other non-stationary items in the work area shall be cleaned with a HEPA filtered vacuum or wet-wiped, and removed from the work area.
 4. Stationary items in the work area, (such as toilets, sinks, water fountains, etc.), shall be cleaned by wet-wiping or by HEPA vacuuming, and covered with two (2) layers of 6-mil thick polyethylene plastic sheeting securely taped into place with duct tape.
 5. Clean all surfaces and walls in the work area before installing primary plastic barriers, and any fixed scaffolding or staging equipment.
 6. Install a primary barrier of 6-mil thick polyethylene plastic sheeting over all building surfaces and critical barriers in the work area.
 7. Cover all non-asbestos containing floor materials in the work area with two (2) layers of 6-mil thick polyethylene plastic sheeting. Extend the sheeting at least twelve (12) inches up the sides of the walls. To minimize the possibility of floor damage from leaks, the seams of the second layer should be offset from the first layer. Care should also be taken not to install the plastic sheeting directly over wooden floors since condensation can occur and buckle the floor.
 8. All electrical supply to the work area shall be de-energized, locked-out, and tagged out.
 9. The Contractor shall install a Pressure Differential System to augment the the physical isolation measures. This system shall continuously maintain the work area at an air pressure that is lower than that in any surrounding space in the building, or at any location in the immediate proximity outside the building envelope. This pressure differential, when measured across any

physical or critical barrier, must equal or exceed a static pressure of 0.02 inches of water.

a. The pressure differential should be accomplished by exhausting a sufficient number of HEPA filtered fan units from the work area. The number of units required will depend on machine characteristics, the seal at the barriers, and the required air circulation.

b. The Pressure Differential System shall be made operational prior to initiating any removal operations, and shall remain operational continuously throughout the removal and decontamination procedures, including final acceptance of clearance air monitoring. Do not turn off the system at the end of a work shift, or when abatement operations temporarily stop.

10. The Contractor shall provide a fully operational Air Circulation System supplying a minimum of four (4) complete air changes per hour in the work area and decontamination units. The Air Circulation System may be combined with the Pressure Differential System, but must meet the requirements of both systems.

11. Before removing the Pressure Differential System / Air Circulation System from the work area, the Contractor shall remove and properly dispose of pre-filters, decontaminate the exterior of the machine, and seal the intake of the machine with 6-mil thick polyethylene plastic sheeting to prevent environmental contamination from the HEPA filters.

G. For exterior work areas, the Contractor shall prepare and isolate the work area as described in the following procedures:

1. The Contractor shall provide critical barriers to completely separate the exterior work area from interior portions of the building. Within the work area, the Contractor shall close all openings to the interior with polyethylene sheet plastic, at least 6-mil thick, and shall seal all cracks with duct tape.

a. Individually seal all ventilation openings, doorways, windows, and other openings with 6-mil thick polyethylene plastic sheeting, taped securely in place with duct tape. Maintain this seal until the asbestos removal and clean-up has been completed.

b. Stationary items in the work area shall be cleaned by wet-wiping or by HEPA vacuuming, and covered with two (2) layers of polyethylene plastic sheeting, each layer at least 6-mil thick, and taped securely in place with duct tape.

2. The Contractor is not required to erect isolation barriers or enclosures on the building roof for removing asbestos-containing roofing materials except for the critical barriers described above.

AIR MONITORING

- A. Pursuant to the requirements of OSHA Regulation 29 CFR 1926.58, the Contractor shall monitor airborne fiber counts and worker exposure levels inside the work area throughout the asbestos removal and cleaning operations.
1. The Contractor shall perform personal air monitoring of his personnel. If any personal air monitoring sample result exceeds 0.1 fibers per cubic centimeter (0.1 f/cc) of air, the Contractor shall immediately identify and correct the employee work practices causing the excessive fiber emissions.
 2. Copies of all air monitoring records and sample results collected by the Contractor shall be provided to the Owner at the completion of all removal and cleaning operations.
 3. The frequency and method of air monitoring by the Contractor during removal and cleaning operations shall be conducted in accordance with OSHA Regulations, 29 CFR 1926.58, using the NIOSH 7400 method for Phase Contrast Microscopy.
 4. The laboratory used by the Contractor to analyze asbestos samples shall be a participant in the AIHA/NIOSH Proficiency in Analytical Testing (PAT) program for asbestos fiber counting, and accredited by the U. S. Environmental Protection Agency for asbestos analysis by polarized light microscopy (PLM).
 5. Personal air monitoring of contractor personnel is for purposes of the Contractor. It shall be performed by the Contractor at no additional cost to the Owner.
- B. Throughout the asbestos removal and cleaning operations, area air monitoring shall be conducted by the Owner both inside and outside the work area to insure that airborne asbestos fiber levels do not exceed regulatory requirements of OSHA Regulation 29 CFR 1926.58 and EPA NESHAPS, 40 CFR Part 61, Subpart M. This area air monitoring is for purposes of the Owner, and will not be performed to meet the Contractor's requirements pursuant to OSHA Regulation, 29 CFR 1926.58.
1. Initial baseline area air samples shall be collected by the Owner at the time actual removal work begins.
 2. Inside the work area, the Contractor shall maintain an average airborne fiber count of less than 0.5 fibers per cubic centimeter (0.5 f/cc) of air. If fiber counts rise above this figure for any sample collected, the Contractor shall revise his work procedures to lower airborne fiber counts. If

airborne fiber counts exceed 2.0 fibers per cubic centimeter (2.0 f/cc) for any sample collected, the Contractor shall immediately cease all work except corrective action until fiber counts fall below 0.5 f/cc. After correcting the cause of the high fiber levels, the Contractor shall not recommence work for 24 hours unless otherwise directed, in writing, by the Project Engineer.

3. If any air sample collected outside the work area exceeds the baseline established at the start of work, the Contractor shall immediately and automatically stop all work except corrective action. The Project Engineer shall determine the source of the high fiber reading, and will so notify the Contractor in writing. The appropriate corrective action shall be determined by the Project Engineer. The Contractor shall complete all corrective work, and shall do so with no change in the contract price if the high airborne fiber counts were caused by the Contractor's activities.
 4. The frequency and method of area air monitoring by the Owner during removal and cleaning operations shall be conducted according to OSHA Regulation, 29 CFR 1926.58, using the NIOSH 7400 method for Phase Contrast Microscopy. Sample location(s) shall be at the discretion of the air monitoring technician with the concurrence of the Project Engineer.
 5. The laboratory used by the Owner to analyze asbestos samples shall be a participant in the AIHA/NIOSH Proficiency in Analytical Testing (PAT) program for asbestos fiber counting, and accredited by the U. S. Environmental Protection Agency for asbestos analysis by polarized light microscopy (PLM).
- C. All air samples collected either by the Contractor or the Owner shall be analyzed within 24 hours of collection.
- D. "Airborne Fibers" as referenced in these provisions include all fibers regardless of composition as counted by Phase Contrast Microscopy (PCM), unless additional analysis by Transmission Electron Microscopy (TEM) demonstrates to the satisfaction of the Project Engineer that non-asbestos fibers are being counted. "Airborne Fibers" counted in samples analyzed by TEM shall be asbestos fibers 5 microns or greater in length, and 0.2 microns or larger in diameter.
- E. Post clean-up clearance air monitoring procedures recommended by EPA are applicable to this project, and are specified in these provisions in the section entitled WORK AREA CLEARANCE AIR MONITORING.

- A. Before the start of work, the Contractor shall submit to the Project Engineer/Architect the following items for review and approval:
1. NESHAPS Certification: Submit certification from the manufacturer of the surfactant (wetting agent) that, to the extent required by this specification, the material, if used in accordance with the manufacturer's instructions, will wet ACM to which it is applied as required by NESHAPS Asbestos Regulations, 40 CFR Part 61, Subpart M.
 2. Material Safety Data Sheets: Submit the Material Safety Data Sheets (MSDS), or equivalent, in accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200) for each surfactant, encapsulating material, solvent and adhesive proposed for use on the work. Include a separate attachment for each MSDS indicating the specific worker protective equipment proposed for use with the material indicated.
- B. The ACM shall be thoroughly wetted with water containing a surfactant (wetting agent) to enhance penetration. The surfactant shall be 50% polyoxyethylene ester and 50% polyoxyethylene ether (AquaGRO), or equivalent, in a concentration of one (1) ounce in five (5) gallons of water. Wetting shall be accomplished by a fine spray (mist) of this amended water, and the material shall be saturated sufficiently to wet to the substrate without causing excess dripping. Perforate the outer covering of any asbestos installation which has been painted and/or jacketed in order to allow penetration of amended water, or use injection equipment to wet the material under the covering. The material should be kept continuously wet during removal to minimize emission of airborne asbestos fibers. Where necessary, carefully strip away while simultaneously spraying the material with amended water. Dispersal of asbestos fibers into the air shall not exceed the exposure limits prescribed in the OSHA regulations (29 CFR 1926.58). Mist the work area continuously with amended water whenever necessary to reduce airborne fiber levels.
- C. Remove saturated ACM in manageable quantities and control the descent to the staging platform or floor. If the height is over twenty (20) feet, use a drop chute to contain the material during descent. Do not allow the material to dry out. As it is removed and while it is still wet, simultaneously pack the material into two (2) plastic, sealable bags (each bag having a minimum wall thickness of 6-mil), or wrap the material in two (2) layers of 6-mil thick polyethylene plastic sheeting. Seal bags by twisting the neck, bend over to form a loop, and wrap with duct tape a minimum of three wraps. Seal the plastic wraps by first sealing the edges

with an acceptable adhesive, folding the edges toward the center, and sealing with duct tape to form a leak tight container. The outside of each bag or wrap should be wet-wiped clean, and marked with two (2) labels as follows:

First Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's Hazard Communication Standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

Second Label: Provide in accordance with U.S. Department of Transportation regulation on hazardous waste marking, (49 CFR Parts 171 and 172, Hazardous Substances):

RQ HAZARDOUS
SUBSTANCE,
SOLID, NOS,
ORM-E, NA 9188
(ASBESTOS)

- D. ACM should be removed as complete and intact sections or components whenever possible. Large components removed intact shall be wrapped in two (2) layers of polyethylene plastic sheeting, each layer at least 6-mil thick, and marked with the OSHA and DOT labels described above. If necessary, nylon reinforced polyethylene plastic sheeting shall be used to wrap exceptionally large and heavy components, such as boilers, tanks, and converters.
- E. ACM having sharp-edged components (ie. nails, screws, metal lath, tin or copper sheeting, etc.) will cut and tear polyethylene plastic bags and sheeting. Asbestos wastes containing these components shall be placed in drums or boxes for disposal. All drums or boxes used shall be properly sealed to form a leak tight container, and marked with the OSHA and DOT labels described above.
- F. After completion of all stripping work, surfaces from which ACM has been removed shall be wet-brushed with a stiff nylon bristled hand brush and sponged, or shall be cleaned by an equivalent method, to remove all visible residue.
- G. Take all equipment and/or materials from the work area through the Equipment Decontamination Unit. The following decontamination procedure shall be used when removing contaminated equipment or containerized asbestos waste materials from the work area:

1. Thoroughly wet-wipe contaminated equipment or containerized asbestos waste materials, and pass into the Wash Room.
 2. When passing equipment or containers into the Wash Room, close all doorways in the Equipment Decontamination Unit except the doorway between the work area and the Wash Room. Keep all personnel outside the work area away from the Decontamination Unit.
 3. Once inside the Wash Room, wet clean the equipment and containers.
 4. When cleaning is complete, pass the items into the Holding Room, and close all doorways except the doorway between the Holding Room and the Clean Room.
 5. Workers from outside the Decontamination Unit may now enter the Holding Room through the Clean Room, and remove the decontaminated equipment or containers. These workers entering the Holding Room from outside must wear full protective clothing and appropriate respirators. At no time is a worker from an uncontaminated area to enter the Decontamination Unit when a contaminated worker from inside the work area is in the Unit. At no time should a contaminated worker from inside the work area enter the Clean Room of the Equipment Decontamination Unit.
- H. All plastic sheeting, tape, cleaning materials, and other materials or items used in the work area must be double bagged in sealable, plastic disposal bags (each bag having a minimum wall thickness of 6-mil), or wrapped in two (2) layers of 6-mil thick polyethylene plastic sheeting, and provided with proper disposal as asbestos waste. Each bag or wrap shall be marked with the OSHA and DOT labels described above.

WORK AREA CLEARANCE AIR MONITORING

- A. Work in this section will not begin until all activity required by the provisions of the section entitled DECONTAMINATION OF WORK AREA have been completed except for removal of critical barriers and decontamination units.
- B. To determine if the elevated airborne asbestos structure concentrations encountered during abatement operations have been reduced to regulatory levels, air samples will be collected by the Owner in accordance with the following aggressive sampling procedures:
1. Before sampling pumps are started, the exhaust from forced-air equipment (leaf blower with an approximately 1 horsepower electric motor) will be swept against all walls, ceilings, floors, ledges and other surfaces in the room. This procedure will be continued for 5 minutes for each 10,000 cubic feet of room volume.
 2. One 20 inch diameter fan per 10,000 cubic feet of room volume will be mounted in a central location at approximately 6 feet above the floor, directed towards the ceiling, and operated at low speed for the entire sample collection period.
 3. The Pressure Differential System shall be in operation throughout the sample collection period.
 4. All air samples will be collected in areas subject to normal air circulation, away from corners, obstructions, and windows, doors, or vents.
 5. All fans and Pressure Differential Systems shall remain in operation until after the sampling pumps have been shut off.
- C. The number and volume of air samples collected, and the analytical methods utilized shall be as follows:
1. For each work area, at least 5 samples, including 1 sample for each room in the work area, shall be collected along with 1 work area blank and 1 laboratory blank. Each sample shall be collected on 25mm. filter cassettes containing mixed cellulose ester media and a conductive extension cowl.
 2. The minimum acceptable volume shall be 1200 liters at a rate of 1 to 10 liters per minute for each sample collected and analyzed.
 3. All samples collected will be analyzed using the NIOSH Method 7400 entitled "Fibers" as published in the NIOSH Manual of Analytical Methods, 3rd. Edition, Second Supplement, August 1987.

- D. Decontamination of the work area is considered complete when every work area sample is at or below the detection limit for the phase contrast microscope of 0.01 fibers/ cc. If any sample is above this detection limit, then the decontamination is incomplete, and recleaning according to the provisions of the section entitled DECONTAMINATION OF WORK AREA is required.
- E. The services of a testing laboratory will be employed by the Owner to provide clearance air monitoring. Payment for these services shall be the responsibility of the Owner up to and including the collection and analysis of the first set of air samples. Costs for clearance air monitoring services after collection and analysis of the first set of samples shall be the responsibility of the Contractor.

DECONTAMINATION OF WORK AREA

- A. Upon completion of all removal work, perform a first cleaning of all surfaces in the work area using damp cleaning and mopping, or a High Efficiency Particulate Air (HEPA) filtered vacuum. (Note: A HEPA vacuum may fail if used with wet material.) Do not perform dry dusting or dry sweeping. Use each surface of a cleaning cloth one time only, and provide disposal as asbestos contaminated waste. Continue this cleaning until there is no visible debris from removed materials, or residue on plastic sheeting.
- B. Perform a complete visual inspection of the entire work area for residue on surfaces or debris from any source. If any such residue or debris is found, repeat the cleaning process until there is no visible debris or residue.
- C. Wait 24 hours to allow HEPA-filtered fan units to clean air of airborne asbestos fibers. Use 24-inch diameter floor fans as necessary to assure circulation of air in all parts of work area during this period. Maintain the Differential Pressure System in operation for the entire 24-hour period.
- D. Carry out a second cleaning of all surfaces in the work area in the same manner as the first cleaning.
- E. Immediately following this second cleaning, remove all Primary Barrier sheeting. Leave only the Critical Barriers between the work area and other portions of the building or outside, the sheeting over lighting fixtures, clocks, ventilation openings, doorways, convectors, speakers, and other openings, and the Decontamination Units. Maintain the Pressure Differential System in operation throughout the cleaning process
- F. Wait 24 hours to allow HEPA-filtered fan units to clean the air of airborne asbestos fibers. Use 24-inch diameter floor fans or 20-inch diameter oscillating fans as necessary to assure circulation of air in all parts of the work area during this period. Maintain the Pressure Differential System in operation for the entire 24-hour period.
- G. Perform a final cleaning of all surfaces in the work area in the same manner as the first cleaning. This cleaning is now being applied to existing room surfaces. Take care to avoid water marks or other damage to surfaces.
- H. After completion of the above cleaning, visually inspect all surfaces. Reclean if dust, debris, etc. is found. At completion of this inspection, sweep entire work area including walls, ceilings, ledges, floors and other surfaces with exhaust from forced air equipment (leaf blower with approximately 1 horsepower

electric motor, or equivalent). Do not direct forced air equipment at any seal in the critical barrier. If any debris or dust is found, repeat the final cleaning. Continue this process until no dust, debris, or other material is found while sweeping with forced air equipment.

- I. After the work area is found to be visually clean, air samples will be collected and analyzed in accordance with the procedure for Phase Contrast Microscopy as set forth in the provisions for WORK AREA CLEARANCE AIR MONITORING.
- J. After final air samples meet the work area clearance criteria, all critical barriers, entrances, exits, etc. should be unsealed, and the plastic, tape, and debris put into disposal bags for disposal as asbestos waste.

DISPOSAL OF ASBESTOS CONTAINING WASTE

- A. Asbestos containing and/or contaminated materials shall be provided with proper disposal at a sanitary landfill operated in accordance with the requirements of NESHAPS Asbestos Regulations (40 CFR Part 61, Subpart M), and approved by EPA for asbestos wastes.
- B. All wastes are to be hauled by a waste hauler with all required licenses from all State and local authorities with jurisdiction.
- C. All containerized waste should be carefully loaded into fully enclosed dumpsters, trucks, or other appropriate vehicles for transport. Care must be exercised before and during transport to ensure that no unauthorized person(s) have access to the material. The interior of the transport vehicle should be protected with two (2) layers of polyethylene plastic sheeting, each layer 6-mil thick.
- D. Containerized waste materials must NOT be stored outside of the work area. Take containers from the work area directly to a sealed truck or dumpster.
- E. Do NOT transport bagged materials on open trucks. Transport only properly sealed containers marked with the OSHA and DOT labels in closed bed vehicles protected with sheet plastic.
- F. At the disposal site, carefully unload containerized asbestos waste from the transport vehicle. Wrapped asbestos waste may require special unloading procedures and equipment. The Contractor shall ensure that all special procedures are followed, and special equipment is provided as needed.
- G. Retain landfill receipts and waste manifests as proof of proper disposal. Copies of these documents shall be provided to the Owner upon completion of the work.
- H. The Contractor is responsible for obtaining all required signatures on landfill disposal documents and waste manifests. Arrangements for obtaining the Project Owner's signature on these types of documents must be made by the Contractor at least twenty-four (24) hours prior to transporting the asbestos waste to ensure that no delay in transporting or disposal of the waste will occur.

ATTACHMENT A

CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT NAME _____ DATE _____

PROJECT ADDRESS _____

CONTRACTOR'S NAME _____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the Owner for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you.

RESPIRATORY PROTECTION: You must have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. You must be given a copy of the written respiratory protection manual issued by your employer. You must be equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: You must have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course must have included the following:

- Physical characteristics of asbestos
- Health hazards associated with asbestos
- Respiratory protection
- Use of protective equipment
- Pressure Differential Systems
- Work practices including hands on or on-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: You must have had a medical examination within the past 12 months at no cost to you. This examination must have included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

By signing this document you are acknowledging only that the Owner of the building you are about to work in has advised you of your rights to training and protection relative to your employer, the Contractor.

Signature _____ Social Security No _____

Printed Name _____ Witness _____

ATTACHMENT B
SUMMARY OF ASBESTOS SAMPLING



TABLE 1
SUSPECT ASBESTOS SAMPLING

<u>SAMPLE NUMBER</u>	<u>LOCATION</u>	<u>MATERIAL</u>	<u>ACM (Y/N)</u>
1	Admin. Bldg. - Plant 2	Ceiling Tile	N
2	Admin. Bldg. - Plant 2	12"x12" Floor Tile	Y
3	Admin. Bldg. - Plant 2	9"x9" Floor Tile	Y
4	Admin. Bldg. - Plant 2	Sprayed on Ceil. Matl.	Y
5	Admin. Bldg. - Plant 2	Plaster	N
6	Admin. Bldg. - Plant 2	Duct Wrap	N
7	Admin. Bldg. - Plant 2	Pipe Insulation	N
8	Admin. Bldg. - Plant 2	Roofing Material	Y
9	Admin. Bldg. - Plant 2	Roofing Material	N
10	Chemical Bldg. No. 1	Fume Hood Lining	Y
11	Chemical Bldg. No. 1	12"x12" Ceiling Tile	N
12	Chemical Bldg. No. 1	Roofing Material	N
13	Filter Bldg. No. 4	Sprayed-on Ceil. Matl.	N
14	Filter Bldg. No. 3	Sprayed-on Ceil. Matl.	Y

TABLE 2
ASBESTOS CONTAINING MATERIALS
CITY OF PHOENIX
SQUAW PEAK RIVER WATER FILTRATION PLANT

<u>Material</u>	<u>Location</u>	<u>Quantity</u>	<u>Type % Asbestos</u>
12"x12" Floor Tile	Plant Bldgs. 1, 2	5853 sf	Chrys/2-5
9"x9" Floor Tile with mastic	Plant Bldgs.	257 sf	Chrys/5-10
Fume Hood Lining	Chemical Bldg. 2	75 sf	Chrys/30-40
Sprayed-on Ceiling	Filter Buildings		
Roofing Material	Plant Bldg. 2	6162 sf	Chrys/10-20
	Filter Bldgs.	5460 sf	Chrys/5-10
	Pump Station 1		

Chrys - Chrysotile Asbestos

ATTACHMENT C

SAMPLE LOCATIONS AND MISCELLANEOUS DIAGRAMS

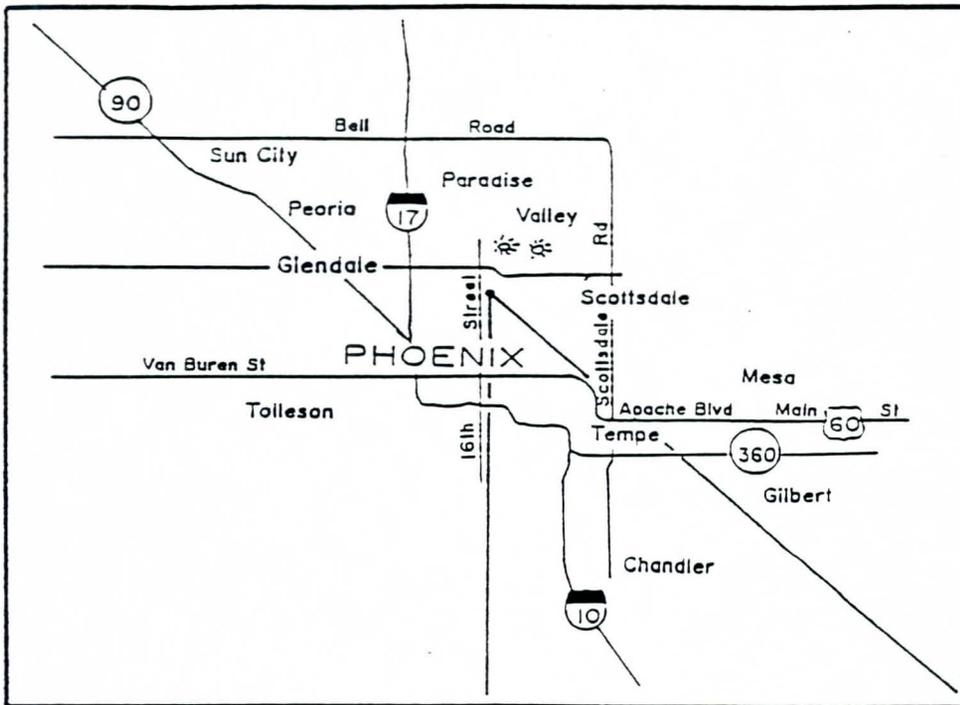
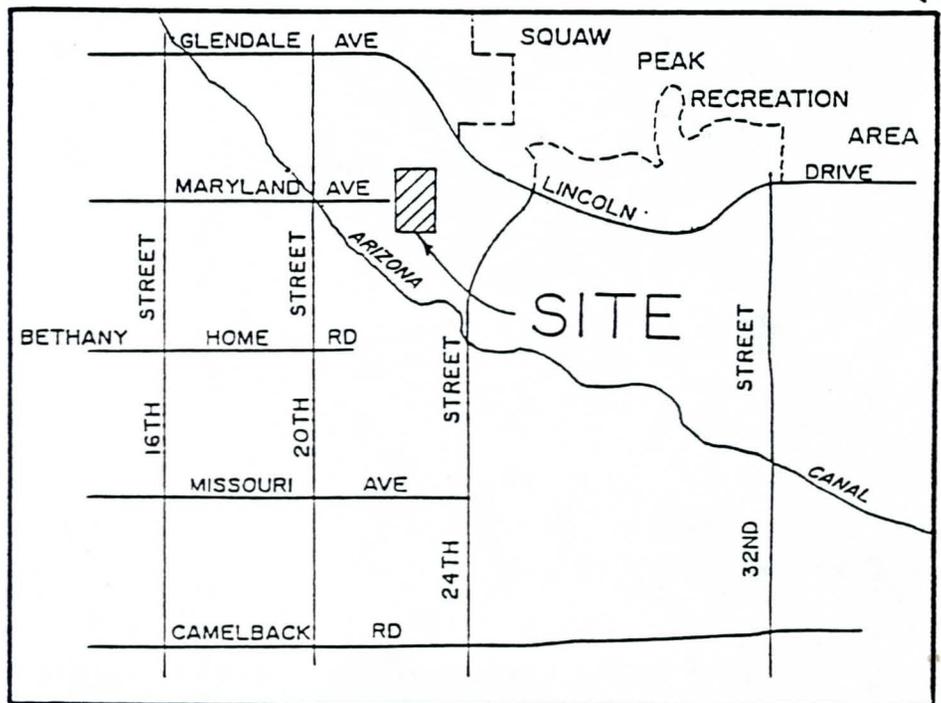


FIGURE 1
 AREA
 AND
 VICINITY MAP



N.T.S.

FIGURE 2 SITE PLAN

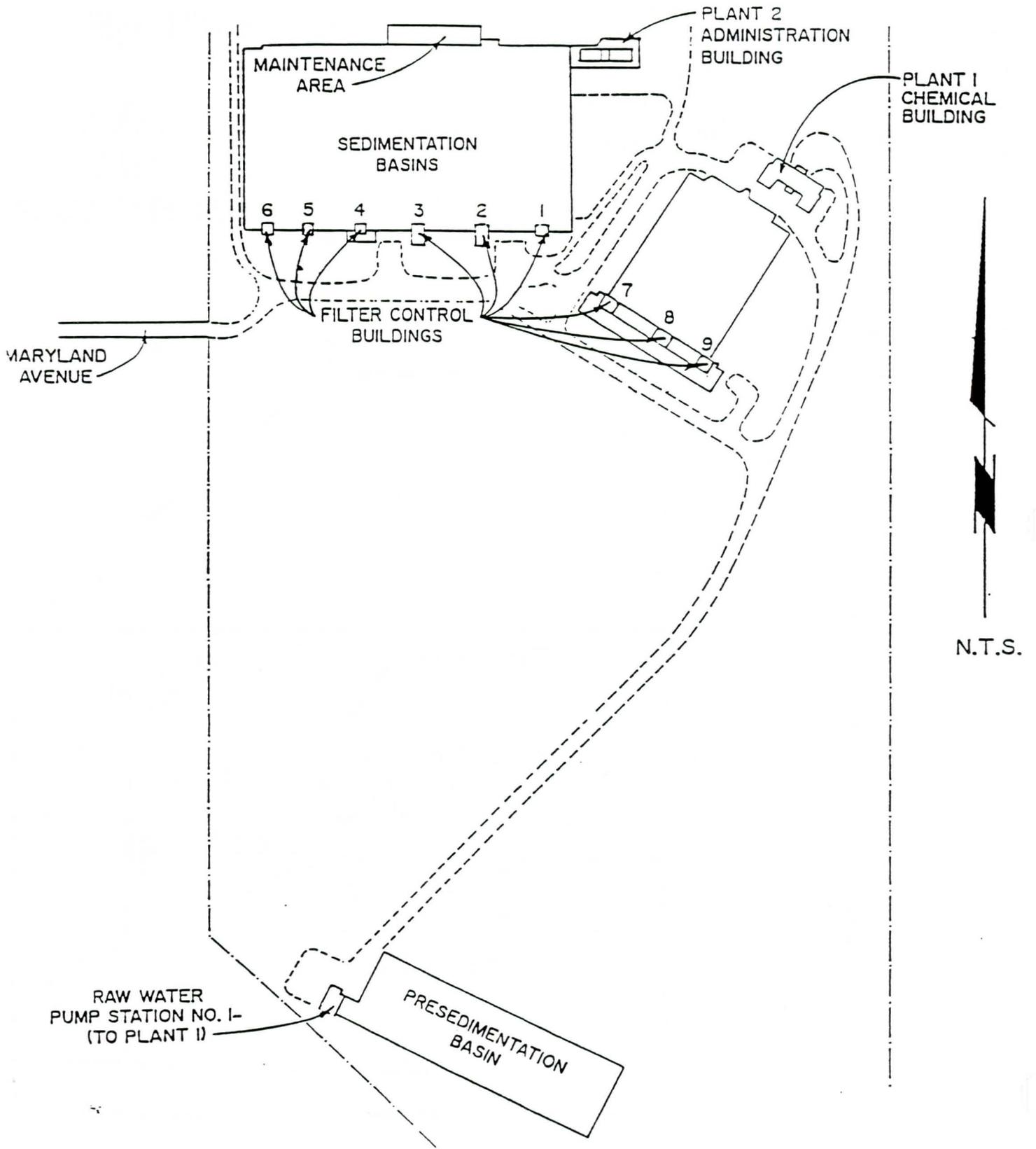
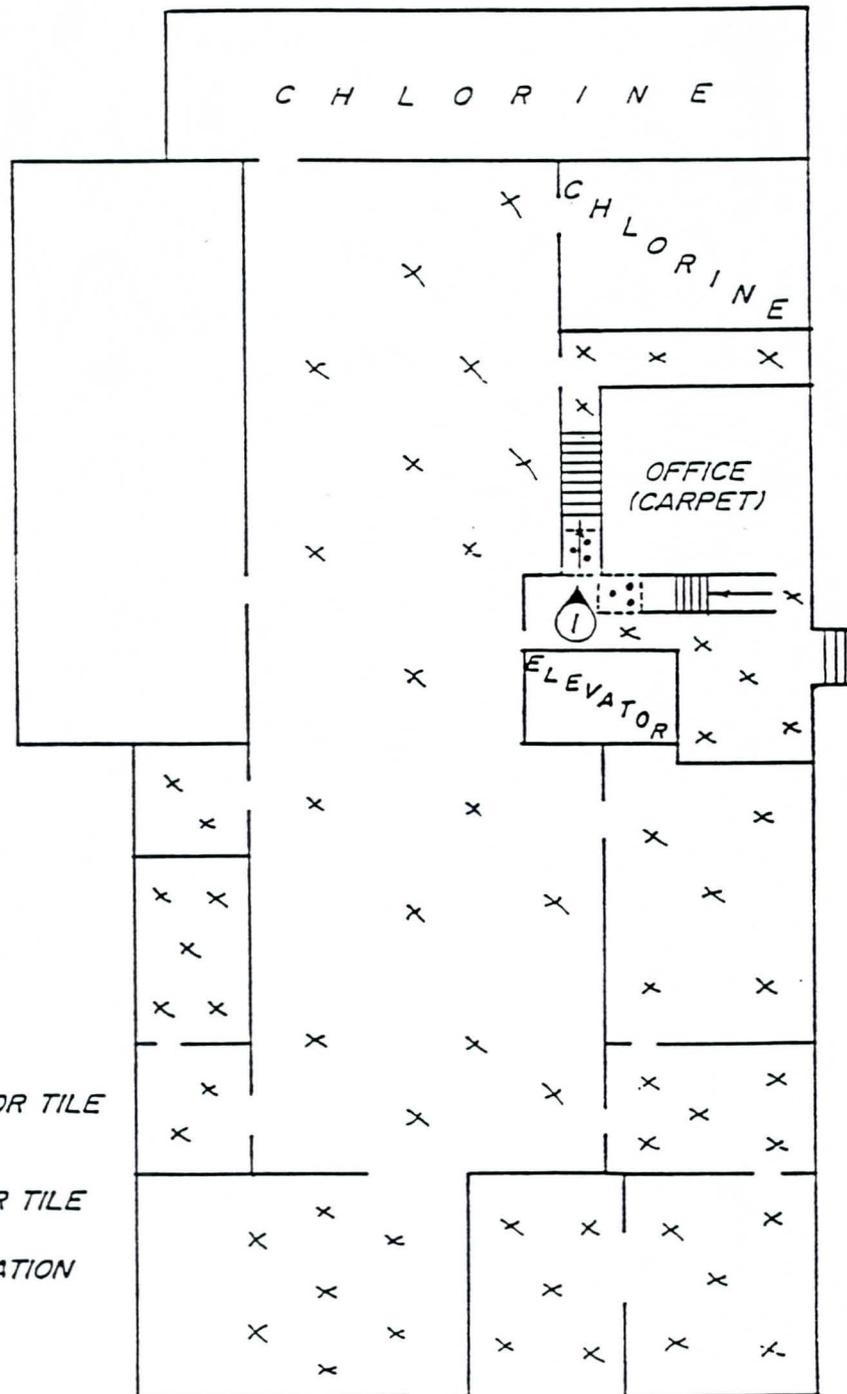


FIGURE 3

ADMINISTRATION BUILDING (GROUND FLOOR)



N.T.S.

-  12"x12" FLOOR TILE
-  9"x9" FLOOR TILE
-  PHOTO LOCATION

FIGURE 4
ADMINISTRATION BUILDING
(GROUND FLOOR)

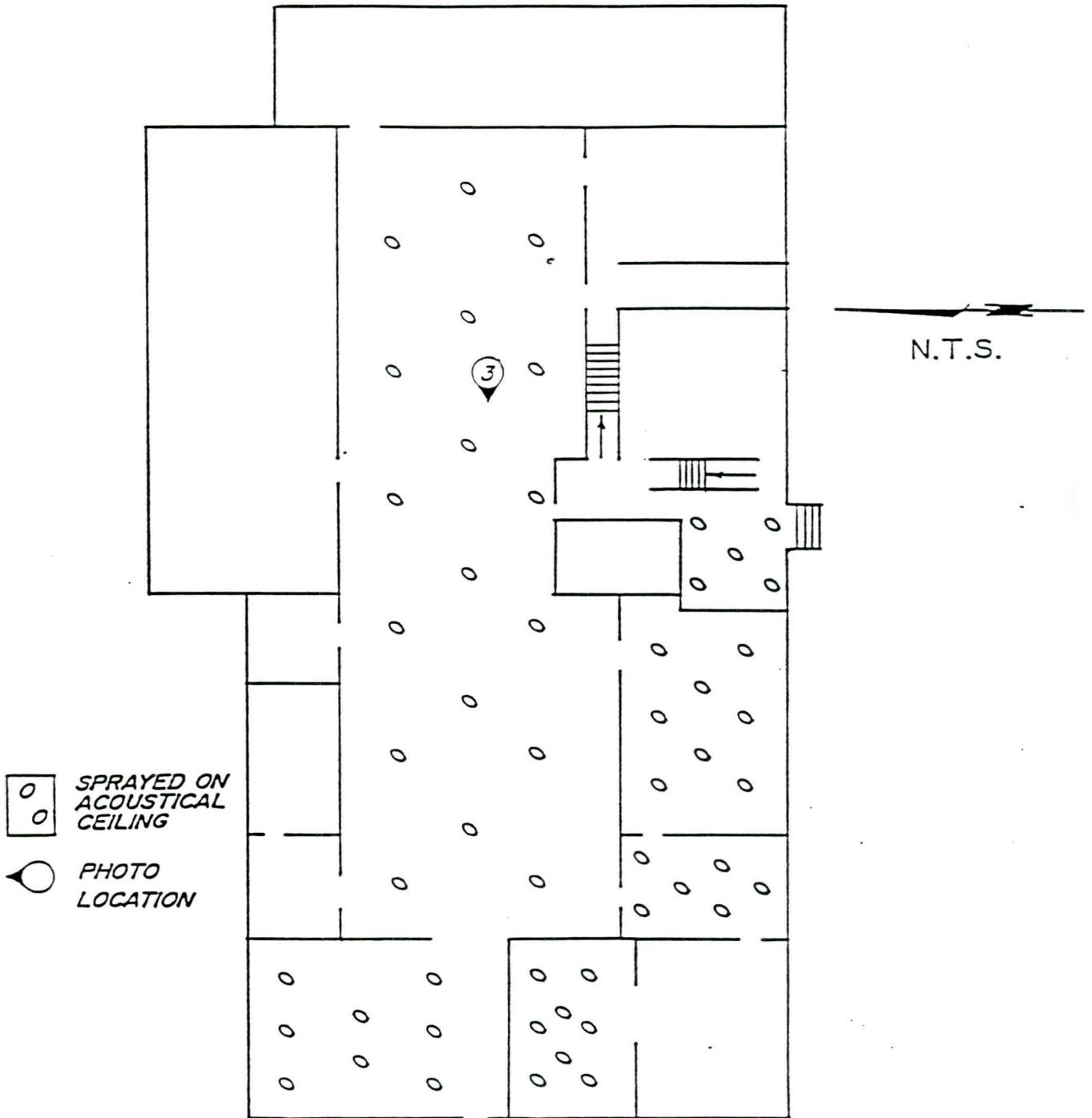
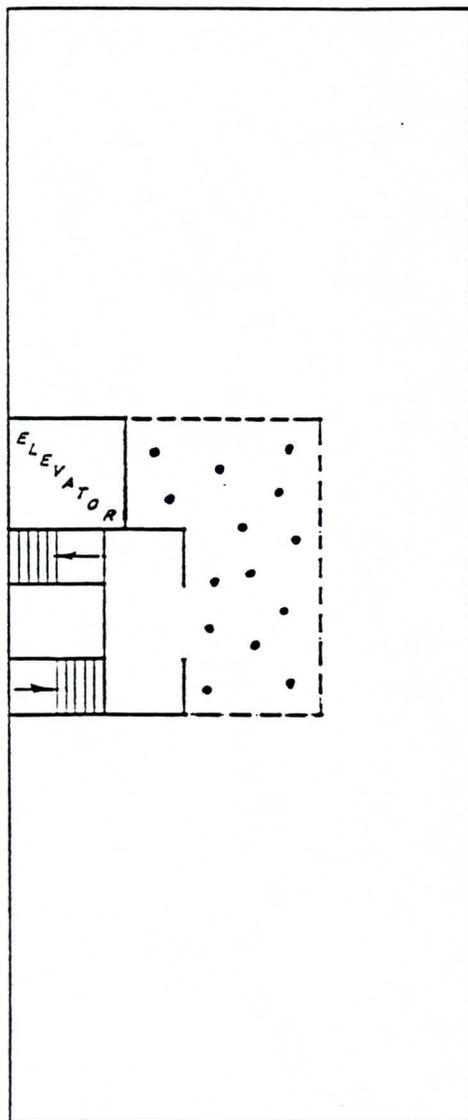


FIGURE 5
ADMINISTRATION BUILDING
(4TH FLOOR)



N.T.S.

 9"x9" FLOOR TILE

FIGURE 6

CHEMICAL BUILDING (GROUND FLOOR)

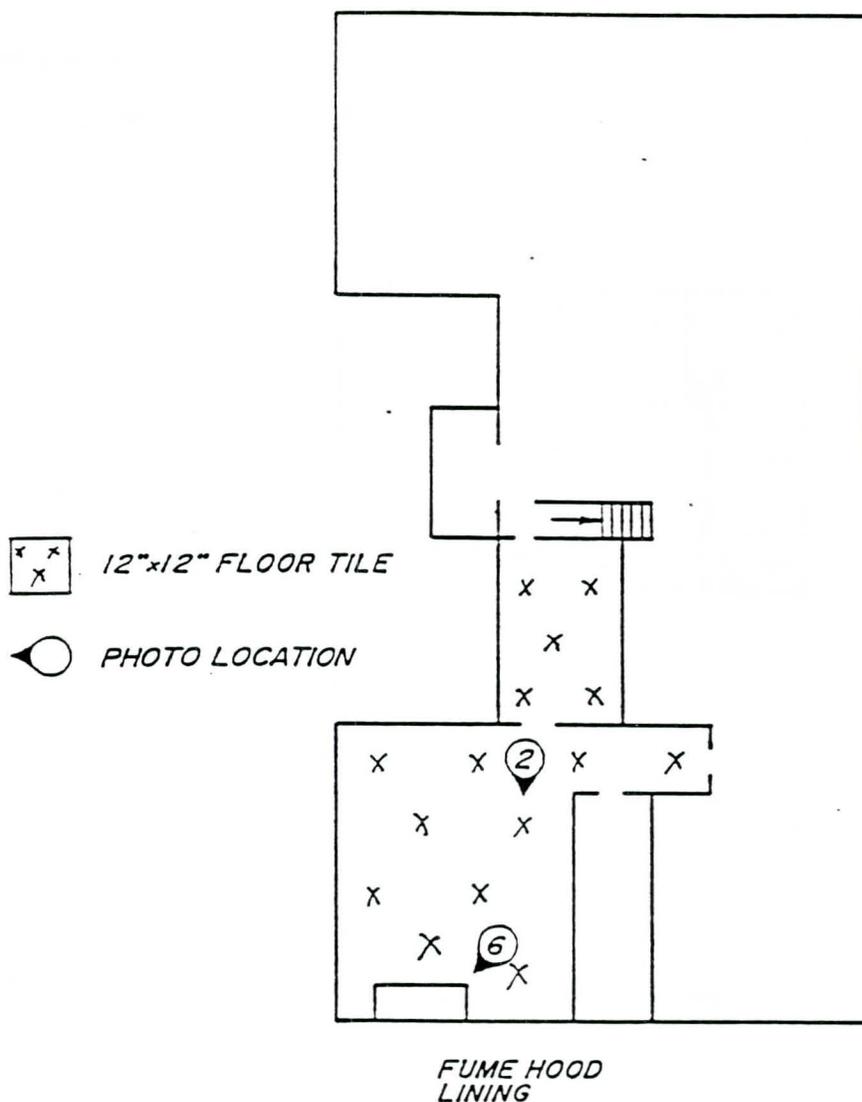


FIGURE 7

ACM ROOFING MATERIAL FILTER CONTROL BUILDINGS

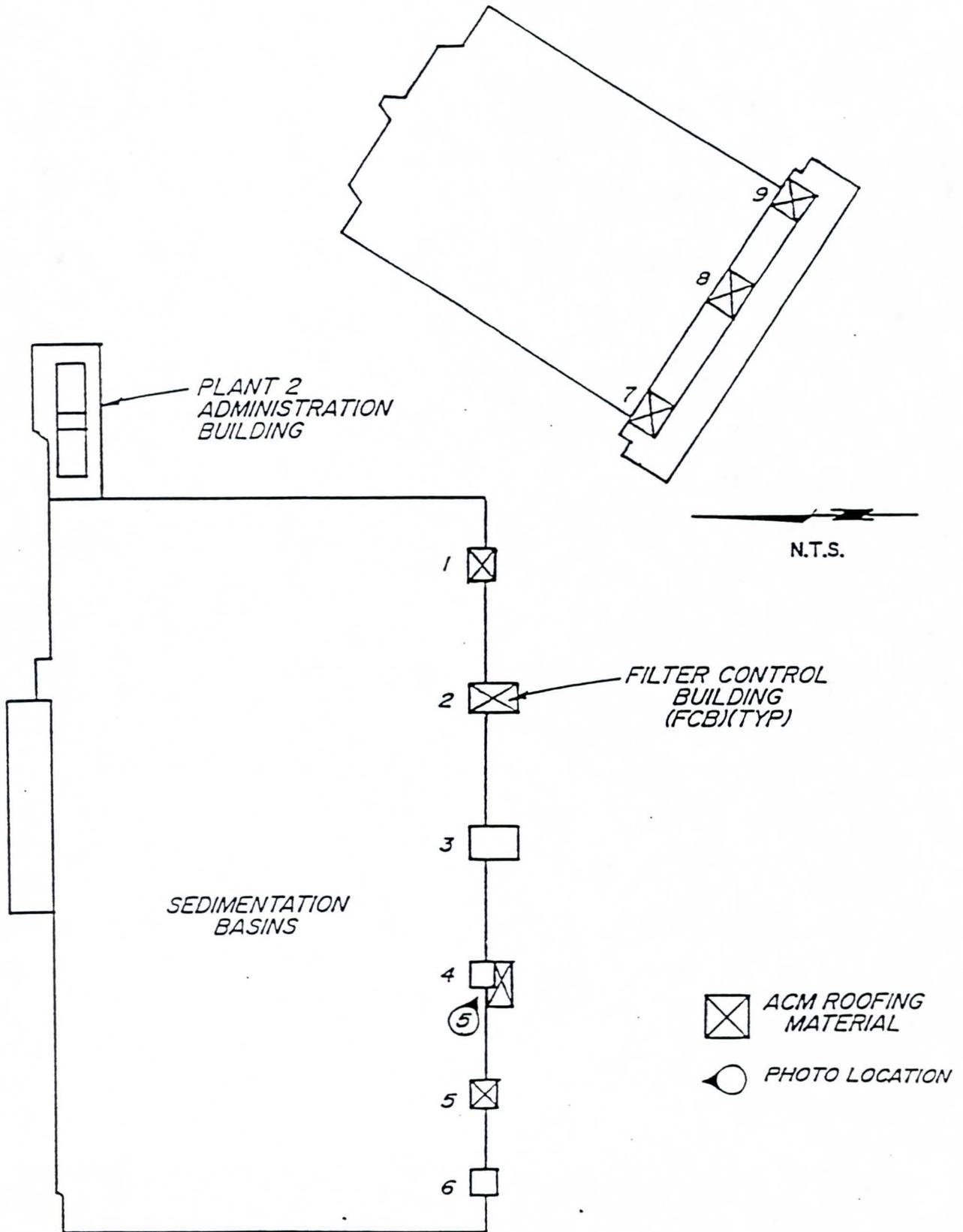


FIGURE 8

SPRAYED ON ACM ACOUSTICAL CEILING MATERIAL

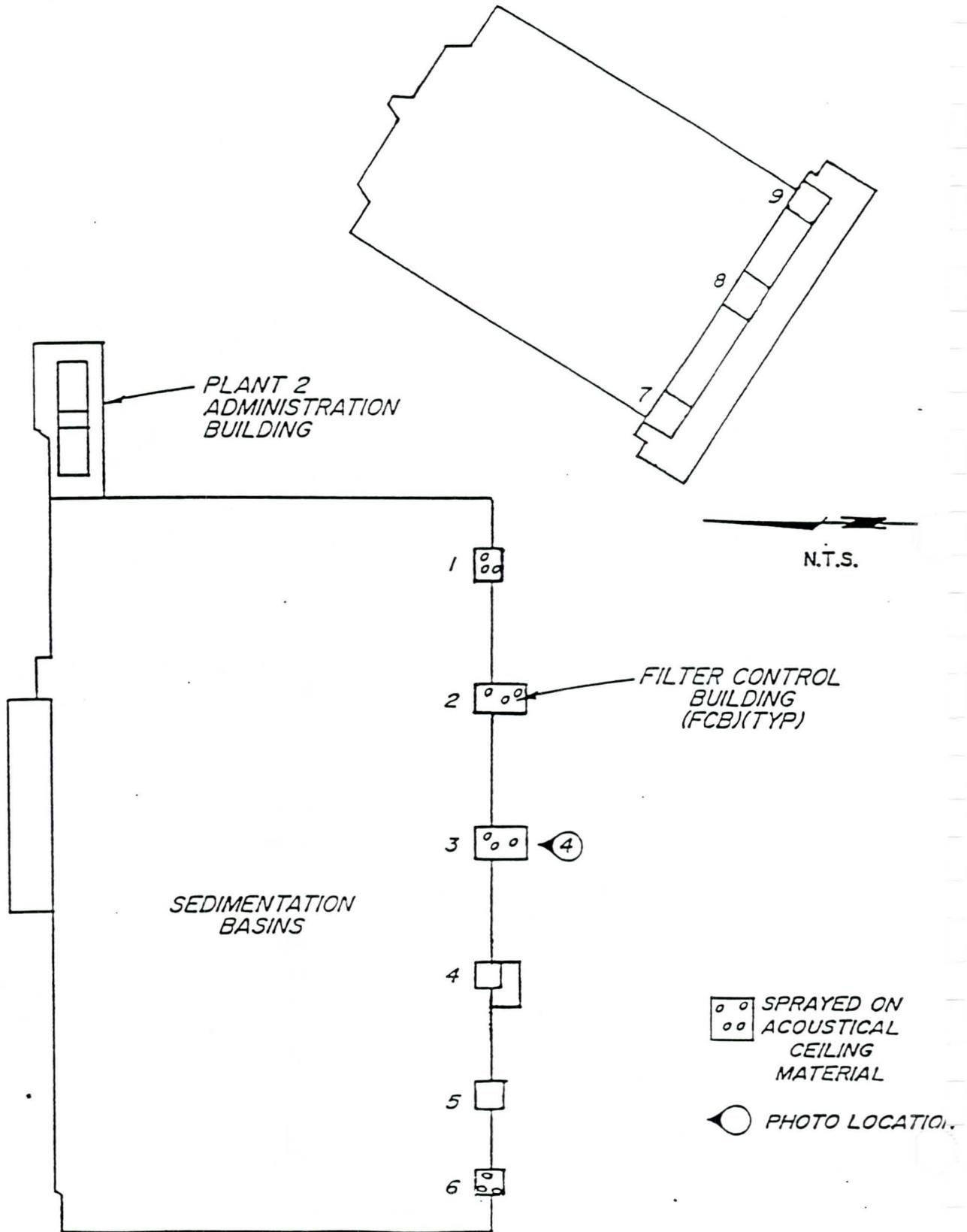
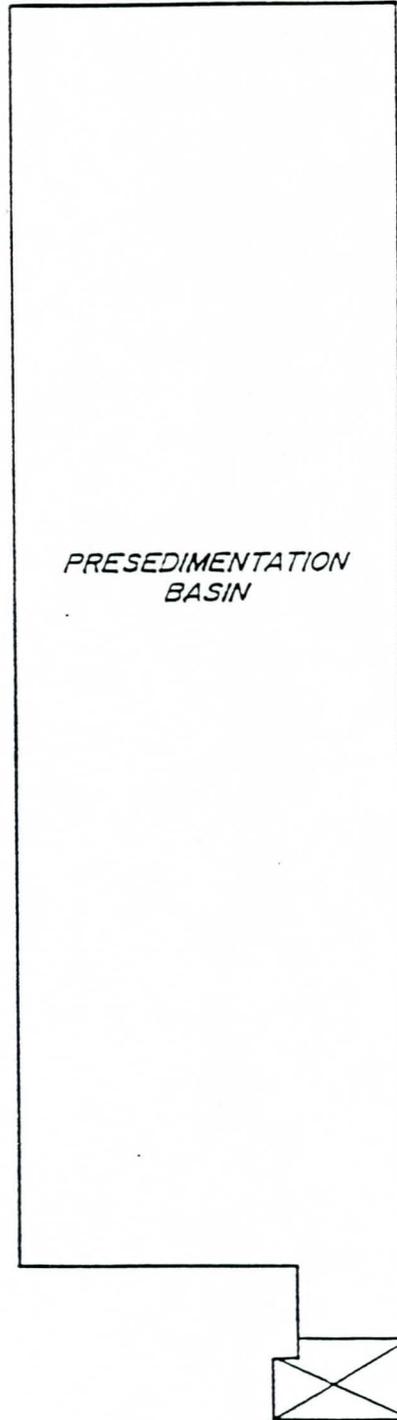
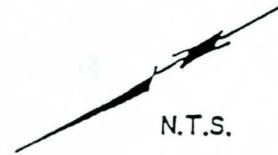


FIGURE 9

ACM ROOFING MATERIAL PUMP STATION NO. 1



*PRESEDIMENTATION
BASIN*



N.T.S.



*ACM ROOFING
MATERIAL*

CONCRETE
Division 3

SECTION 03100
CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete formwork. The Work also includes:
 - a. Providing openings in formwork to accommodate the Work under this and other Sections and building into the formwork all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
- B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
- C. Related Sections:
1. Section 03200, Concrete Reinforcement.
 2. Section 03251, Concrete Joints.
 3. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Standard Specifications and Details:
1. CONTRACTOR shall conform to all applicable requirements of Section No. 505 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specifications, provisions of this Specifications shall govern.
 2. CONTRACTOR shall examine the substratum and the conditions under which concrete framework is to be performed, and notify the ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ACI 301, Specifications for Structural Concrete for Buildings.
 2. ACI 347, Recommended Practice for Concrete Formwork.
 3. US Product Standard, PS-1.
- C. Allowable Tolerances: Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.

- D. All items for permanent or temporary facilities shall be used in accordance with manufacturers instructions.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for information purposes copies of manufacturer's data and installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. On delivery to job site, place materials in area protected from weather.
- B. Store materials above ground on framework or blocking. Cover wood for forms with protective waterproof covering. Provide for adequate air circulation or ventilation.
- C. Handle materials to prevent damage.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to ENGINEER, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown or specified. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in the finished structure with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side.
- C. Cylindrical Columns and Supports:
 - 1. Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.
 - a. Provide manufacturer's seamless units to minimize spiral gaps or seams.
 - 2. Fiberglass or steel forms may be used for cylindrical columns if approved by the ENGINEER.

D. Form Ties:

1. Provide factory-fabricated, removable or snapoff metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying forms will be subject to approval of ENGINEER.
2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Unless otherwise shown, provide form ties that will leave a hole no larger than 1-inch diameter in the concrete surface.
3. Ties for exterior walls and walls subject to hydrostatic pressure shall have waterstops.
4. Provide wood or plastic cones for ties, where concrete is exposed in the finish structure and in the interior of tanks.

- E. Forms Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. For concrete surfaces which will be in contact with potable water, the form coating shall be a mineral oil base coating.

2.2 DESIGN OF FORMWORK

- A. Design, erect, support, brace and maintain formwork so that it shall safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system or in-place construction that has attained adequate strength for this purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- B. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- C. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- D. Support form facing materials by structural members spaced sufficiently close to prevent significant deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long span members without intermediate supports, provide camber in formwork as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.
- E. Design formwork to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.

- F. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 FORM CONSTRUCTION

- A. General: Construct forms complying with ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.
- D. Falsework:
 - 1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
 - 2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.

- E. Forms for Exposed To View Concrete:
1. Do not use metal cover plates for patching holes or defects in forms.
 2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
 3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
 4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
 5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.
- F. Corner Treatment:
1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Except as specified below for reentrant or internal corners, exposed corners shall be chamfered.
 2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for all architecturally formed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
 3. Reentrant or internal corners and unexposed corners may be formed either square or chamfered.
- G. Joints: See Section 03251 of these Specifications for treatment of joints. Locate as shown and specified.
- H. Openings and Built-In Work:
1. Provide openings in concrete formwork shown or required by other Sections or other contracts. Refer to paragraph 1.1.B herein for the requirements of coordination.
 2. Accurately place and securely support items to be built into forms.
- I. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORM COATINGS

- A. Coat form contact surfaces with a non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections and other contracts. Refer to paragraph 1.1.B herein for the requirements of coordination. Use necessary setting drawings, diagrams, instructions and directions.
- B. Edge Forms and Screeds Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

3.5 FIELD QUALITY CONTROL

- A. Before concrete placement, CONTRACTOR shall check the formwork, including tolerances, lines, ties, tie cones, and form coatings. He shall make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement CONTRACTOR shall check formwork and related supports to ensure that forms are not displaced and that completed Work shall be within specified tolerances.
- C. If CONTRACTOR finds that forms are unsatisfactory in any way, either before or during placing of concrete, placement of concrete shall be postponed or stopped until the defects have been corrected, and reviewed by ENGINEER.

3.6 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Chapter 4 and ACI 347, Chapter 3.6.2.3, except as specified below.
 - 1. Removal of Forms and Supports:

	<u>Temperature (F)</u>					
	Over 95°	70°-95°	60°-70°	50°-60°	Below 50°	
a. Walls	5 days	1 day	2 days	3 days	Do not remove forms until site-cured test cylinder develops 50% of 28 day strength.	
b. Columns	7 days	2 days	3 days	4 days		
c. Beam Soffits	10 days	4 days	5 days	6 days		
d. Slabs 5" thick or less	10 days	5 days	6 days	7 days		
e. Slabs over 5" thick		12 days	6 days	8 days		

- B. When high-early strength concrete is specified, a schedule for removal of forms will be developed in the field from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI-301, Section 3.8.

- C. Form facing material shall remain in place a minimum of 4 days after concrete placement unless otherwise approved by ENGINEER.
- D. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the load upon them. Results of suitable control tests may be used as evidence that the concrete has attained sufficient strength.
- E. The time for removal of all forms will be subject to ENGINEER'S approval.

3.7 PERMANENT SHORES

- A. Provide permanent shores as defined in ACI 347 Chapter 3.7.
- B. Reshores will not be permitted.

3.8 RE-USE OF FORMS

- A. 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.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces. Form surfaces shall be subject to ENGINEER'S approval.

+ + END OF SECTION + +

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete reinforcement.
2. The extent of concrete reinforcement is shown on the Drawings.
3. The Work includes fabrication and placement of reinforcement including bars, ties and supports, and welded wire fabric for concrete, encasements and fireproofing.

B. Related Sections:

1. Section 03300, Cast in Place Concrete.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. Concrete Reinforcing Steel Institute, Manual of Standard Practice, includes ASTM standards referred to herein.
2. ACI 318, Building Code Requirements for Reinforced Concrete.
3. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.

B. Allowable Placing Tolerances: Comply with ACI 318, Chapter 7 - Details of Reinforcement except as specified below:

1. Concrete surfaces which are in contact with liquids: 2 inches minimum coverage.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's specifications and installation instructions for all materials and reinforcement accessories.
2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Parts A and B. For walls, show elevations to a minimum scale of 1/4 inch to 1 foot. For slabs, show top and bottom reinforcing on separate plan views. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement unless otherwise noted. Splices shall be kept to a minimum. Splices in regions of maximum tension stresses shall be avoided whenever possible.
 - a. Drawings detailing the location of all construction and expansion joints as required under Section 03251, shall be submitted and approved before Shop Drawings for reinforcing steel are submitted.

B. Certificates:

1. Submit 1 copy of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.
- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars: ASTM A 615, and as follows:
 1. Provide Grade 60 for all bars.
- B. Steel Wire: ASTM A 82.
- C. Welded Smooth Wire Fabric: ASTM A 185.
 1. Furnish in flat sheets, not rolls.
- D. Column Spirals: Hot-rolled rods for spirals, ASTM A 615.
- E. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
 3. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI "Manual of Standard Practice" as follows:
 - a. Either hot-dip galvanized, plastic protected or stainless steel legs.
 4. Over waterproof membranes, use precast concrete chairs.
 5. For all polyvinyl chloride (PVC) lined concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI "Manual of Standard Practice" as follows:
 - a. Either plastic or metal plastic protected legs.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI, Manual of Standard Practice. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 2. Bends or kinks not shown on approved Shop Drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which concrete reinforcement is to be placed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.
1. Place reinforcement to obtain the minimum concrete coverages as shown and as specified in ACI 318. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 2. Reinforcing steel shall not be secured to forms with wire, nails or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.
- D. Install welded wire fabric in as long lengths as practical. Lap adjoining pieces at least one full mesh and lace splices with 16 gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
- E. Provide sufficient numbers of supports of strength required 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.

- F. Splices: Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.

3.3 INSPECTION OF REINFORCEMENT

- A. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by the ENGINEER. All concrete placed in violation of this provision will be rejected.

+ + END OF SECTION + +

SECTION 03251
CONCRETE JOINTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete joints.
 2. The types of concrete joints required include the following:
 - a. Construction joints.
 - b. Expansion joints and fillers.
 - c. Waterstops.
 - d. Control joints.
- B. General: All joints subject to hydrostatic pressure shall be provided with continuous waterstop.
- C. Related Sections:
1. Section 03100, Concrete Formwork.
 2. Section 03300, Cast-In-Place Concrete.
 3. Section 07920, Caulking and Sealants.

1.2 QUALITY ASSURANCE

- A. Standard Specifications Details:
1. CONTRACTOR shall conform all applicable requirements of Section No. 505 and 729 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specifications shall govern.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ACI 301, Specifications for Structural Concrete for Buildings, Chapter 6, Joints and Embedded Items.
 2. ASTM A 36, Structural Steel.
 3. ASTM D 1752, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.
 4. CRD-C572, Corps of Engineers Specifications for Polyvinyl-Chloride Waterstop.
- C. All manufactured items shall be installed in accordance with manufacturer's instructions.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. Polyvinyl chloride and steel waterstops for joints.
 - 2. Cork expansion joint fillers.
- B. Shop Drawings: Submit for approval the following:
 - 1. Manufacturer's specifications and installation instructions for all materials required.
 - 2. Layout of all construction joint locations prior to the submittal of steel reinforcing drawings.

PART 2 - PRODUCTS

2.1 WATERSTOPS

- A. Polyvinyl Chloride (Dumbbell type only):
 - 1. Reference Standard: CRD-C572.
 - 2. Construction Joints: Minimum of 3/8-inch thick.
 - a. Width shall be minimum 6-inches.
 - 3. Expansion Joints: Uniform minimum thickness of 1/4 inch by 9 inches minimum width. Center bulb shall be "O" or "U" shaped. The "O" shall have an outside diameter of 1-inch minimum. The top of the "U" shall be jointed by a membrane which will tear when the expansion occurs.
 - 4. Manufacturer: Provide one of the following:
 - a. W.R. Meadows, Incorporated.
 - b. A.C. Horn, Incorporated.
 - c. Vulcan Metal Products, Incorporated.
 - d. Or equal.

2.2 PREFORMED EXPANSION JOINT FILLER

- A. Provide preformed expansion joint filler complying with ASTM D 1752, Type II, cork.

2.3 CONCRETE CONSTRUCTION JOINT ROUGHENER

- A. Provide a water soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Rugasol-S by Sika Corporation for horizontal joints only.
 - 2. EAC-S by Preco Industries, Ltd. for horizontal joints only.
 - 3. Tuf-Cote (Deep Etch) by Preco Industries Ltd. for vertical joints.
 - 4. Or equal.

2.4 EPOXY BONDING AGENT

- A. Provide an epoxy-resin bonding agent, two component type.

- B. Product and Manufacturer: Provide one of the following:
1. Sikadur Hi-Mod by Sika Corporation.
 2. Epoxite Binder (Code #2390) by A.C. Horn, Incorporated.
 3. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONSTRUCTION JOINTS

- A. Comply with ACI 301, Chapter 6, and as specified below.
- B. Locate and install construction joints as shown. Additional construction joints shall be located as follows:
1. In walls locate joints at a spacing of 30 feet maximum and approximately 12 feet from corners.
 2. In foundation slabs and slabs on grade locate joints at a spacing of approximately 30 feet. Place concrete in a checkerboard pattern.
 3. In mats and structural slabs and beams, at a spacing of approximately 30 feet. Locate joints in compliance with ACI 301, Chapter 6.
- C. Horizontal Joints:
1. Roughen concrete at the interface of construction joints by sand-blasting to expose the aggregate and remove accumulated concrete on rebar immediately subsequent to form stripping unless otherwise approved by the ENGINEER. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.
 2. Remove laitance, waste mortar or other substance which may prevent complete adhesion.
 3. Place a 2-inch thick coat of mortar, of similar proportions to the mortar in the concrete, over the contact surface of the old concrete. Place fresh concrete before the mortar has attained its initial set.
- D. Vertical Joints:
1. Apply roughener to the form in a thin, even film by brush, spray or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed.
 2. When concrete has been placed and the form removed, wash loosened material off with high pressure water spray to obtain roughened surface subject to approval by ENGINEER.

3.3 EXPANSION JOINTS

- A. Comply with ACI 301, Chapter 6, and as specified below.
- B. Locate and install expansion joints as shown. Install cork filler in accordance with manufacturer's instructions. Caulking and sealants shall be installed as specified in Section 07920.

3.4 WATERSTOPS

- A. General:
 - 1. Comply with ACI 301, Chapter 6, and as specified below. All joints shall be made in accordance with manufacturer's instructions.
 - 2. Obtain ENGINEER'S approval for waterstop locations not shown.
 - 3. Provide waterstops in all foundations, tanks and other substructures up to an elevation at least 12 inches above grade or to an elevation at least 12 inches above liquid level in tanks, whichever is higher, except where otherwise shown or noted.
- B. Polyvinyl Chloride Waterstop:
 - 1. Tie waterstop to reinforcement so that it is securely and rigidly supported in the proper position during concrete placement. Continuously inspect waterstops during concrete placement to insure their proper positioning.
 - 2. Waterstops shall be fused using equipment as supplied by or recommended by the manufacturer.

3.5 BONDING WITH EPOXY ADHESIVE

- A. Use adhesive for the following:
 - 1. Bonding of fresh concrete to concrete cured at least 45 days or to existing concrete.
 - 2. Bonding of horizontal construction joints where these are required by the Drawings or approved by ENGINEER for foundation mats that are 5 feet thick or greater.
- B. Handle and store epoxy adhesive in compliance with the manufacturer's printed instructions, including safety precautions.
- C. Mix the epoxy adhesive in complete accordance with the instructions of the manufacturer.
- D. Before placing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy grout not less than 1/16-inch thick. Place fresh concrete while the epoxy material is still tacky, without removing the in-place grout coat, and as directed by the epoxy manufacturer.

+ + END OF SECTION + +

SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install cast-in-place concrete.
2. The Work includes providing concrete consisting of portland cement, fine and coarse aggregate, water, and approved admixtures; combined, mixed, transported, placed, finished and cured. The Work also includes:
 - a. Providing openings in concrete to accommodate the Work under this and other Sections and building into the concrete all items such as sleeves, frames, anchor bolts, inserts and all other items to be embedded.

B. Coordination: Review installation procedures under other Sections and coordinate the installation of items that must be installed in the concrete.

C. Classes of Concrete:

1. Concrete shall be provided in accordance with the following classes and strengths:

Contract Part	Superseded Concrete Class	Type of Use	Concrete Class	Minimum 28-day Compressive Strength, psi
A	-	See Paragraph 2	A	4,000
	-	See Paragraph 3	B	2,500
B	A	See Paragraph 2	A	4,000
	B	High early strength concrete	A	4,000
	C	Thrust blocks, pipe bedding	B	2,500
	CE	Electrical conduit encasement	B	2,500
C	A	Concrete greater than 24 inches thick	A	4,000
	B	Concrete 12 to 24 inches thick, inclusive	A	4,000
	C	Concrete less than 12 inches thick	A	4,000
	D	Topping concrete	B	2,500
	E	Pipe bedding and encasement electrical conduit encasement (duct banks) and concrete fill	B	2,500
	F	Encasement of reinforcement extension for future construction	B	2,500

*TELECON w/
Bob Anderson
on 3/13 ~
which concrete
to use for 18" SD
Power beds?
See plan sheet
C-B.*

Class "A" concrete shall be steel reinforced and includes the following:

- a. Foundations.
- b. Walls.
- c. Slabs.
- d. Beams.
- e. Girders.
- f. Columns.

Class "B" concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following:

- a. Concrete fill.
- b. Equipment bases.
- c. Pipe supports.
- d. Curbs and gutters.
- e. Sidewalks.
- f. Thrust blocks.
- g. Encasements.

D. Related Sections:

1. Section 03100, Concrete Formwork
2. Section 03200, Concrete Reinforcement
3. Section 03251, Concrete Joints
4. Section 09780, Concrete Hardener

1.2 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. CONTRACTOR shall conform to all applicable requirements of Sections Nos. 505, 725 and 726 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ACI 301, Specification for Structural Concrete for Buildings, (includes ASTM Standards referred to herein).
2. ACI 318, Building Code Requirements for Reinforced Concrete.
3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 311, Recommended Practice for Concrete Inspection.
5. ACI 211.1, Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.
6. ACI 214, Recommended Practice for Evaluation of Compression Test Results of Field Concrete.
7. ACI 305, Recommended Practice for Hot Weather Concreting.
8. ACI 306, Recommended Practice for Cold Weather Concreting.
9. ACI 309, Recommended Practice for Consolidation of Concrete.
10. AASHTO M 182, Burlap Cloth Made From Jute or Kenaf.

C. Concrete Testing Service:

1. CONTRACTOR shall employ, at his own expense, a testing laboratory experienced in design and testing of concrete materials and mixes to perform material evaluation tests and to design concrete mixes.
 - a. Testing agency shall meet the requirements of ASTM E 329.
 - b. Selection of a testing laboratory is subject to ENGINEER'S approval.
 - c. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities and equipment, and other information which may be requested by ENGINEER.
2. Materials and installed Work may require testing and retesting, as directed by ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be done at OWNER'S expense, including the retesting of rejected materials and installed Work, shall be done at CONTRACTOR'S expense.

- D. Qualifications of Water-Reducing Admixture Manufacturer:
1. Water-reducing admixtures shall be manufactured under strict quality control in facilities operated under a quality assurance program. CONTRACTOR shall furnish copy of manufacturer's quality assurance handbook to document the existence of the program. Manufacturer shall maintain a concrete testing laboratory which has been approved by the Cement and Concrete Reference Laboratory at the Bureau of Standards, Washington, D.C.
 2. When requested by ENGINEER, provide a qualified concrete technician employed by the admixture manufacturer to assist in proportioning the concrete for optimum use of the admixture. The concrete technician, when requested, shall advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing jobsite conditions.
- E. Tests for Concrete Materials:
1. Submit written reports to ENGINEER, for each material sampled and tested, prior to the start of Work. Provide the Project identification name and number, date of report, name of CONTRACTOR, name of concrete testing service, source of concrete aggregates, material manufacturer and brand name for manufactured materials, values specified in the referenced specification for each material, and test results. Indicate whether or not material is acceptable for intended use.

1.3 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by ENGINEER, including names, sources and descriptions.
- B. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 2. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
 3. The following information, if ready-mixed concrete is used.
 - a. Physical capacity of mixing plant.
 - b. Trucking facilities available.
 - c. Estimated average amount which can be produced and delivered to the site during a normal 8 hour day, excluding the output to other customers.
- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. ENGINEER'S review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of the CONTRACTOR.
- D. Submit notarized certification of conformance to referenced standards when requested by ENGINEER.

- E. Delivery Tickets: Furnish to ENGINEER copies of all delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C 94, Section 15.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to insure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cement:
1. Portland cement, ASTM C 150, Type II; or blended hydraulic cement, ASTM C 595, Type 1P (MS).
 2. Use portland cement made by a well-known acceptable manufacturer and produced by not more than one plant.
 3. Do not use cement which has deteriorated because of improper storage or handling.
- B. Aggregates: ASTM C 33 and as herein specified.
1. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ocher, or other materials that can cause stains on exposed concrete surfaces.
 2. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - a. Dune sand, bank run sand and manufactured sand are not acceptable.
 3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - a. Crushed stone, processed from natural rock or stone.
 - b. Coarse Aggregate Size: Size to be ASTM C 33, Nos. 57 or 67.
- C. Water: Clean, free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel.

2.2 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instruction. Do not use admixtures which have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER.

- B. Air-Entraining Admixtures: ASTM C 260.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. SIKA AER by Sika Chemical Corporation.
 - b. MB-VR by Master Builders Company.
 - c. Or equal.

- C. Water-Reducing High Range Admixture (Non Water Containing Structures Only): ASTM C 494, Type F/G.
 - 1. High range water-reducer shall be used in all Class "A" concrete. The admixture shall not contain more chloride ions than are contained in municipal drinking water. It shall be added only at the job site to concrete in compliance with the manufacturer's printed instruction. Provide one of the following:
 - a. Duracem 100 by W.R. Grace & Company.
 - b. Sikament 320 by Sika Corporation.
 - c. Or equal.

- D. Water-Reducing Admixture: ASTM C 494, Type A.
 - 1. Proportion all concrete with non-air entraining, normal setting, water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. The admixture shall not contain any lignin, nitrates, or chlorides added during manufacture.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Eucon WR-75 by The Euclid Chemical Company.
 - b. Pozzolith by Master Builders Company.
 - c. Or equal.

- E. Pozzolan Admixture: ASTM C 618, Class F: A substitution by weight of the portland cement by pozzolan, so that the total tricalcium aluminate content of the resulting cement plus pozzolan is not greater than 8 percent, will be considered. However, the pozzolan shall not exceed 20 percent by weight of the cement plus pozzolan. The pozzolan shall meet all the requirements of ASTM C 618 for Class F except, the loss of ignition shall be not greater than 5 percent.

- F. Calcium Chloride: Do not use calcium chloride in concrete, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride where concrete is placed against galvanized steel.

2.3 PROPORTIONING AND DESIGN OF MIXES

- A. Prepare design mixes of concrete. Mixes subject to the following limitations:
 - 1. Class A Concrete
 - a. Specified 28-day Compressive Strength: 4,000 psi.
 - b. Maximum Water-Cement Ratio by Weight: 0.45.
 - c. Coarse Aggregate Minimum Cement Content-Pounds Per Cubic Yard Percent Air Content

<u>Number</u>	<u>Per Cubic Yard</u>	<u>Content</u>
57, 67,	564	6 ± 1%

2. Class B Concrete

- a. 28-day Compressive Strength = 2,500 psi.
- b. Maximum Water-Cement Ratio by Weight: 0.48.
- c.

Coarse	Minimum Cement	Percent
Aggregate	Content-Pounds	Air
<u>Number</u>	<u>Per Cubic Yard</u>	<u>Content</u>
57, 67,	470	5 ± 1%

- B. Use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.
 - 1. The testing facility shall not be the same as used for field quality control testing.
- C. Proportion mixes by the laboratory trial batch method using materials to be employed on the Project for concrete required. If pozzolan is considered the CONTRACTOR shall prepare laboratory trial batches to concrete with and without pozzolan. The trial batches for concrete without pozzolan shall adhere to the requirements of ACI 301. A minimum of five (5) trial batches shall be prepared for concrete utilizing pozzolan. The pozzolan-cement concrete trial batches shall adhere to the requirements of ACI 301, except that the water-cement ratio shall be constant (not to exceed 0.45) and the percentage of pozzolan shall be varied. The pozzolan shall not exceed 20 percent by weight of cement plus pozzolan. Comply with ACI 211.1 and report to the ENGINEER the following data:
 - 1. Complete identification of aggregate source of supply.
 - 2. Tests of aggregates for compliance with specified requirements.
 - 3. Scale weight of each aggregate.
 - 4. Absorbed water in each aggregate.
 - 5. Brand, type and composition of cement.
 - 6. Brand, type and amount of each admixture.
 - 7. Amounts of water used in trial mixes.
 - 8. Proportions of each material per cubic yard.
 - 9. Gross weight and yield per cubic yard of trial mixtures.
 - 10. Measured slump.
 - 11. Measured air content.
 - 12. Compressive strength developed at 7 days and 28 days, from not less than 3 test cylinders cast for each 7-day and 28-day test, and for each design mix.
- D. Submit written reports to ENGINEER of proposed mix of concrete at least 15 days prior to start of Work. Do not begin concrete production until mixes have been approved by ENGINEER.
- E. Laboratory Trial Batches: When laboratory trial batches are used to select concrete proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Chapter 3 - Proportioning. However, 4,000 psi concrete mixes need not be designed for greater than 4,600 psi regardless of the production facilities standard deviation.
- F. Field Experience Method: When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301, Chapter 3.

- G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by CONTRACTOR when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the OWNER and as accepted by ENGINEER. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by ENGINEER before using the revised mixes.
- H. Admixtures:
1. Use air-entraining admixture in all concrete, except interior slabs subject to abrasion, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
 2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.
- I. Slump Limits:
1. Class A Concrete: Proportion and design mixes to result in concrete slump:
 - a. Not more than 3 inches prior to adding high range water-reducer.
 - b. Not more than 8 inches at point of placement after adding high range water-reducer.
 2. Class B Concrete: Proportion and design mixes to result in concrete slump at point of placement of not less than 1 inch and not more than 4 inches.
- J. Conduit Encasement: All concrete used for the encasement of electrical ducts, conduits, etc. shall be colored red by mixing into each cubic yard of concrete 10 pounds of red oxide No. 1117 as manufactured by the Frank D. Davis Company, I. Reiss Company, Inc., or equal.

2.4 EPOXY BONDING AGENT

- A. Provide an epoxy-resin bonding agent, two component, polysulfide type.
- B. Product and Manufacturer: Provide one of the following:
1. Sikadur Hi-Mod by Sika Chemical Corporation.
 2. Epoxite Binder (Code #2390) by A.C. Horn, Incorporated.
 3. Or equal.

2.5 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.
- B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Waterproof paper.
 2. Polyethylene film.

3. White burlap-polyethylene sheet.
- C. Curing Compound: ASTM C 309 Type 1-D (water retention requirements)
1. Product and Manufacturer: Provide one of the following:
 - a. Kurez Formula E-100 with red fugitive dye by The Euclid Chemical Company.
 - b. L&M Resin cure with red fugitive dye by L&M Construction Chemicals.
 - c. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONCRETE MIXING

A. General:

1. Concrete may be produced at batch plants or it may be produced by the ready-mixed process. Batch plants shall comply with the recommendations of ACI 304, and shall have sufficient capacity to produce concrete of the qualities specified, in quantities required to meet the construction schedule. All plant facilities are subject to testing laboratory inspection and acceptance of ENGINEER.
2. Mixing:
 - a. Mix concrete with an approved rotating type batch machine, except where hand mixing of very small quantities may be permitted.
 - b. Remove hardened accumulations of cement and concrete frequently from drum and blades to assure acceptable mixing action.
 - c. Replace mixer blades when they have lost 10 percent of their original height.
 - d. Use quantities such that a whole number of bags of cement is required, unless otherwise permitted.

B. Ready-Mix Concrete:

1. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by ENGINEER before implementation.
 - a. Plant equipment and facilities: Conform to National Ready-Mix Concrete Association "Plant and Delivery Equipment Specification".
 - b. Mix concrete in revolving type truck mixers which are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 - c. Do not exceed the proper capacity of the mixer.

- d. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 - e. Do not allow the drum to mix while in transit.
 - f. Mix at proper speed until concrete is discharged.
 - g. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
 - h. Provide access to the mixing plant for ENGINEER at all times.
- C. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.

3.3 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 45 minutes after water has been added to the dry ingredients.
- B. Take care to avoid spilling and separation of the mixture during transportation.
- C. Do not place concrete in which the ingredients have been separated.
- D. Do not retemper partially set concrete.
- E. Use suitable and approved equipment for transporting concrete from

3.4 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in Section 03251 of these Specifications. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.
 - 1. Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.
 - 2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
 - 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 - 4. Do not place footings in freezing weather unless adequate precautions are taken against frost action.
 - 5. Do not place footings, piers or pile caps on frozen soil.
 - 6. Unless otherwise approved, place concrete only when ENGINEER is present.
 - 7. Allow a minimum of 3 days before placing concrete against a slab or wall already in place.

B. Concrete Conveying:

1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods which will prevent segregation and loss of concrete mix materials.
2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.
3. Do not use chutes for distributing concrete unless approved in writing by ENGINEER.
 - a. Provide sketches showing methods by which chutes will be employed when requesting such approval.
 - b. Design chutes, if permitted, with proper slopes and supports to permit efficient handling of the concrete.
4. Pumping concrete is permitted, however do not use aluminum pipe for conveying.

C. Placing Concrete into Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete which is being integrated with fresh concrete is still plastic.
2. Do not permit concrete to free fall within the form from a distance exceeding 4 feet. Use "elephant trunks" to prevent free fall and excessive splashing on forms and reinforcement.
3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by ENGINEER.
5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
6. Do not place concrete in beam and slab forms until the concrete previously placed in columns and walls is no longer plastic.
7. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.

D. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures.
4. Bring slab surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

E. Bonding for Next Concrete Pour: Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent. Construction joints shown on the Drawings are specified in Section 03251 of these Specifications. Clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and to not leave laitance, loose particles of aggregate, or damaged concrete at the surface.

1. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:
 - a. Thoroughly wet the surface but allow no free standing water.
 - b. For horizontal surfaces place a 2-inch layer of mortar, 1 part sand and 1 part cement with water, over the hardened concrete surface.
 - c. Place fresh concrete before the mortar has attained its initial set.
2. Bonding of fresh concrete to fully-cured hardened concrete or existing concrete shall be accomplished by using an epoxy-resin bonding agent as specified in Section 03251 of these Specifications.

F. Quality of Concrete Work:

1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
3. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering will not be acceptable.
4. All leaks through concrete, and cracks, holes or other defective concrete in areas of potential leakage, shall be repaired and made watertight by CONTRACTOR.
5. Repair, removal, and replacement of defective concrete as ordered by ENGINEER shall be at no additional cost to OWNER.

G. Cold Weather Placing:

1. Protect all concrete Work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
2. When the air temperature has fallen to or may be expected to fall below 40 F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50 F and 70 F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to insure that the ambient temperature does not fall more than 30 F in the 24 hours following the seven-day period. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
3. When air temperature has fallen to or is expected to fall below 40 F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 F and not more than 85 F at point of placement.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
5. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.

H. Hot Weather Placing:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 80 F when the temperature is rising and below 85 F when the temperature is falling. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated in the total amount of mixing water.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
4. Wet forms thoroughly before placing concrete.
5. Do not place concrete at a temperature so as to cause difficulty from loss of slump, flash set, or cold joints.
6. Do not use set-control admixtures unless approved by ENGINEER in mix designs.
7. Obtain ENGINEER'S approval of other methods and materials proposed for use.

3.5 FINISH OF FORMED SURFACES

A. Rough Form Finish:

1. Standard rough form finish shall be the concrete surface having the texture imparted by the form material used, with tie holes

and defective areas repaired and patched with mortar of 1 part cement to 1 1/2 parts sand and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

2. Use rough form finish for the following:
 - a. Exterior vertical surfaces up to 1 foot below grade.
 - b. Interior exposed vertical surfaces of liquid containers up to 1 foot below liquid level.
 - c. Interior and exterior exposed beams and undersides of slabs.
 - d. Other areas shown.
- B. Smooth Form Finish:
 1. Produce smooth form finish by selecting form materials which will impart a smooth, hard, uniform texture. Arrange panels in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas as above with all fins or other projections completely removed and smoothed.
 2. Use smooth form finish for surfaces that are to be covered with a coating material. The material may be applied directly to the concrete or may be a covering bonded to the concrete such as waterproofing, dampproofing, painting or other similar system.
- C. Smooth Rubbed Finish:
 1. Provide smooth rubbed finish to concrete surfaces which have received smooth form finish as follows:
 - a. Rubbing of concrete surfaces not later than the day after form removal.
 - b. Moistening of concrete surfaces and rubbing with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
 2. Except where surfaces have been previously covered as specified above, use smooth rubbed finish for the following:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to 1 foot below grade.
 - c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
 - d. Interior exposed vertical surfaces of liquid containers down to 1 foot below liquid level.
 - e. Other areas shown.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.6 MONOLITHIC SLAB FINISHES

- A. Float Finish:
 1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Use a wood float only. Check and level the surface plane to a

tolerance not exceeding 1/4 inch in 10 feet when tested with a 10 foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

2. Use float finish for the following:
 - a. Interior exposed horizontal surfaces of liquid containers.
 - b. Exterior below grade horizontal surfaces.
 - c. Surfaces to receive additional finishes, except as shown or specified.

B. Trowel Finish:

1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
2. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10 foot straight edge. Grind smooth surface defects which would telegraph through applied floor covering system.
3. Use trowel finish for the following:
 - a. Interior exposed slabs unless otherwise shown or specified.
 - b. Slabs to receive resilient floor finishes.

C. Non-Slip Broom Finish:

1. Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on the Drawings or in schedules.
2. Immediately after trowel finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with ENGINEER before application.

3.7 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared for the concrete surface. Keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. For concrete sections over 30 inches thick, continue final curing for an additional 7 days, minimum. Avoid rapid drying at the end of the final curing period.

B. Curing Methods:

1. Perform curing of concrete by moist curing, or by moisture-retaining cover curing. Use curing compound only in cold weather and only when permitted by ENGINEER.
 - a. For curing, use water that is free of impurities which could etch or discolor exposed, natural concrete surfaces.
2. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.
3. Provide moisture-retaining cover curing as follows:
 - a. Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practical width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.
4. Provide liquid curing compound as follows:
 - a. Apply the specified curing compound to all concrete surfaces when permitted by ENGINEER. The compounds shall be applied immediately after final finishing in a continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. For concrete surfaces which will be in contact with potable water, the manufacturer shall certify that the curing compound used is EPA approved.

C. Curing Formed Surfaces:

1. Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

D. Curing Unformed Surfaces:

1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by using the appropriate method specified above.
2. Final cure unformed surfaces, unless otherwise specified, by utilizing methods specified above, as applicable.

E. Temperature of Concrete During Curing:

1. When the atmospheric temperature is 40 F and below, maintain the concrete temperature between 50 F and 70 F continuously throughout the curing period. When necessary, make arrangement before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture con-

ditions continuously for the concrete curing period. Provide cold weather protection complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80 F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305, unless otherwise specified.
3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5 F in any one hour and 50 F in any 24 hour period.

F. Protection from Mechanical Injury:

1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.8 FIELD QUALITY CONTROL

- A. CONTRACTOR shall employ a testing laboratory to perform field quality control testing. ENGINEER will make slump tests and will direct the number of tests and cylinders required. CONTRACTOR shall make standard compression test cylinders and entrained air tests as specified below, under the direct inspection by ENGINEER. CONTRACTOR shall furnish all necessary assistance required by ENGINEER. CONTRACTOR shall also furnish all labor, material and equipment required including cones, rods, molds, air tester, thermometer, curing in a heated storage box, and all other incidentals required. Above will be subject to approval by ENGINEER. CONTRACTOR shall furnish all necessary storage, curing, and transportation required by the testing.
- B. Quality Control Testing During Construction:
 1. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C 172.
 - b. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C 231; one for every other concrete load at point of discharge, or when required by an indication of change.
 - d. Compressive Strength Tests: ASTM C 39; one set of compression cylinders for each 50 cubic yards or fraction thereof, of each mix design placed in any one day or for each 2,500 square feet of surface area placed; 1 specimen tested at 7 days, and 2 specimens tested at 28 days, 1 specimen tested at 56 days.

- 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - 2) Concrete which does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by ENGINEER, at the expense of CONTRACTOR.
- e. Compression Test Specimens: ASTM C 31; make one set of 3 standard cylinders for each compressive strength test, unless otherwise directed.
- 1) Cast, store and cure specimens as specified in ASTM C 31.
- f. Concrete Temperature: Test hourly when air temperature is 40 F and below, and when 80 F and above; and each time a set of compression test specimens is made.
2. The testing laboratory shall submit certified copies of test results directly to ENGINEER and CONTRACTOR within 24 hours after tests are made.
- C. Evaluation of Quality Control Tests:
1. Do not use concrete delivered to the final point of placement which has slump or total air content outside the specified values.
 2. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
 - a. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by the ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the same samples as the laboratory cured specimens.
 - 1) Provide improved means and procedures for protecting concrete when the 28 day compressive strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders.
 - 2) When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
 - 3) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question will be required at CONTRACTOR'S expense.

- b. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.

D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, CONTRACTOR shall employ at his expense the services of a concrete testing service to take cores drilled from hardened concrete for compressive strength determination. Tests shall comply with ASTM C 42 and the following:
 - a. Take at least 3 representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent and no single core is less than 75 percent of the 28 day required compressive strength.
 - c. Report test results in writing to ENGINEER on the same day that tests are made. Include in test reports the Project identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
2. Fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.
3. Conduct static load test and evaluations complying with ACI 318 if the results of the core tests are unsatisfactory, or if core tests are impractical to obtain, as directed by ENGINEER.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-inholes and openings left in concrete structures for the passage of work by other contractors, unless otherwise shown or directed, after the work of other CONTRACTORS is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the Work.
- B. Curbs:
 1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
 2. Exterior curbs shall have rubbed finish for vertical surfaces and a broomed finish for top surfaces.

C. Equipment Bases:

1. Unless specifically shown otherwise, provide concrete bases for all pumps and other equipment. Construct bases to the dimensions shown, or as required to meet manufacturers' requirements and Drawing elevations. Where no specific elevations are shown, bases shall be 6 inches thick and extend 3 inches outside the metal equipment base or supports. Bases to have smooth trowel finish, unless a special finish such as terrazzo, ceramic tile or heavy duty concrete topping is required. In those cases, provide appropriate concrete finish.
2. Include all concrete equipment base work not specifically included under other Sections or other contracts.
3. In general, place bases up to 1 inch below the metal base. Properly shim equipment to grade and fill 1 inch void with non-shrink grout as specified in Section 03600.

3.10 CONCRETE REPAIRS

A. Repair of Formed surfaces:

1. Repair exposed-to-view formed concrete surfaces, that contain defects which adversely affect the appearance of the finish. Surface defects that require repair include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface; and stains and other discolorations that cannot be removed by cleaning.
2. Repair concealed formed concrete surfaces that may contain defects that adversely affect the durability of the concrete. Surface defects that require repair include cracks in excess of 0.01 inch wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced sections, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corner.
3. Repair structural cracks and cracks in water-holding structures.

B. Method of Repair of Formed Surfaces:

1. Repair and patch defective areas with cement mortar immediately after removal of forms and as directed by ENGINEER.
2. Cut out honeycomb, rock pockets, voids over 1/2-inch diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with the specified bonding agent.
 - a. For exposed-to-view surfaces, blend white portland cement and standard portland cement so that, when dry, the patching mortar color will match the color of the surrounding concrete. CONTRACTOR shall impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

3. Cracks which require repair shall be pressure grouted using one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur Hi-Mod L.V. and Gel by Sika Chemical Company.
 - b. Euco Epoxy #460 and #461 by The Euclid Chemical Company.
 - c. Or equal.
 4. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling.
 5. Sandblast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish of unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01-inch wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 4. Repair structural cracks and cracks in water-holding structures.
- D. Methods of Repair of Unformed Surfaces:
1. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
 2. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Use one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Poly-Patch by The Euclid Chemical Company.
 - b. Sikatop by Sika Chemical Company.
 - c. Or equal.
 3. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4-inch clearance all around. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same materials and proportions to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as re-

quired to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

4. Repair isolated random cracks, and single holes not over 1-inch diameter, by the dry-pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
 5. Cracks which require repair shall be pressure grouted using one of the following. Apply in accordance with the manufacturer's directions and recommendations.
 - a. Sikadur Hi-Mod L.V. and Gel by Sika Chemical Company.
 - b. Euco Epoxy #460 and #461 by The Euclid Chemical Company.
 - c. Or equal.
 6. Assure that surface is acceptable for flooring material to be installed in accordance with manufacturer's recommendations.
- E. Other Methods of Repair:
1. Repair methods not specified above may be used if approved by ENGINEER.

+ + END OF SECTION + +

SECTION 03421

PRECAST, PRESTRESSED HOLLOW SLAB UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide precast prestressed hollow slab units as shown and specified. The Work also includes:
 - a. Providing openings in units to accommodate the Work under this and other Sections and building into the units items such as sleeves, anchor bolts and inserts.

B. Coordination:

1. Notify other CONTRACTORS in advance of the precasting to provide them with sufficient time to advise of items required in their work that must be installed in the units.

C. Related Work Specified Elsewhere:

1. Section 03300, Cast-In-Place Concrete.
2. Section 07900, Sealants.
3. Section 09900, Painting.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ACI 318, Building Code Requirements for Reinforced Concrete, which includes referenced ASTM Standards.
 - a. Comply with local building code requirements where more stringent than ACI 318.
2. ACI 211.3, Recommended Practice for Selecting Proportions for No-Slump Concrete.
3. ACI 517, Recommended Practice for Atmospheric Pressure Steam Curing of Concrete.
4. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.

B. Fabricator Qualifications: Fabricated by a firm regularly engaged in the manufacture of precast prestressed hollow slab units for at least two years. Manufacturer to participate in and furnish evidence to ENGINEER of plant certification program specified in MNL-116.

1. Manufacturer: Provide precast prestressed hollow slab units as manufactured by one of the following:
 - a. Spancrete
 - b. Span-Deck
 - c. Or equal.

C. Source Quality Control: Make cylinder tests of concrete quality in accordance with ASTM C 192, for each mix design, for each day of production, or for each 100 cubic yards of concrete.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Shop Drawings showing all dimensions, openings, jointing, camber, inserts, reinforcing and prestressed strands, design calculations, initial prestress force, and method of handling. Include manufacturer's standard and special loading chart data for span and load conditions required, and manufacturer's setting plans and anchorage details. Show all conditions at openings, including size, location, topping and grout details, fasteners, etc., and header locations and dimensions.
 2. Submit computations stamped with seal of a registered professional ENGINEER, to verify structural adequacy of members and connections for review with Shop Drawings.
 3. Copies of all concrete cylinder test reports.
 4. Manufacturer's literature and installation instructions.
 5. Certificates of material conformance with Specifications.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Transport and handle precast concrete slabs with proper equipment to protect units from dirt and damage. Handle by means of lifting inserts.
- B. Storage: Store units off ground and on firm surfaces to avoid warping and cracking. Protect units from damage and discoloration. Stack so that lifting devices are accessible and undamaged. Separate stacked members by battens across full width of each bearing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete:
1. Portland cement shall conform to ASTM C 150, Types II or III. Type I may be used when acceptable to ENGINEER.
 2. Aggregate shall conform to ASTM C 33, for fine to coarse gradation.
 3. Admixtures: Chemical admixtures shall conform to ASTM C 494. Calcium chloride shall not be used.
 4. Water shall be free from foreign materials in amounts harmful to concrete.
- B. Prestressing strands shall be uncoated, 7 wire, stress-relieved strands conforming to ASTM A 416, Grade 250 or 270.
- C. Bearing pads shall be non-staining pressed or tempered wood; or plastic with a compressive strength of 8,000 psi, minimum, and negligible cold flow characteristics.
- D. Weld inserts, anchors, and anchor plates shall be as shown and as required for anchoring slabs to supports.

- E. Headers required to safely carry design loads shall be fabricated of steel conforming to ASTM A 36, shop primed as specified in Section 09900.

2.2 MIXES

- A. Mix design shall be in accordance with ACI 211.3.
- B. Measurements of concrete mix materials shall be within the following limits:
 - 1. Cement: plus or minus 1 percent.
 - 2. Water: plus or minus 1 percent.
 - 3. Fine Aggregate: plus or minus 2 percent.
 - 4. Coarse Aggregate: plus or minus 2 percent.
 - 5. Admixtures: plus or minus 3 percent.

2.3 DESIGN AND FABRICATION

- A. Design units to support the superimposed loads shown or specified, in addition to the dead weight load of the units and construction loads.
- B. Type: Machine made, precast prestressed concrete units with open voids running the full length of slabs, produced under a rigid factory-inspected process acceptable to ENGINEER.
- C. Furnish units which are free of voids and honeycomb, with straight true edges and surfaces.
 - 1. Provide units of a uniform color and free from stains or discoloration. Top surface to have a float finish free from holes.
- D. Fabrication: Manufacture units of concrete materials which will provide a minimum 3,000 psi compressive strength at time of initial prestress and a 28 day minimum strength of 4,000 psi.
- E. Pretension prestressing strands by either a dead weight system or a single strand jacking system. Mark strands for slippage, and if slippage occurs, detention and restress strand. Check tension of strand to insure accurate results.
- F. Release strands when concrete reaches a minimum strength of 3,000 psi, or greater as required by design.
- G. Adequately reinforce slab units to resist all transporting and handling stresses.
- H. Include cast-in weld plates where required for anchorage or lateral bracing to structural steel members.
- I. Identifications: Provide permanent markings as shown on the Shop Drawings. Markings shall not show in the finished Work.

- J. Dimensional Tolerances: Fabricate hollow slab units to comply with the following fabricated dimensional tolerances:
1. Length: plus or minus 1/2 inch.
 2. Width: plus or minus 1/4 inch.
 3. Depth: plus or minus 1/4 inch.
 4. Position of weld plates; plus or minus 1 inch.
 5. Differential camber between adjacent members of the same design; 1/4 inch per 10 feet but not greater than 1/2 inch.
- K. Units may be wet or steam cured at atmospheric pressure. If steam cured, conform to the requirements of ACI 517.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which hollow slab units are to be installed. Notify the ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 INSTALLATION

- A. Lift, place, and secure hollow slab units in accordance with manufacturer's printed instructions and approved Shop Drawings. Keep units tight and perpendicular to bearing supports. Do not install hollow slab units until supporting members are in place and secured. If any units rest on masonry block lintels, assure that voids in lintels are filled with concrete.
1. Follow erection procedures and sequence of erection as recommended by hollow slab unit manufacturer and as acceptable to the ENGINEER.
- B. Units having any dimension smaller or greater than required or that are outside the specified tolerance limits, will be rejected if the appearance or function of the structure is adversely affected.
- C. Level slabs accurately or set to uniform slope as shown.
1. Use bearing pads where units set on tile or brick masonry. Set slabs on solid, level bearings, with bearing surface of slab units not less than 3 inches at steel supports and not less than 4 inches at other supports, unless otherwise acceptable to the ENGINEER.
 2. Align and level to approved tolerance by methods, procedures, and equipment as recommended by the hollow slab unit manufacturer.
 3. Where adjacent units are not in vertical alignment due to camber or other reason, provide mortar fill on lower unit to create a smooth transitional surface for the application of insulation. Slope of fill, measured perpendicular to side joints, shall not be steeper than 1/8-inch per foot.

- D. Do not cut holes or install sleeves larger than size permitted by hollow slab unit manufacturer for pipe, conduits, duct or other penetrations after fabrication, except as otherwise shown or specified.
- E. Do not cut reinforcing or prestressing strands without approval of manufacturer and as acceptable to the ENGINEER.
- F. Field cut holes for openings that do not disturb prestressing strands in accordance with hollow slab unit manufacturer's instructions, unless otherwise shown or specified.
- G. Weld inserts in slab units to bearing surfaces, as shown and specified.
- H. Grouting Joints:
 - 1. Clean joints before grouting.
 - 2. Grout for joints shall be 1 part portland cement to 2-1/2 parts sand
 - 3. Fill joints between units with grout.
 - 4. Remove grout that seeped through to ceiling below before grout hardens.
- I. Repair damaged exposed surfaces. Leave units in a condition acceptable to the ENGINEER and ready to receive subsequent work.

+ + END OF SECTION + +

SECTION 03600

GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install grout.
2. Grout shall be placed at the following locations:
 - a. Column and beam bearing.
 - b. Equipment bases.
 - c. Handrails and railings.
 - d. Topping in concrete tanks.
 - e. Construction joints.
 - f. Intrusion grouting.
3. The types of grout include the following:
 - a. Non-shrink, epoxy type.
 - b. Non-shrink, non-metallic type.
 - c. Ordinary cement-sand.

B. Related Sections:

1. Section 03251, Concrete Joints.
2. Section 03300, Cast-In-Place Concrete.
3. Section 04100, Mortar (grout for masonry work).
4. Section 05120, Structural Steel.
5. Section 05523, Aluminum Handrails and Railings.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 144, Aggregate for Masonry Mortar.
2. ASTM C 150, Portland Cement.
3. ASTM C 109, Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50 mm. Cube Specimens).
4. ASTM C 191, Time of Setting of Hydraulic Cement by Vicat Needle.
5. CRD-C-588, Specifications for Non-Shrink Grout.
6. CRD-C-619, Specification for Grout Fluidifier.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's specifications and installation instructions for all proprietary materials.
2. For ordinary cement grout, submit copies of grout design mix and laboratory test reports for grout strength tests.

B. Reports and Certificates:

1. For proprietary materials, submit copies of reports on quality control tests.

2. For nonproprietary materials, submit certification that materials meet specification requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Grout materials from manufacturers shall be delivered in unopened containers and shall bear intact manufacturer's labels.
- B. Storage of Materials: Grout materials shall be stored in a dry shelter and shall be protected from moisture.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Non-metallic, 100 percent solids, high strength epoxy grout.
 1. Use clean well graded sand with epoxy resins suitable for use on dry or damp surfaces.
 2. Product and Manufacturer: Provide one of the following:
 - a. Euco High Strength Grout by The Euclid Chemical Company.
 - b. Sikadur Hi-Mod Grout by Sika Chemical Company.
 - c. Five Star Epoxy Grout by U.S. Grout Corporation.
 - d. Or equal.
- B. Non-Shrink, Non-Metallic Grout:
 1. Pre-mixed non-staining cementitious grout requiring only the addition of water at the jobsite.
 2. Product and Manufacturer: Provide one of the following:
 - a. Euco N-S by The Euclid Chemical Company.
 - b. Masterflow 713 by Master Builders Company.
 - c. Five Star by U.S. Grout Corporation.
 - d. Or equal.
- C. Ordinary Cement-Sand Grout: Prepare design mixes of ordinary cement grout. Mixes subject to the following limitations:
 1. Cement:
 - a. Portland cement, ASTM C150, Type II; or blended hydraulic cement, ASTM C595, Type 1P.
 2. Aggregates: ASTM C33 and as herein specified.
 - a. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ocher, or other materials that can cause stains on exposed concrete surfaces.
 - b. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
 - 1) Dune sand, bank run sand and manufactured sand are not acceptable.
 - c. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
 - 1) Crushed stone, processed from natural rock or stone.
 - 2) Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.

- 3) Coarse Aggregate Size: Size to be ASTM C33, Nos. 8 for grout topping in concrete tanks. Coarse aggregate not permitted in grout used in construction.
3. Specified 28-day Compressive Strength:
 - a. Construction Joint Grout: $F'c = 4000$ psi.
 - b. Grout Topping in Concrete Tanks: $F'c = 3000$ psi.
4. Maximum Water-Cement Ratio by Weight: 0.45.
5. Use air-entraining admixture in all ordinary cement grout. Provide not less than 4-1/2 percent nor more than 7-1/2 percent entrained air.
6. Slump Limits: Proportion and design mixes to result in grout slump at the point of placement of not more than 5 inches.

D. Water:

1. Use clean, fresh, potable water free from injurious amounts of oils, acids, alkalies or organic matter.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and conditions under which grout is to be placed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. General:

1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until ENGINEER provides clarification.
2. Drypacking will not be permitted.
3. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.
4. Placing grout shall conform to temperature and weather limitations in Section 03300.

B. Columns, Beams and Equipment Bases:

1. After shimming equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates, allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the epoxy grout.
2. After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and

the top of concrete base must be provided to assure that the void is completely filled with the non-metallic grout.

C. Handrails and Railings:

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink, non-metallic grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Bonded Topping for Concrete Tanks:

1. Topping shall be as specified in Part B, Sections 030730 and 030731.

+ + END OF SECTION + +

MASONRY
Division 4

SECTION 04100

MORTAR

PART 1 - GENERAL1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish all mortar Work.
2. This Section specifies the mortar for masonry materials specified in the following:
 - a. Section 04220, Concrete Unit Masonry.
 - b. Section 04270, Glass Unit Masonry.
3. The types of mortar Work required includes, but is not necessarily limited to, the following:
 - a. Portland cement-lime mortar.
 - b. Fire-resistant mortar.
 - c. Masonry cement mortars.
 - d. Grout.
 - e. Miscellaneous additives.

B. Related Sections:

1. Section 03600, Grout.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled for unit masonry construction (4-hour, 3-hour and similar designations), provide mortar and proportions complying with the requirements established by UL and other governing authorities.

B. Codes: Comply with the applicable requirements of the Uniform Building Code for types of mortar Work specified.

C. Source Quality Control:

1. Do not change source or brands of mortar materials during the course of the Work.
2. Where question of compliance to the requirements of this Section arise the mortar properties specification shall take precedence over the mortar proportion specifications.
3. No change shall be made in the proportions established for mortar accepted under the property specifications nor shall materials with different physical characteristics be utilized in mortar used in the Work unless compliance with the requirements of the property specifications is re-established by Shop Drawing data submission to ENGINEER.
4. Two air-entraining materials shall not be combined in mortar.
5. Provide mortar Work complying with the requirements for special inspection as determined by the Uniform Building Code.

- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM C 5, Quicklime for Structural Purposes.
 2. ASTM C 91, Masonry Cement.
 3. ASTM C 136, Sieve or Screen Analysis of Fine and Coarse Aggregates.
 4. ASTM C 144, Aggregate for Masonry Mortar.
 5. ASTM C 150, Portland Cement.
 6. ASTM C 207, Hydrated Lime for Masonry Purposes.
 7. ASTM C 270, Mortar for Unit Masonry.
 8. ASTM C 404, Aggregates for Masonry Grouts.
 9. ASTM C 476, Grout for Masonry.
 10. UL, Design Numbers U901 through U908.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of each type of colored mortar, showing the range of color which can be expected in the Work. Label samples to indicate type and amount of colorant used. ENGINEER'S review will be for color only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's specifications and instructions for each manufactured product.
 2. Product specification data for integral waterproofing admixture.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials:
1. Store mortar materials off the ground in a dry location and under a properly constructed shelter using tarpaulins, felt paper, or polyethylene sheets.
 2. Protect liquid admixtures from freezing.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Portland Cement: Provide the following for portland cement-lime mortars:
1. ASTM C 150, Type I.
 2. Use ASTM C 150, Type III, high early strength, for laying masonry when outside temperature is less than 50 F.
 3. Provide nonstaining portland cement of natural color or of the color required to be compatible with the required colored mortar pigment selected by ENGINEER.
 4. Product and Manufacturer: Provide one of the following:
 - a. Speed Portland Cement and Hi-Speed Portland Cement by Louisville Cement Company.

- b. Atlas Type I and Atlas Type III Portland Cement by Lehigh Portland Cement Company.
 - c. Or equal.
 5. Product and Manufacturer: Provide one of the following:
 - a. White Portland Cement by Ideal Basic Industries.
 - b. Atlas White Portland Cement Type I and Type III by Lehigh Portland Cement Company.
 - c. Or equal.
- B. Masonry Cement: Provide the following for masonry cement mortars:
 1. ASTM C 91, Type S; proportioned as specified to comply with ASTM C 270.
 2. Maximum Air Content, ASTM C 91: 18 percent.
 3. Non-staining and of the color required to be compatible with the required colored mortar pigment selected by ENGINEER.
 4. Product and Manufacturer: Provide one of the following:
 - a. Brixment-in Color Type S by Louisville Cement Company.
 - b. Atlas Custom Color Masonry Cement Type S by Lehigh Portland Cement Company.
 - c. Or equal.
- C. Hydrated Lime: ASTM C 207, Type S, or lime putty ASTM C 5.
- D. Sand Aggregates:
 1. ASTM C 144, except for joints less than 1/4 inch use aggregate graded with 100 percent passing the No. 16 sieve.
 2. White Mortar Aggregates: Provide natural white sand or ground white stone for portland cement-lime mortars.
 3. Colored Mortar Aggregates: Provide ground marble, granite or other sound stone, as required to match the sample approved by ENGINEER for portland cement-lime mortars.
 4. Fine Aggregate for Grout: Sand, ASTM C 404, Size No. 1.
 5. Course Aggregate for Grout: ASTM C 404, Size No. 8 or Size No. 89.
- E. Colored Mortar Pigments: Provide the following for portland cement-lime mortars:
 1. Commercial iron oxide, manganese dioxide, ultramarine blue, chromium oxide, or carbon black, compounded for use in mortar mixes.
 2. Do not exceed pigment to cement ratios, by weight of 1 to 35 for carbon black and 1 to 7 for other pigments.
 3. Product and Manufacturer: Provide one of the following:
 - a. Truetone Mortar Colors by Frank D. Davis Company Subsidiary Rockwood Industries Incorporated.
 - b. Sonobrite by Sonneborn Building Products Division Rexnord Chemical Products Incorporated.
 - c. Or equal.
 4. Submit complete selection of manufacturer's standard and custom colors for final selection by ENGINEER.
- F. Water: Free from injurious amounts of oils, acids, alkalis, or organic matter, and clean, fresh and potable.

- G. Waterproofing Admixture for Exterior and Interior Wythe of Exterior Concrete Unit Masonry:
1. Provide a cross-linking acrylic polymer integral waterproofing system.
 2. Proportion and Mixing: In strict accordance with manufacturer's instructions.
 3. Product and Manufacturer: Provide one of the following:
 - a. DRY-BLOCK Mortar Admix by Forrer Industries.
 - b. Or equal.

2.2 MORTAR MIXES

- A. General:
1. Anti-Freeze Admixture or Agents: Not permitted.
 2. Calcium Chloride: Not permitted.
- B. Fire Resistant Mortar:
1. Standard: UL Design Numbers 0901, 0902, 0903, 0904, 0905, 0906, 0907 and 0908.
 2. Proportion: Use 1 part portland cement, 3 parts clean sand, and 15 percent hydrated lime (by cement volume).
- C. Mortar for All Unit Masonry: Comply with ASTM C 270, Table 2, except limit materials to those specified herein, do not substitute ASTM C 91 masonry cement for ASTM C 150 portland cement without an approved Shop Drawing review by ENGINEER, and limit cement to lime ratio by volume as follows:
1. Type S:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: 1 part.
 - 2) Hydrated Lime or Lime Putty: Over 1/4 to 1/2 maximum.
 - 3) Aggregate Ratio (Measured in Damp Loose Condition): Not less than 2-1/4 and not more than 3 times the sum of the volumes of cementitious materials.
 - b. Provide the following proportions by volume:
 - 1) Portland Cement: 1/2 part.
 - 2) Masonry Cement: 1 part.
 - 3) Aggregate Ratio (Measured in a Damp Loose Condition): Not less than 2-1/4 and not more than 3 times the sum of the volumes of cementitious materials.
 - c. Property Specification:
 - 1) Average Compressive Strength, ASTM C 270: 1800 pounds per square inch.
 - 2) Minimum Water Retention, ASTM C 270: 75 percent.
 - 3) Maximum Air Content, ASTM C 270: 12 percent for portland cement-lime mortars; 18 percent for masonry cement mortars.
- D. Grout:
1. Fine Grout:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: 1 part.
 - 2) Hydrated Lime or Lime Putty: 0 to 1/10 part.

- 3) Aggregate Ratio (Measured in a Damp Loose Condition): Sand; not less than 2-1/4 and not more than 3 times the sum of the volumes of cementitious materials.
- b. Mix grout to have a slump of 10-inches plus or minus 1-inch, at time of placement.
2. Coarse Grout:
 - a. Provide the following proportions by volume:
 - 1) Portland Cement: 1 part.
 - 2) Hydrated Lime or Lime Putty: 0 to 1/10 part.
 - 3) Fine Aggregate Ratio (Measured in a Damp Loose Condition): Sand; not less than 2-1/4 and not more than 3 times the sum of the volumes of cementitious materials.
 - 4) Coarse Aggregate Ratio: Not less than 1 and not more than 2 times the sum of the volumes of cementitious materials.
 - b. Mix grout to have a slump of 10-inches plus or minus 1-inch, at time of placement.
3. Grout Fill Around Reinforcement in Masonry Lintels: Portland cement, sand, gravel and water, to be proportioned as required to provide a 28-day minimum compressive strength of 3000 pounds per square inch.
- E. Colored Pigmented Cement Mortar: For portland cement-lime mortars proportion pigments with other ingredients as follows:
 1. Mix to match sample approved by ENGINEER.
 2. For black mortar mix with 1/8 part black iron oxide per part of portland cement and reduce lime content to not more than 1/10 part.
- F. Colored Aggregate Mortar: For portland cement-lime mortars proportion colored aggregate with other ingredients to match sample approved by ENGINEER.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measurement of Materials:
 1. Cement and Hydrated Lime: Batched by the bag.
 2. Sand: Batched by volume in suitably calibrated containers, provided proper allowance is made for bulking and consolidation and for weight per cubic foot, of contained moisture.
 3. Proportion of Volumetric Mixtures: One 94-pound sack of portland cement and one 50-pound sack of hydrated lime constitute nominal one cubic foot.
 4. Shovel measurement: Not permitted.
- B. Mortar Mixing:
 1. Type of Mixer: Machine mix in approved mixer in which the quantity of water is accurately and uniformly controlled.
 2. While mixer is in operation add approximately 3/4 the required water, 1/2 the sand, all the cement, then add remainder of sand.
 3. Allow batch to mix briefly then add water in small quantities until satisfactory workability is obtained.

4. Mix for not less than five minutes after all materials have been added.
5. Hydrated Lime for Mortar Requiring Lime Content: Use dry-mix method. Turn over together the materials for each batch until the even color of the mixed, dry materials indicates that cementitious material has been thoroughly distributed throughout the mass, then add water to obtain required plasticity.
6. Lime putty if approved for use shall be prepared in accordance with ASTM C 5.
7. Waterproofing Admixture: Add to mortar mix for all exterior masonry in strict accordance with manufacturer's instructions.
8. The mixer drum shall be completely emptied before recharging the next batch.
9. Limit batch size to avoid retempering. Retempering of mortar shall not be permitted.

3.2 INSTALLATION

- A. Refer to the following:
 1. Section 04201, Unit Masonry Construction.

3.3 FIELD QUALITY CONTROL

- A. CONTRACTOR shall engage an independent testing laboratory acceptable to ENGINEER, to take samples and conduct tests to evaluate air entrainment, water retention and the compliance of materials with the Specifications and to determine the compressive strength of mortar and grout. Tests shall be conducted in accordance with ASTM C 91. Tests results shall be made available to ENGINEER prior to the commencement of Work.
- B. After the initial test, ENGINEER will require a maximum of 5 additional tests to be conducted at his discretion.

+ + END OF SECTION + +

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SECTION 04201

UNIT MASONRY CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to furnish and install all unit masonry construction Work. The Work also includes:
 - a. Providing openings in unit masonry construction to accommodate the Work under this and other Sections and building into the unit masonry construction all items such as sleeves, anchor bolts, inserts and all other items to be embedded in unit masonry construction for which placement is not specifically provided under other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the unit masonry construction Work.
2. Unit masonry construction Work advanced without built-in flashings and other built-in Work shall be removed and rebuilt at no additional expense to OWNER even if discovered after unit masonry construction Work has been completed.
3. Coordinate the Work of other Sections to avoid delay of the unit masonry construction Work.
4. Notify other contractors in advance of the erection of unit masonry construction Work to provide other contractors with sufficient time for the installation of items included in their contracts that must be installed with or before the unit masonry construction Work.

C. Related Sections:

1. Section 04100, Mortar.
2. Section 04510, Masonry Accessories.

1.2 QUALITY ASSURANCE

A. Codes: Comply with the applicable requirements of the Uniform Building Code for the types of unit masonry construction Work shown.

B. Construction Tolerances:

1. Variation from Plumb: For lines and surfaces of columns, walls and arrises, do not exceed 1/4 inch in 10 feet, or 3/8 inch in a story height or 20 feet maximum, nor 1/2 inch in 40 feet or more. Except for external corners, expansion joints and other conspicuous lines, do not exceed 1/4 inch in any story or 20 feet maximum, nor 1/2 inch in 40 feet or more.

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2. Variation from Level: For lines of exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.
3. Variation of Linear Building Line: For position shown and related portion of columns, walls and partitions, do not exceed 1/2 inch in any bay or 20 feet maximum, nor 3/4 inch in 40 feet or more.
4. Variation in Cross-Sectional Dimensions: For columns and thickness of walls, from dimensions shown, do not exceed minus 1/4 inch nor plus 1/2 inch.

D. Job Mock-up:

1. Prior to installation of unit masonry construction Work, but after ENGINEER'S approval of samples, erect job mock-up using materials, pattern bond and joint tooling shown or specified for final Work. Provide special features as directed including finished opening 1 foot-4 inches by 1 foot-4 inches, finished end, and masonry control joint. Build mock-up at the site, in location approved by ENGINEER, of full required wall thickness and approximately 4 feet by 3 feet-4 inches, unless otherwise shown. Indicate the proposed range of color, texture and workmanship to be expected in the completed Work. Obtain ENGINEER'S acceptance of visual qualities of the mock-up before start of unit masonry construction Work. Retain and protect mock-up during construction as a standard for judging completed unit masonry construction Work. Do not alter, move or destroy mock-up until given written permission by ENGINEER.
2. Build as many job mock-up panels as required to obtain ENGINEER'S acceptance of the Work.
3. Masonry construction that does not meet the standards approved on the sample panel shall be removed and rebuilt as required by ENGINEER. Provide mock-up panel for the following:
 - a. Typical complete exterior wall.

E. Preconstruction Conference:

1. Prior to the installation of unit masonry construction Work, CONTRACTOR shall schedule a preconstruction conference at the project site. Review foreseeable methods and procedures related to the unit masonry construction Work including, but not necessarily limited to, the following:
 - a. Project requirements, including Drawings, Specifications and other Contract Documents.
 - b. Structural concept.
 - c. Method of sequence of masonry construction.
 - d. Special masonry details.
 - e. Required submittals, both completed and yet to be completed.
 - f. Standard of workmanship.
 - g. Quality control requirements.
 - h. Job organization and availability of materials, tradesmen, equipment and facilities needed to make progress and avoid delays.
 - i. Masonry control and expansion joint location and materials.

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- j. Modular planning requirements.
 - k. Weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
 - l. Required inspection, testing and certifying procedures.
 - m. Regulations concerning building code compliance.
 - 2. Attendance is mandatory for the following:
 - a. CONTRACTOR'S job superintendant.
 - b. Masonry subcontractor's job superintendant.
 - c. Masonry subcontractor's foreman.
 - d. Authorized representative of concrete unit masonry supplier.
 - e. ENGINEER'S authorized representative.
 - 3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.
 - 4. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending.
- F. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
- 1. ASTM C 67, Standard Methods of Sampling and Testing Brick.
 - 2. Brick Institute of America, "Technical Notes on Brick and Tile Construction".
 - 3. Brick Institute of America, Technical Bulletin 1A, "Construction and Protection Recommendations for Cold Weather Masonry Construction".
 - 4. Brick Institute of America, Technical Notes on "Cleaning Clay Products Masonry".
 - 5. National Concrete Masonry Association, "Guide Specifications" and "Technical Bulletins".

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
- 1. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Provide plans and elevations drawn at 1/4 inch scale and details drawn at 1-1/2 inch scale. Show all items required to be built into unit masonry construction Work.
 - 2. Masonry control joint locations and details.
 - 3. Shop Drawings showing the location, extent and accurate configuration and profile of all items shown, specified and required by this and other sections to be built into the unit masonry construction Work as the Work progresses. Provide elevations drawn at 1/4 inch scale and all details drawn at 1-1/2 inch scale.
 - 4. Shop Drawing for fabrication, bending, and placement of reinforcing bars. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcing for unit masonry construction Work.

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1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver reinforcing to the site, bundled, tagged and marked. Use metal tags indicating size, lengths and other markings shown on approved Shop Drawings.
- B. Storage of Materials:
 - 1. Protect masonry materials during storage and construction with a properly erected shelter from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.
 - 2. Maintain temperatures in shelter so that masonry materials are above 20 F when laid.
- C. Handling Materials:
 - 1. Handle materials in a manner that minimizes chips, cracks, voids, discolorations or other defects which might be visible or cause staining in finished Work.

1.5 JOB CONDITIONS

- A. Site Facilities: Supplemental heat sources as may be required should CONTRACTOR wish to continue unit masonry construction Work in cold weather are not available at the project site. The provision of all supplemental heat energy sources and equipment is the responsibility of CONTRACTOR.
- B. Environmental Requirements:
 - 1. Do not place any unit masonry construction Work when air temperature is below 28 F on a rising temperature or below 36 F on falling temperatures without temporary heated enclosures or without heating materials or other precautions necessary to prevent freezing as specified in 1.4.C. below.
 - 2. No frozen materials shall be used nor shall frozen unit masonry construction Work be built upon.
 - 3. Remove and replace all unit masonry construction Work damaged by frost or freezing.
- C. Protection:
 - 1. Protect all unit masonry construction Work against freezing for at least 48 hours after being placed.
 - a. Mean Daily Air Temperature 40 F to 32 F: Protect unit masonry construction Work from rain or snow for 48 hours after installation.
 - b. Mean Daily Air Temperature 32 F to 25 F: Completely cover unit masonry construction Work for 48 hours after installation.
 - c. Mean Daily Temperature 25 F to 20 F: Completely cover unit masonry construction Work with insulating blankets for 48 hours.

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- d. Mean Daily Air Temperature 20 F and Below: Maintain unit masonry construction Work above 32 F for 48 hours by enclosure and supplementary heat.
 2. Protect partially completed masonry against rapid heat loss and from water entering masonry, when Work is not in progress, by covering top of walls with strong, waterproof, nonstaining membrane. Extend membrane at least 2 feet down both sides of walls and secure in place using wall cover clamps spaced at intervals of 4 feet-0 inches and at each end and joint of covering.
 3. Do not apply uniform floor or roof loading for at least three days after completing masonry columns or walls.
 4. Do not apply concentrated loads for at least seven days after completing masonry columns or walls.
- D. Cold Weather Unit Masonry Construction Work:
1. All mortar for use in unit masonry construction Work when the mean daily temperature is below 40 F shall be portland cement-lime-sand mortars using high early strength portland cement.
 2. Clay or shale unit masonry with suction in excess of 20 grams per 30 square inches shall be sprinkled with heated water just prior to laying. Provide water temperature above 70 F when units are above 32 F. Water temperature shall be above 120 F when temperature of units are below 32 F.
 3. Air Temperature 40 F to 32 F: Heat sand or mixing water to minimum of 70 F and maximum of 160 F.
 4. Air Temperature 32 F to 25 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F.
 5. Air Temperature 25 F to 20 F: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Provide heat on both sides of wall under construction. Employ wind breakers when wind is in excess of 15 mph.
 6. Air Temperature 20 F and Below: Heat sand and mixing water to minimum of 70 F and maximum of 160 F. Provide enclosure and auxiliary heat to maintain air temperature above 32 F. Temperature of masonry units when laid shall not be less than 20 F.
- E. Hot Weather Unit Masonry Construction Work: Protect unit masonry construction Work by methods acceptable to ENGINEER, from direct exposure to wind and sun when the surrounding air temperature is 99 F in the shade with relative humidity less than 50 percent.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to the following Sections for required masonry materials.
1. Section 04100, Mortar.
 2. Section 04510, Masonry Accessories.
 3. Section 04220, Concrete Unit Masonry.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine areas and conditions under which unit masonry construction Work is to be installed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Wetting of Masonry Units:
 - 1. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.
- B. Cleaning Reinforcement: Before being placed, remove all loose rust, mill scale, earth, ice and other coatings (except galvanizing) from reinforcement. Do not use reinforcing bars with kinks or bends not shown on Drawings or approved Shop Drawings, or bars with reduced cross-section due to excessive rusting or other causes.

3.3 INSTALLATION, GENERAL

- A. Thickness: Build walls, floors and other unit masonry construction Work to the full thickness shown. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.
- B. Build chases and recesses as shown or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses.
- C. Leave openings for equipment, piping, ducts, and other items to be installed subsequent to starting of masonry Work. After installation of said items, complete unit masonry construction Work to match Work immediately adjacent to openings.
- D. Cut masonry units using motor driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern specified and to fit adjoining Work neatly. Use full size units without cutting wherever possible.
- E. Build interior masonry walls, visible from both sides in the finished Work, using two wythes of masonry.

3.4 LAYING MASONRY WALLS

- A. General:
 - 1. Mortar Types: Unless otherwise indicated, use mortar as specified in Section 04100, Mortar, and as follows:

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- a. For all masonry wall Work, use Type S mortar.
 - b. Use grout fill for structural requirements and for grouting reinforcing steel in unit masonry construction Work.
 - c. Do not use mortar which has begun to set or if more than 1/2 hour has elapsed since initial mixing. Retemper mortar during the 1/2-hour period only as required to restore workability.
2. Layout walls in advance for accurate spacing of surface pattern bond with uniform joint widths and to properly locate openings, masonry control joints, returns and offsets. Avoid the use of less than half size units at corners, jambs and wherever possible at other locations.
 3. Lay up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other Work.
 4. Pattern Bond:
 - a. Lay all concrete unit masonry construction Work visible in the finished Work in running bond with vertical joints in each course centered on units in courses above and below.
 - b. Bond and interlock each course of each wythe at corners.
 - c. Do not use units with less than 8-inches horizontal face dimensions at corners or jambs.
- B. Mortar Bedding and Jointing:
1. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course of piers, columns and pilasters, and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
 - a. Maintain joint widths shown, except for minor variations required to maintain pattern bond alignment. If not shown, lay walls with 3/8-inch joints.
 2. Cut joints flush for masonry walls that are to be concealed or to be covered by other materials, except paint, unless otherwise shown.
 3. Tool exposed joints, when mortar is "thumbprint" hard, slightly concave, unless otherwise required to match existing joint treatment. Rake out mortar in preparation for application of caulking or sealants where required.
 4. Concave-tool exterior joints below grade.
 5. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.
- C. Stopping and Resuming Work: Rake back 1/2-unit masonry length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly, if required, and remove loose masonry units and mortar prior to laying new masonry.

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D. Built-in Work:

1. As the Work progresses, build in items shown, specified or required by others. Refer to paragraph 1.1.B. herein for the requirements of coordination with others. Fill cores in one block width solidly with masonry around built-in items.
2. Fill space between hollow metal frames and masonry solidly with mortar.
3. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of cavity fill mesh in the joint below and rod mortar or grout into core.

E. Non-Load-Bearing Interior Partitions:

1. Build full height of story to underside of plywood roof deck above, unless otherwise shown.
2. Tie non-load-bearing partitions at sides with masonry anchors at terminations. Insert compressible filler, specified in Section 04510, Masonry Accessories in all horizontal and vertical joints where non-load-bearing masonry walls terminates. Insert filler $3/4$ inches from both faces of masonry. Use filler four times as thick as the widest part of the joint. Thickness of filler shall be a minimum of 1.5 times the compressed thickness. Compress filler to less than thickness of joint and insert. At splices, overlap strips by 3 inches and compress ends to form tight joint. Finish with backer rod and sealant.
3. At terminations of non-load-bearing masonry walls requiring a fire rating use fire safing insulation specified in Section 07210, Building Insulation. Insert insulation in a continuous vaportight solid blanket to $3/4$ inches from both faces of masonry. Finish with backer rod and sealant.

F. Horizontal Joint Reinforcing:

1. Provide continuous horizontal joint reinforcing as shown and specified. Refer to Section 04510, Masonry Accessories, for type of reinforcing units required. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of $5/8$ inch on exterior side of walls and $1/2$ inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge masonry control joints and building expansion joints with reinforcing.
2. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.
3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend units in accordance with manufacturer's written instructions for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
4. Space continuous horizontal reinforcing as follows:
 - a. For single wythe walls, space reinforcing at 16 inches on centers vertically, unless otherwise shown.

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5. Reinforce masonry openings greater than 12 inches wide, with horizontal joint reinforcing placed in two horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 24 inches beyond jambs of the opening.
 6. In addition to wall reinforcing, provide additional reinforcing at openings as required to comply with the above.
- G. Structural Reinforced Unit Masonry Construction:
1. Shape and dimension reinforcement as shown and are required by governing codes.
 2. Position reinforcing accurately at the spacing shown. Support and secure vertical bars against displacement.
 3. Where vertical bars are shown in close proximity, provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.
 4. For columns, piers and pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties.
 5. Provide lapped splices with reinforcing steel placed in contact and wire tied. Provide minimum lap required by governing code unless more stringent requirements are shown. Do not splice reinforcement at points other than shown or as approved on Shop Drawings.
- H. Grouting Structural Reinforced Unit Masonry Construction:
1. Limit extent of masonry construction to sections which do not exceed the maximum pour requirements specified. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.
 2. Use fine grout for filling spaces less than 4 inches in both horizontal direction. Use coarse grout for filling spaces 4 inches or larger in both horizontal directions.
 3. For spaces 10 inches and larger use concrete fill.
 4. Low-Lift Grouting:
 - a. Use low-lift grouting techniques using fine grout mix for the following:
 - 1) Two-wythe walls with grout space of 2-inches or less in width.
 - 2) Multi-wythe walls.
 - 3) Columns, piers and pilasters where masonry units are shown in core areas enclosed by masonry units.
 - 4) At CONTRACTOR'S option, low-lift grouting technique may be used for structural reinforced unit masonry construction Work with grout spaces wider than 2 inches, except use coarse grout mix and place in lifts not to exceed 8 inches in height.
 - b. Grout spaces less than 2 inches in width at intervals not to exceed 24 inches in lifts of 6 to 8 inches.

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- c. Construct low-lift structural reinforced unit masonry construction Work by placing reinforcing, laying masonry units and pouring grout as the Work progresses.
- d. Place vertical reinforcing bars and supports prior to laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcing bars may be placed progressively with laying of masonry units.
- e. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 12 inch pour height.
- f. Lay masonry units prior to each grout pour, but do not construct more than 12 inches above maximum grout pour height in one exterior wythe and 4 inches above in other exterior wythe. Provide metal wall ties if required to prevent blow-outs.
- g. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 1-1/2 inches below top of highest course in pour.

I. Masonry Control Joints:

1. Provide vertical expansion, and control joints in masonry where shown. Build in related items as the unit masonry construction Work progresses. Rake out mortar in preparation for application of calking and sealants. Refer to Section 07920, Sealants and Calking.
2. Provide masonry control joints items specified under Section 04510, Masonry Accessories, where masonry control joints are shown.
 - a. Build in compressible fillers where shown. Install in accordance with manufacturer's written instructions.
 - b. Build in factory premolded control joint strips into masonry. Build in sash block and premolded control joint strips as the Work progresses.
 - c. Provide end blocks where masonry partitions abut structure to facilitate installation of compressible filler, fire safing insulation, backer rod and sealant.
3. Masonry Control Joint Spacing: Locate masonry control joints as shown.

J. Lintels and Bond Beams:

1. Provide masonry lintels and bond beams where shown and wherever openings of 16 inches or more. Provide formed in place masonry lintels and bond beams. Temporarily support formed-in-place lintels and bond beams.
 - a. Unless otherwise shown, provide one horizontal number six deformed reinforcing bar for each 4 inches of wall thickness.

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- b. For hollow masonry unit walls, use specially formed "U" shaped lintel and bond beam units with reinforcing bars placed as shown, filled with grout as specified in Section 04100, Mortar.
 2. Provide minimum bearing at each jamb, of 4 inches for openings less than 6 feet-0 inches wide, and 8 inches for wider openings.
 3. On concrete unit masonry walls where pattern bond remains visually exposed, increase minimum bearing of masonry lintels to maintain joint pattern of wall and install so as to be indistinguishable from surrounding masonry.
- K. Flashing of Masonry Work:
1. Provide concealed flashings in masonry Work as shown. Refer to Section 07617, Elastic Masonry Flashing for type of flashing required. Prepare masonry surfaces smooth and free from projections which might puncture flashing. Place through wall flashing on bed of mortar and cover with mortar. Seal flashing penetrations with mastic before covering with mortar. Terminate flashing 1/2 inch from face of wall, unless otherwise shown.
 - a. Install elastic flashings in accordance with manufacturer's instructions.
 2. Install reglets and nailers for flashing and other related work where shown to be built into unit masonry construction Work.
- L. Collar Joints:
1. Fill the vertical space between wythes solidly with mortar by parging the in-place wythe and shoving units into the parging, for the following unit masonry construction Work:
 - a. All exterior walls, except cavity walls, and interior multi-wythe walls and partitions.
 - b. Load-bearing interior walls and partitions where metal ties or horizontal reinforcing are specified for structural bonding.
 - c. Non-load-bearing interior walls or partitions where metal ties or horizontal reinforcing are specified for structural bonding and full thickness of wall or partition is required to meet code requirements for thickness to height ratio.
- M. Anchoring Masonry Work:
1. Provide anchoring devices of the type shown and as specified under Section 04510, Masonry Accessories. If not shown or specified, provide standard type for facing and back-up involved.
 2. Anchor single wythe masonry veneer to backing with metal ties as follows:
 - a. Anchor veneer to structural members with metal anchors embedded in masonry joints and attached to structure. Provide anchors with flexible tie section, unless otherwise shown.
 - b. Space anchors as shown, but not more than 24 inches on center vertically and 36 inches on center horizontally.
 - c. Anchor veneer to concrete back up with dovetail anchors.

3.5 REPAIR, POINTING AND CLEANING

- A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point up all joints at corners, openings and adjacent Work to provide a neat, uniform appearance, properly prepared for application of sealant compounds.
- C. Cleaning Exposed, Unglazed Masonry Surfaces:
 - 1. Wipe off excess mortar as the Work progresses. Dry brush at the end of each day's work.
 - 2. Final Cleaning: After mortar is thoroughly set and cured, clean sample wall area of approximately 20 square feet as described below. Obtain ENGINEER'S acceptance of sample cleaning before proceeding to clean remainder of masonry Work.
 - a. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.
 - b. Presoak wall by saturating with water and flush off loose mortar and dirt.
 - c. Scrub down wall with stiff fiber brush and a solution of 1/2 cup of sodium hexameta phosphate and 1/2 cup of household detergent dissolved in one gallon of water.
 - d. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.
 - e. Acid cleaning of masonry shall not be permitted.
 - 3. Water Repellent Treatment: See Section 07175, Water Repellent Coatings.
- D. Protection:
 - 1. Protect the unit masonry construction Work from deterioration, discoloration or damage during subsequent construction operations. See Section 06100, Rough Carpentry.

+ + END OF SECTION + +

SECTION 04220
CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish all concrete unit masonry Work.
2. The extent of concrete unit masonry is shown.
3. The types of concrete unit masonry Work required includes, but is not necessarily limited to, the following:
 - a. Hollow load-bearing units.
 - b. Split-face hollow load-bearing units.

B. Related Sections:

1. Section 04100, Mortar.
2. Section 04510, Masonry Accessories.
3. Section 04201, Unit Masonry Construction.
4. Section 07210, Building Insulation.

1.2 QUALITY ASSURANCE

- A. Codes: Comply with applicable requirements of governing authorities and the Uniform Building Code for each type of concrete unit masonry shown or scheduled.
- B. Source Quality Control: Obtain each type of concrete unit masonry from one manufacturer, cured by one process and of uniform texture and color.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM C 33, Concrete Aggregates.
 2. ASTM C 55, Concrete Building Brick.
 3. ASTM C 62, Building Brick (Solid Masonry Units Made from Clay or Shale).
 4. ASTM C 67, Brick and Structural Clay Tile, Sampling and Testing.
 5. ASTM C 90, Hollow Load-Bearing Concrete Masonry Units.
 6. ASTM C 140, Sampling and Testing Concrete Masonry Units.
 7. ASTM C 331, Lightweight Aggregates for Concrete Masonry Units.
 8. ASTM C 426, Drying Shrinkage of Concrete Block.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. Samples of each type of concrete masonry unit specified. Select each type of concrete masonry unit to show the range of color and texture which can be expected in the finished work.

2. ENGINEER'S selections will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's specifications and test data, including notarized certification that the units comply with the specified requirements. Include instructions for handling, storage, installation and protection of concrete masonry units.
 2. Complete layout of all masonry walls showing modular planning and all special shapes to be used in the Work. Show all details for each condition encountered in the Work. Provide plans and elevations at 1/4 inch scale and details at 1-1/2 inch scale.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver concrete masonry units in original packages and pallets, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials: Store and cover concrete masonry units to prevent damage such as chipping and staining.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Size: Manufacturer's standard units with nominal face dimensions of 16-inches long by 4-inches high (15-5/8-inches by 3-5/8-inches actual).
- B. Special Shapes: Provide interior and exterior corner shapes, solid jambs, sash block, premolded control joint blocks, end blocks, bull-nosed vertical corners at all openings, lintel, bond beams and other special conditions.

2.2 CONCRETE MASONRY UNITS

- A. General: Where concrete masonry units are shown, comply with the following classification, weight, grade, curing, and other requirements as specified.
- B. Hollow Load-Bearing Concrete Masonry Units: ASTM C 90, Grade N-1.
- C. Weight: Provide lightweight units using aggregate complying with ASTM C 331 producing dry net weight of not more than 105 pounds per cubic foot.
- D. Provide two-core concrete masonry units.
- E. Exposed Faces: Provide manufacturer's standard color and texture.

2.3 SPLIT-FACE CONCRETE MASONRY UNITS

- A. General: Where split-face concrete masonry units are shown, comply with the following classification, weight, grade, curing, color and texture as specified.
- B. Hollow Load-Bearing Split-Face Concrete Masonry Units: Provide the following:
 - 1. ASTM C 55, Grade N-1.
 - 2. Minimum Compressive Strength: 3500 pounds per square inch average of five units; 3000 pounds per square inch minimum for an individual unit.
 - 3. ASTM C 62, Grade SW.
 - 4. ASTM C 426, Dry Shrinkage: 0.025 percent maximum average for five specimens.
 - 5. ASTM C 67, Saturation Coefficient: 0.75 average.
- C. Provide the following:
 - 1. Two-core split-face units with integral color.
 - 2. A complete selection of standard and custom colors for selection by ENGINEER.
 - 3. All special factory fabricated profiles as shown, specified or required for complete Work including, but not limited to, internal and external corners, sash blocks and half units.
 - 4. Color, surface texture and aggregate uniform within the normal range established by sample submission.
- D. Provide medium weight units using aggregate complying with ASTM C 33 producing dry net weight of not more than 125 pounds per cubic foot.
- E. Waterproofing Admixture: Manufacture all split-face concrete unit masonry with an integral waterproofing admixture as follows:
 - 1. Proportion: In strict accordance with manufacturer's instructions.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Dry-Block System by Forrer Chemical Company.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. See Section 04201, Unit Masonry Construction.

+ + END OF SECTION + +

SECTION 04270
GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all glass unit masonry Work.
2. The extent of glass unit masonry is shown.
3. The type of glass unit masonry Work required includes, but is not necessarily limited to, the following:
 - a. Partially evacuated double walled patterned clear glass block units.
 - b. Miscellaneous anchors, fasteners, reinforcing, packing, expansion strips, asphalt emulsion and other accessories.

B. Related Sections:

1. Section 04100, Mortar.
2. Section 05504, Miscellaneous Metal Fabrications.
3. Section 07920, Caulking and Sealants.

1.2 QUALITY ASSURANCE

- A. Allowable Tolerances: For glass unit masonry units with all edges and face dimensions made to plus or minus 1/16-inch tolerance.
- B. Codes: Comply with applicable requirements of the Uniform Building Code.
- C. Source Quality Control: Obtain each type of glass unit masonry from one manufacturer.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. One unit of each type of glass unit masonry specified and 6-inch lengths of reinforcing, packing, anchors and expansion material used in the Work.
2. ENGINEER'S review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's specifications and test data for each type of glass unit masonry specified, including certification that each type of glass unit masonry complies with the specified requirements. Include instructions for handling, storage, installation and protection of the glass unit masonry.

2. Show all details for each condition encountered in the Work at 1-1/2 inch scale including where each product specified will be used in the Work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver glass unit masonry in original packages and pallets, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials: Store and cover glass unit masonry to prevent damage such as cracking and shipping.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Size: Manufacturer's standard units with nominal face dimensions of 8-inches long by 8-inches high by 3-inches thick (7-3/4-inch by 7-3/4-inch by 3-1/8-inch actual).
- B. Provide the following physical properties:
 1. Shading Coefficient (based on 8-inch by 8-inch units): 0.65.
 2. Light Transmission: 75 percent.
 3. Weight: 5 pounds per unit.
 4. Heat Transmission: 0.56 Btu/hr/sq.ft/degree F.
- C. Expansion Strips: White polyethylene as manufactured by glass unit masonry manufacturer.
- D. Asphalt Emulsion: Water-based asphalt emulsion as recommended by glass unit masonry manufacturer.
- E. Panel Reinforcing: Panel reinforcing shall be galvanized steel double-wire mesh formed of two parallel 9 gage wires 2-inches on center with electrically welded cross ties at regular intervals.
- F. Panel Anchors: Panel anchors shall be 20 gage perforated steel strips 24-inches long by 1-3/4-inch wide galvanized after fabrication.
- G. Mortar: Type S as specified in Section 04100, Mortar plus an integral type acrylic polymer waterproofer.
- H. Packing: Polyethylene foam backer rod.
- I. Sealant: As specified in Section 07920, Caulking and Sealant.
- J. Product and Manufacturer: Provide one of the following:
 1. Delphi Thinline Series Glass Block by Pittsburgh Corning Corporation.
 2. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine areas and conditions under which glass unit masonry Work is to be installed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Sill areas to be covered by mortar shall have a heavy coat of asphalt emulsion. Allow emulsion to dry before placing mortar.
- B. Adhere expansion strips to jamb and head with asphalt emulsion using technique recommended by the glass unit masonry manufacturer. Insure that expansion strips extend to sill.
- C. Set a full mortar bed joint, applied to sill.
- D. Set lower course of glass unit masonry. All mortar joints shall be full and not furrowed. Do not use steel tools to tap glass unit masonry into position.
- E. Install panel reinforcing in horizontal joints 24-inches on centers maximum. Install horizontal joint reinforcing in joints immediately above and below all openings within or discontinuities in glass unit masonry even if this results in spacing less than 24-inches. Reinforcing shall run continuously from end to end of glass unit masonry panels and shall be lapped not less than 6-inches whenever it is necessary to use more than one length.
- F. Install horizontal joint reinforcing by placing lower half of mortar in bed joint. Press panel reinforcing into place. Cover panel reinforcing with upper half of mortar bed and trowel smooth. Do not furrow mortar bed.
- G. Place full mortar bed for joints not requiring panel reinforcing. Do not furrow.
- H. Strike joints smooth while mortar is still plastic and before final set. At this time rake out all spaces requiring sealant to a depth equal to the width of the spaces.
- I. Remove surplus mortar from faces of glass unit masonry and wipe dry. Tool joints smooth and concave before mortar takes final set.
- J. After final mortar set install packing tightly between glass unit masonry panel and jamb and head construction. Leave space for sealant.
- K. Apply sealant evenly to the full depth of recesses and in accordance with the sealant manufacturer's written instructions.

3.3 PROTECTION AND CLEANING

- A. Remove surplus mortar from faces of glass unit masonry at the time joints are tooled. Wipe faces of glass unit masonry dry.
- B. Final cleaning of glass unit masonry shall be accomplished using techniques recommended by manufacturer of glass unit masonry.

+ + END OF SECTION + +

SECTION 04510

MASONRY ACCESSORIES

PART 1 - GENERAL1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish all masonry accessories Work.
2. This Section specifies the masonry accessories for Work specified in the following:
 - a. Section 04201, Unit Masonry Construction.
 - b. Section 04220, Concrete Unit Masonry.
3. The types of masonry accessories Work required includes, but is not necessarily limited to, the following:
 - a. Continuous horizontal wire reinforcing and ties.
 - b. Anchoring devices.
 - c. Miscellaneous masonry accessories.

B. Related Sections:

1. Section 04100, Mortar.
2. Section 04201, Unit Masonry Construction.
3. Section 04270, Glass Unit Masonry
4. Section 05504, Miscellaneous Metal Fabrications.
5. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- A. Codes: Comply with the applicable requirements of the Uniform Building Code for types of masonry accessories Work shown and specified.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 1. ASTM A 82, Cold-Drawn Steel Wire for Concrete Reinforcement.
 2. ASTM A 153, Zinc-Coating (Hot Dip) on Iron and Steel Hardware.
 3. ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 4. ASTM A 663, Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
 5. ACI 315, "Manual of Standard Practice for Detailing Reinforced Concrete Structures."
- C. Design Criteria: Provide masonry accessories as required by the Uniform Building Code to provide Work meeting all criteria for special inspection approval.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. 6-inch lengths of each item specified.

2. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval copies of manufacturer's specifications and installation instructions for each masonry accessory required. Include data substantiating that materials comply with specified requirements, and where each masonry accessory shall be used in the Work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver accessories in original packages, plainly marked with identification of materials and manufacturer.
- B. Storage of Materials: Store and cover materials to prevent corrosion and deterioration.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Continuous Horizontal Wire Reinforcing and Ties for Masonry: Provide the following unless otherwise shown:
1. General: Welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner "L" and intersection "T" units. Fabricate from cold-drawn steel wire complying with ASTM A 82, with deformed continuous 9 gage side rods and plain 9 gage cross rods, crimped for cavity wall construction, if any, with unit width of 1-1/2 to 2 inches less than thickness of wall or partition. All reinforcing and ties shall be hot dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-1 unless otherwise specified.
 2. For single-wythe and multi-wythe (except cavity wall) masonry, use units fabricated as follows:
 - a. Truss-type fabricated with one horizontal rod beneath each unit masonry shell wall and continuous diagonal cross-rods spaced not more than 16 inches on centers.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Blok-Trus AA600 by AA Wire Products Company.
 - 2) Or equal.
- B. Anchoring Devices for Masonry: Provide the following unless otherwise shown:
1. General:
 - a. Unless otherwise specified all anchoring devices for masonry shall be hot dipped galvanized after fabrication with 1.5 ounces per square foot of zinc coating complying with ASTM A 153, Class B-1 and B-2, crimped for cavity wall construction.
 - b. Flexible Anchors: Whenever masonry abuts structural walls or framework provide flexible anchors which permit horizontal and vertical movement of masonry but provides lateral restraint.

2. For anchorage to concrete structure provide the following:
 - a. Two-piece anchors with 24 gage sheet metal dovetail and 16 gage rectangular corrugated tie 1-inch wide, sized to extend to within one inch of face of masonry or to a depth of 12 inches.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) No. AA100 Dovetail and AA201, AA202, and AA205 Anchors by AA Wire Products Company.
 - 2) Or equal.
 3. For anchorage to steel framework provide the following:
 - a. Two-piece anchors with 8-inch long channel slot fabricated from 11 gage steel and 16 gage rectangular corrugated 1-inch wide tie sections sized to extend within one inch of opposite face of masonry, to a depth of 12 inches abutting flanges, or between 1-1/2 inch and 2 inches less than width of masonry abutting web.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) No. AA209 Channel and AA210 Tie by AA Wire Products Company.
 - 2) Or equal.
 4. For anchorage to flanges of steel columns provide the following:
 - a. Two-piece anchors with round continuous rods of 1/4-inch steel 10 foot-0 inches long and triangular rods of 1/4-inch round steel, sized to extend within 5/8 inches of the face of masonry.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) No. AA401 Continuous and Flex-0-Lok AA400 by AA Wire Product Company.
 - 2) Or equal.
 5. For anchorage of partitions to existing concrete structure provide the following:
 - a. Two-piece anchors with 11 gage sheet metal channel slot 8-inches long and 12 gage rectangular corrugated tie 1-inch wide, sized to extend to within one inch of face of masonry or to a depth of 12 inches.
 - b. Two 1/2-inch by 2-inch long stainless steel expansion bolts per channel slot.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) No. 362 Gripstay Channels and No. 364 Corrugated Gripstay Anchor by Hohmann and Barnard Incorporated.
 - 2) No. AA209 Channel Slot and AA 210 Anchor by AA Wire Products Company.
 - 3) Or equal.
 6. Lateral Supporting Masonry Wall Anchors: Provide galvanized steel 1/4-inch thick by 1-inch wide of length sufficient to extend to center of each wythe shop-fabricated with 5/8-inch long legs bent at 90 degrees to flat face of anchor.
- D. Miscellaneous Masonry Accessories: Provide the following where shown:
1. Reinforcing Bars:
 - a. Deformed carbon steel, ASTM A 615, Grade 60 for bars No. 3 to No. 18 except as otherwise shown.
 - b. Plain carbon steel, ASTM A 663, Grade 80 where No. 2 bars are shown or required.

- c. Provide galvanized steel reinforcing bars complying with ASTM A 153, Class B-1, where shown.
- 2. Premolded Control Joint Strips: Solid polyvinyl chloride strips with a Shore A durometer hardness of 80 to 90, designed to fit standard sash block and maintain lateral stability in masonry wall, size and configuration shall be as specified.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Blok-Tite AA2003, AA2005 by AA Wire Products Company.
 - 2) Or equal.
- 3. Compressible Filler:
 - a. Use foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50 percent of its original volume, filler shall hold six feet of water hydrostatically, and 10 feet at 60 percent compression. Filler shall maintain its resiliency to allow for installation in temperatures as low as 40 F. Filler shall be waterproof when compressed to 50 percent of its original volume in temperatures from -40 F to +200 F. Elongation shall be at least 325 percent with a tensile strength of not less than 53 pounds per square inch. No migration of polybutylene compound in the polyurethane strip will be allowed.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Polytite by Sandell Manufacturing Company.
 - 2) Compriband by Secoa Corporation, Division of Phoenix Building Products, Incorporated.
 - 3) Or equal.
- 4. Sealants: Section 07920, Calking and Sealants.
- 5. Cavity Fill Mesh: Provide hot dip galvanized 1/2-inch mesh hardware cloth, backed with asphalt impregnated cloth below. Install below all block courses that are to be filled with mortar.

2.2 FABRICATION

- A. Weld-in-place all channel slots and other specified weld-on anchors at the shop. Field welding is not acceptable.
- B. Coordinate location of all weld-on anchors and show on structural steel Shop Drawings included under Section 05120, Structural Steel.
- C. Weld anchor slots and other required accessories in place before shop priming of structural steel.
- D. Prime all weld-on anchors and other accessories and passivate anchor coating as required and specified under Section 09900, Painting.
- E. Shop-fabricate reinforcing bars which are shown or required to be bent or hooked. Comply with ACI 315 for the fabrication of reinforcing steel for unit masonry construction Work.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to the following:
1. Section 04201, Unit Masonry Construction.

+ + END OF SECTION + +

METALS
Division 5

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to provide the structural steel, including surface preparation and shop priming, as shown and specified.
2. Structural steel is that work defined in AISC "Code of Standard Practice", Section 2, and as shown. The Work also includes:
 - a. Providing openings in and attachments to structural steel to accommodate the Work under this and other Sections and providing for the structural steel all items such as anchor bolts, studs and all items required for which provision is not specifically included under other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the structural steel.

C. Related Work Specified Elsewhere:

1. Section 03600, Grout.
2. Section 05504, Miscellaneous.
3. Section 09900, Painting (Specification for surface preparation and shop priming is under Section 09900).
4. Installation of anchor bolts for columns.
5. Installation of embedded plates for steel framing.

1.2 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. CONTRACTOR shall conform to all applicable requirements of Sections Nos. 515 and 770 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.

B. Reference Standards and Codes: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. ASTM A 36, Structural Steel.
2. ASTM A 108, Cold Finished Carbon Steel Bars and Shafting.
3. ASTM A 307, Carbon Steel Externally and Internally Threaded Standard Fasteners.
4. ASTM A 325, High Strength Bolts for Structural Steel Joints, Including Suitable Nuts and Plain Hardened Washers.

5. ASTM A 490, Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints.
 6. AWS D1.1, Structural Welding Code.
 7. AREA, Manual of Railway Engineering.
 8. AISC, Manual of Steel Construction".
 9. AISC, Code of Standard Practice for Steel Buildings and Bridges.
 10. AISC, Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings and including the Commentary and Supplements thereto as issued.
 11. AISC, Specifications for Structural Joints using ASTM A 325 or A 490 Bolts, approved by the Research Council on Riveted and Bolted Structural Joints (RCRBSJ) of the Engineering Foundation.
- B. Design of Members and Connections:
1. All details shown are typical; similar details apply to similar conditions, unless otherwise shown or specified. Verify dimensions at the site without causing delay in the Work.
 2. CONTRACTOR shall examine conditions under which structural steel is to be provided, and notify ENGINEER in writing of unsatisfactory conditions existing or whenever design of members and connections may not be clearly indicated. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.
- C. Source Quality Control:
1. Materials and fabrication procedures shall be subject to inspection and tests in the mill, shop, and field, conducted by a qualified inspection agency. Such inspections and tests will not relieve the CONTRACTOR of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
 2. Fabrication shall be performed by a structural steel fabricating plant possessing a current certificate from AISC stating that the plant satisfies the requirements for certification for Category II of the AISC Quality Certification Program. The plant shall maintain this certification for the entire time fabrication for this project is being performed.
- D. Qualifications for Welding Work:
1. Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code" D1.1, Section 5, Qualification.
 2. Provide certification that all welders employed on or to be employed for the work have satisfactorily passed AWS qualification tests within the previous 12 months. CONTRACTOR shall ensure that all certifications are kept current.

1.3 SUBMITTALS

- A. Shop Drawings:
1. Submit for approval Shop Drawings including complete details and schedules for fabrication and shop assembly of members and details, schedules, procedures and diagrams showing the sequence of erection.

- a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
- b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages.
2. Submit for approval, copies of manufacturer's specifications and installation instructions for products listed below. Include laboratory test reports and other data as required to show compliance with these specifications.
 - a. Structural steel of each type, including certified copies of mill reports covering the chemical and physical properties.
 - b. High-strength bolts of each type, including nuts and washers.
 - c. Unfinished bolts and nuts.
 - d. Touch-up field primer paint.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site at such intervals to insure uninterrupted progress of the Work.
 1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that Work.
- B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
 1. Do not store materials on the structure in a manner that might cause distortion or damage to the members or the supporting structures. Repair or replace damaged materials or structures as directed.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Rolled Steel Plates, Shapes and Bars: ASTM A 36, except where other type steel is shown.
- B. Crane Rails: As shown and as noted in the AISC Manual.
 1. Provide rails with tight end joints suitable for crane service with joint bars matching the rail sections, joint bar bolts and nuts complying with ASTM A 325 with AREA alloy steel spring washers, and fixed or floating type rail clamps, as required to suit the conditions shown.
- C. Anchor Bolts: ASTM A 307, nonheaded type unless otherwise shown or specified.
- D. Headed Stud Type Shear Connectors: ASTM A 108, Grades 1010-1020, with dimensions complying with AISC Specifications, or equal.

- E. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts.
 - 1. Provide hexagonal heads and nuts for all connections.
- F. High-Strength Threaded Fasteners: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, as follows:
 - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325 or:
- G. Electrodes for Welding: E70XX complying with AWS D1.1, Design of New Buildings, Section 8. AWS D1.1.
- H. Surface Preparation and Shop Priming: All structural steel shall be primed in the shop. Surface preparation and shop priming are included herein but are specified in Section 09900, Painting.

2.2 FABRICATION

- A. Shop Fabrication and Assembly:
 - 1. General:
 - a. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with AISC, Manual of Steel Construction, and as shown on the Shop Drawings. Provide camber in structural members as shown.
 - b. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
 - c. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
- B. Connections:
 - 1. Shop Connections:
 - a. Unless otherwise shown, shop connections may be welded or high strength bolted. Unless shown otherwise, all welds shall be 1/4-inch minimum.
 - b. Wherever reaction values of a beam are not shown, the connections shall be designed to support the total uniform load capacity tabulated in the AISC tables for allowable loads on beams for the given shape, span, and steel specified for the beam in question.
 - c. Shop welded connections shall be designed to eliminate or minimize eccentricity. The size, extent, location and type of all shop welds shall be clearly shown on the Shop Drawings by use of AWS standard notations and symbols.
 - d. End connection angles fastened to the webs of beams and girders and the thickness of the angles, size and extent of fasteners or shop welds shall conform to tables of "Framed" and "Heavy Framed" beam connections in the AISC Manual. All connections shall be two sided, unless otherwise shown.

2. Field connections:
 - a. All field connections unless otherwise specified below or noted shall be made with high strength bolts, and shall be bearing type connections.
 - b. Field welding is permitted only where noted or approved by the ENGINEER.
 3. High-Strength Bolted Construction:
 - a. Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).
 - b. High strength bolt design shear values shall be as specified in the AISC Manual for bolts with threads in the shear plane.
 - c. The minimum size of bolts shall be 3/4-inch diameter, unless otherwise noted.
 4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.
 - a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
 5. Where rigid connections are required by the stresses shown, web shear reinforcement and stiffeners per AISC Specifications shall be provided.
 6. All moment connections shall be designed for bending moments shown and shall conform to the details shown.
 7. Shear Connectors: Install stud shear connectors in accordance with AWS D1.1 Section 4, and as recommended by the manufacturer.
- C. Bracing:
1. Bracing, for which a calculated stress is not shown, shall have a minimum two bolt connection, or a shop welded connection of equivalent strength.
 2. Vertical bracing and knee braces connecting to columns shall be on the centerline of the columns, unless otherwise noted.
 3. Knee braces shall be at 45 degree angle, unless shown or noted.
 4. All gussets shall be minimum 3/8-inch thick, unless otherwise shown.
- D. Columns: Column shafts shall have "finished" bearing surfaces at the base and at all splice lines.
- E. Structural Tubing: Structural tubing shall be properly sealed to protect the internal surfaces.
- F. Monorails:
1. All hoist beam splices shall be smooth and positive and keep the track in perfect alignment both horizontally and vertically. The top joint plate shall keep the splice from spreading and develop full strength at the splice. The splice shall be located as close as possible to the track support.
 2. Clamps for connecting hoist beams to support beams shall be of the flush type and suitable for the loads shown.
 3. Coordinate monorail work with Section 14310 of these Specifications.

- G. Holes and Appurtenances for Other Work:
1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the Shop Drawings. If large block-outs are required and approved, the webs shall be reinforced to develop specified shears. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
 2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
 3. Coordinate as specified in paragraph 1.1.B.

PART 3 - EXECUTION

3.1 ERECTION

- A. General: Comply with the AISC Specifications and Code of Standard Practice, and as herein specified.
- B. Surveys: Provide services of a registered surveyor to check lines and elevations of concrete and masonry bearing surfaces, and locations of anchor bolts and similar devices before steel erection proceeds. Discrepancies shall be reported immediately to the ENGINEER. Do not proceed with erection until corrections have been made, or until compensating adjustments to the structural steel work have been agreed upon with the ENGINEER.
- C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of the structures as erection proceeds.
- D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the Work. CONTRACTOR shall provide sufficient planking to meet OSHA requirement of a tightly planked substantial floor within 2 stories or 30 feet, whichever is less, below each tier of steel beams on which Work is performed.
- E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work.
1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
 - a. Refer to Division 3 of these Specifications for anchor bolt installation requirements in concrete, and Division 4 for installation in masonry.
- F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.
1. Set loose and attached base plates and bearing plates for structural members on steel wedges or other adjusting devices.

2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
 3. Place grout between bearing surfaces and bases or plates as specified in Section 03600. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.
 4. Leveling plates and wood wedges will not be permitted.
- G. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of the structure within tolerances as specified in AISC Manual. For members requiring accurate alignment, clip angles, lintels and other members shall be provided with slotted holes for horizontal adjustment at least 3/8 inch in each direction, or more when required.
 2. Splice members only where shown or specified.
- H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.
- I. Comply with AISC Manual for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.
1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.
- J. Gas Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to the ENGINEER. Finish gas-cut sections equal to a sheared appearance when permitted.
- K. Crane Runways:
1. Install runways complete with rails, crane stops and other required items. Set and adjust the gage, alignment and elevation of the crane rails to tolerances of AISC for crane rails, unless otherwise shown. Stagger joint locations in opposite rails. Rail joints shall also be at least 24 inches from crane girder joints. Provide flush joints at the top of all crane rails.
- L. Touch-Up Painting:
1. Unless otherwise specified below comply with all requirements of touch-up painting in Section 09900.

2. Immediately after erection, clean field welds, bolted connections, and all damaged and abraded areas of the shop paint. Apply paint to exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

+ + END OF SECTION + +

SECTION 05310
METAL ROOF DECKING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals required to provide the galvanized metal roof decking as shown and specified.
2. Metal roof decking work shall include roof sump pans, cant strips, ridge and valley plates, and metal closure strips. The Work also includes:
 - a. Cutting and flashing of openings to accommodate the Work under this and other Sections, and providing for the metal roof decking all items required for which provision is not specifically included under other Sections.
3. Finish painting shall be as specified in Section 09900 of the Specifications.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the metal roof decking.

C. Related Work Specified Elsewhere:

1. Section 03100, Concrete Formwork.
2. Section 05120, Structural Steel.
3. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Reference Standards and Codes: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified:

1. AISI, Specification for the Design of Cold-Formed Steel Structural Members.
2. AWS D1.1, Structural Welding Code.
3. SDI, Steel Roof Deck Design Manual.
4. ASTM A 36, Structural Steel.
5. ASTM A 446, Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
6. MIL-P-21035, (Ships) Paint, High Zinc Dust Content, Galvanizing Repair.

B. Unless otherwise specified or indicated on the Drawings, design, fabrication, and erection shall be in accordance with the current edition of the American Iron and Steel Institute's "Light Gauge Steel Design Specification." Steel decking shall be delivered, stored, handled, and installed in such a manner that it will not be damaged or deformed.

- C. Design of Decking and Connections:
 - 1. All details shown are typical; similar details apply to similar conditions, unless otherwise shown or specified. Verify dimensions at the site without causing delay in the Work.
- D. Qualification of Welding Work:
 - 1. Qualify welding processes and welding operators in accordance with AWS D1.1, Section 5 - Qualification.
 - 2. Decking welded in place is subject to inspection and testing. Expense of removing and replacing any portion of decking for testing purposes will be borne by the OWNER if welds are found to be satisfactory; otherwise CONTRACTOR shall pay all costs involved. Remove Work found to be defective and provide new acceptable Work.

1.3 PERFORMANCE REQUIREMENTS

- A. Compute the properties of metal roof deck sections on the basis of the effective design width as limited by the provisions of the AISI Specifications. Provide no less than the deck section properties shown, including section modulus and moment of inertia per foot of width.
- B. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/240 of the clear span under the total uniform dead and live load.
- C. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 30 pounds per square foot.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit for review Shop Drawings showing layout of deck panels, anchorage details and every condition requiring closure panels, supplementary framing, special jointing or other accessories.
 - 2. Manufacturer's certified mill analysis and test reports covering all decking to be provided.

1.5 DELIVERY, HANDLING AND STORAGE

- A. Deliver steel decking materials to the site tagged and marked.
- B. Decking stored at the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable weathertight covering.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Galvanized Steel Sheet: ASTM A 446, Grade C. Before forming, the steel receive a protective metal coating of zinc conforming to ASTM A 525, with a minimum of 0.5 ounce zinc per square foot. The decking shall be 20 gauge unless noted otherwise on the Drawings.
- B. Decking shall be as manufactured by Vulcraft, or approved equal.
- C. Deck sections shall be as shown on the Drawings. Decking having cross-sectional properties which differ from the indicated may be used, provided that the structural properties of the proposed decking, when combined with the required concrete fill, are equal to, or greater than, the structural properties of the decking indicated. The diaphragm shear values established by test shall be equal to shear values established for the decking indicated.
- D. Decking, where indicated, shall have sheet lengths that cover three or more spans wherever practicable.
- E. Accessories shall be formed of the same material as used for the steel deck. Deck units receiving concrete fill shall be formed with integral locking lugs or embossments to provide a mechanical lock between the steel deck and the concrete.
- F. Miscellaneous Steel Shapes: ASTM A 36.
- G. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine conditions under which decking is to be installed, and notify ENGINEER in writing of unsatisfactory condition existing or whenever design of decking and connection may not be clearly indicated. Do not proceed with the Work until unsatisfactory conditions or deficiencies have been corrected in a manner acceptable to ENGINEER.

3.2 WORKMANSHIP

- A. Prior to commencement of any work, the deck manufacturer shall furnish an affidavit certifying to the yield strength, unit design stress, and gauge of the metal which will be used for the deck fabrication and test-established diaphragm shear values for the deck supplied using indicated connections.

- B. Metal decking shall be installed according to the manufacturer's recommendations. The decking manufacturer's recommendations, as approved are hereby made a part of these Specifications.
- C. Failure to conform to this requirement shall be ample justification for rejection of the material.
- D. Steel decking shall be provided complete including all cutting, shaping, fitting, drilling, welding, ridge plates, valley plates, reinforcing plates for all openings in the deck and miscellaneous pieces necessary for proper installation and weathertight construction.
- E. The CONTRACTOR shall submit complete erection drawings to the ENGINEER for review prior to erection in accordance with Section 01341, Shop Drawings and Correspondence Procedure. These drawings shall show type of decking section, adaptations around openings and other special conditions, method of welding sections to supporting structural steel, procedure for attaching end closure plates, end butt joint cover plates, and miscellaneous flashing. Where the steel beams or decking are to support loads, framing, monorails, hangers, or any other items effecting design and detailing of connections, the CONTRACTOR shall obtain shop drawings from all subcontractors, review these shop drawings, coordinate all interrelated work and submit a complete combined submittal.
- F. Special care shall be exercised not to damage or overload the deck during installation. The maximum uniform distribution load shall not exceed 20 pounds per square foot. The decking shall not be used for storage or as a working platform until the sheets have been welded in position. Decking stored at the site before erection shall be stacked on platforms or pallets and covered with tarpaulins or other suitable weathertight covering.
- G. Deck units shall not be placed on supporting members until all connections are completed and the supporting assembly has its final design strength and capacity.
- H. Decking shall be installed in a continuous operation to avoid delays in the construction.
- I. The steel deck units shall be placed on the supporting framework, aligned, and adjusted to final position before being permanently fastened.
- J. If the supporting beams are not properly aligned or sufficiently level to permit proper bearing of steel units, the CONTRACTOR shall take corrective action to insure properly aligned work.
- K. The decking sheet shall be formed at the longitudinal sides in such a manner that they will overlap and/or interlock, and preclude the possibility of the dripping of any cement paste from the concrete placed on it. All interlocking seams shall be button punched at 36 inches o.c. unless indicated otherwise on the Drawings. End laps shall occur over bearings only.

- L. Where the end of sheets overlap, they shall be die-formed in such manner that the sheet in the next row telescopes and snugly overlaps the sheet laid previously; end overlaps at bearings shall not be less than 2 inches. Sheets that abut at supports without overlapping may be provided, in which case, steel underlapping die-formed sleeves, having a minimum width of 2 inches, shall be provided to connect the abutting sheets. Where the ends of the decking sheets abut without overlapping at the supports, each end of the decking sheets shall have a minimum bearing of three inches on the supports and shall be welded to the supports as the underlapping sleeve connectors are installed.
- M. The steel decking shall provide a continuous uniform slope with practically flush top surfaces and shall be installed in straight and continuous rows as far as practicable, with ribs at right angles to the supporting members.
- N. All openings in the deck shall be cut and fitted neatly and shall be reinforced with structural steel members or as indicated on the Drawings. Openings less than 24 inches and greater than 12 inches in their longest dimension and not shown as reinforced with structural steel members shall have two #4 reinforcing bars placed each side of the opening in the direction perpendicular to the decking ribs, and one #4 bar each side parallel to the ribs. The #4 bars shall extend 24 inches minimum beyond the opening at each side. Additional reinforcement is not required for openings 12 inches and under in their longest dimension.
- O. Flashing: Provide zinc coated continuous flashing for deck units at openings and at deck perimeters, if necessary, in order to contain concrete fill. Flashing shall be detailed and installed to prevent concrete leakage.
- P. Connection Plates: Provide 14 gauge galvanized bent plate sections as shown or required over perimeter and interior framing to allow specified welding to parallel supports.
- Q. Where suspended ceilings occur, appropriate hanger supports shall be provided; coordinate with ceiling system manufacturer and installer.
- R. After erection, all damaged surfaces shall be primed with a zinc dust type primer paint.
- S. All Work not in conformance with these Specifications and /or generally accepted standards of the trade will be deemed defective by the ENGINEER and will be rejected. All Work which is defective shall be corrected or replaced as directed by the ENGINEER. Corrections, redesign, and replacement of defective Work shall be at the CONTRACTOR'S expense.
- T. After erection, all surfaces shall be cleaned and left free of all grime and dirt. Decking shall be cleaned with solvents if necessary to provide a surface which will readily bond with concrete fill. Remove unused materials, tools, scaffolding, and debris from the premises and leave the area broom clean.

3.3 WELDING

- A. Steel deck unit shall be fastened to steel framework by the arc welding process. Welds shall be free of sharp points or edges. All welds shall be cleaned immediately by chipping or wire brushing and shall be coated with a zinc dust type primer paint.
- B. Welding shall conform to the applicable requirements of the AISC "Light Gauge Steel Design" and all welding shall be done by qualified welders. Welder qualifications shall be in accordance with AWS Specification B3.0, "Standard Qualification Procedures".
- C. Decking sheets shall be fastened to the steel framework at all intermediate supports perpendicular to the deck ribs by 5/8-inch diameter puddle welds at each deck rib unless indicated otherwise on the Drawings.
- D. Weld deck units to parallel framing supports with 5/8-inch diameter puddle welds at 16 inches on center unless indicated otherwise on the Drawings.
- E. Welding at diaphragm boundaries shall be 5/8-inch puddle welds at 16 inches on center unless indicated otherwise on the Drawings.
- F. Weld all connection angles and plates to supporting members and decking with 5/8-inch diameter fusion welds at 12 inches on center, unless indicated otherwise on the Drawings.
- G. Any weld found to be defective shall be replaced before concrete is placed. Decking shall be erected and properly aligned prior to welding.

+ + END OF SECTION + +

SECTION 05503

ANCHOR BOLTS, EXPANSION ANCHORS AND CONCRETE INSERTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide anchor bolts, expansion anchors and concrete inserts as shown and specified.
- B. This Section includes all bolts, anchors and inserts required for the Work but not specified under other Sections.
- C. The types of work using the bolts, anchors and inserts include, but are not limited to the following:
 - 1. Baffles and weirs.
 - 2. Rails.
 - 3. Sluice and slide gates.
 - 4. Hangers and brackets.
 - 5. Equipment.
 - 6. Piping.
 - 7. Tanks.
 - 8. Grating and floor plate.
 - 9. Electrical, Plumbing and HVAC Work.
 - 10. Wood and plastic fabrications.
 - 11. Partitions and ceilings.
- D. Related Work Specified Elsewhere:
 - 1. Section 05120, Structural Steel.
 - 2. Section 05504, Miscellaneous Metal Fabrications.
 - 3. Section 05523, Aluminum Handrails and Railings.
 - 4. Section 15094, Pipe Hangers and Supports.

1.2 QUALITY ASSURANCE

- A. Standard Specifications and Details:
 - 1. CONTRACTOR shall conform to all applicable requirements of Section 770 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments as supplemented by the City of Phoenix. Where there is a conflict between the MAG Specifications as supplemented by the City of Phoenix and this Specification the provisions of this Specification will apply.
- B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
 - 1. ASTM A 307, Carbon steel Externally and Internally Threaded Standard Fasteners.
 - 2. ASTM A 320, Alloy-Steel Bolting Materials for Low-Temperature Service.

- C. Expansion anchors and inserts shall be UL or FM approved.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. Representative samples of bolts, anchors and inserts as may be requested by the ENGINEER. His review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 - 1. Setting drawings and templates for location and installation of anchorage devices.
 - 2. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the devices.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt, expansion anchor, or concrete insert is not shown on the Drawings, provide the size, length and capacity required to carry the design load times a minimum safety factor of four.
- B. Determine design loads as follows:
 - 1. For equipment anchors, use the design load recommended by the manufacturer and approved by the ENGINEER.
 - 2. For pipe hangers and supports, use one half the total weight of pipe, fittings, valves, accessories and water contained in pipe, between the hanger or support in question and adjacent hangers and supports on both sides.
 - 3. Allowances for vibration are included in the safety factor specified above.
- C. Anchor bolts for equipment frames and foundations shall be designed in accordance with the Uniform Building Code for seismic zone 2.

2.2 MATERIALS

- A. Anchor Bolts:
 - 1. Anchor bolts shall be as specified in Part B Specification, Section 050521.
- B. Expansion Anchors:
 - 1. Provide zinc plated anchors. Anchors shall be ASTM A304 and of the size required for the concrete strength specified. Provide stud type (male thread) or flush type (female thread), as required.
 - 2. Product and Manufacturer: Provide anchors by one of the following:
 - a. Molly Division of USM Corporation.
 - b. Hilti, Incorporated.
 - c. Or equal.

3. In buried or submerged locations, provide stainless steel anchors complying with ASTM 316. Other AISI types may be used, subject to ENGINEER'S approval.
- C. Concrete Inserts:
1. For piping, grating and floor plate, provide malleable iron inserts. Provide those recommended by the manufacturer for the required loading.
 2. Finish shall be black.
 3. Product and Manufacturer: Provide one of the following inserts:
 - a. Figure 282 by ITT Grinnell.
 - b. No. 380 by Hohmann and Barnard, Inc.
 - c. Or equal.
- D. Power actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by ENGINEER.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
- B. Assure that embedded items are protected from damage and are not filled in with concrete.
- C. Expansion anchors may be used for hanging or supporting pipe 2 inches diameter and smaller. Expansion anchors shall not be used for larger pipe unless otherwise shown or approved by the ENGINEER.
- D. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
- E. Unless otherwise shown or approved by ENGINEER conform to following for expansion anchors:
 1. Minimum embedment depth in concrete: 5 diameters.
 2. Minimum anchor spacing on centers: 10 diameters.
 3. Minimum distance to edge of concrete: 5 diameters.
 4. Increase dimensions above if required to develop the required anchor load capacity.

3.2 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

+ + END OF SECTION + +

SECTION 05504

MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all miscellaneous metal fabrications Work, including surface preparation and shop priming.
2. The extent of miscellaneous metal fabrications is shown or scheduled and includes items fabricated from iron, steel and aluminum shapes, plates, bars, castings and extrusions, which are not a part of other metal systems covered by other Sections of these Specifications.
3. The types of miscellaneous metal fabrications Work required includes, but is not necessarily limited to, the following:
 - a. Ladders.
 - b. Ladder safety cages.
 - c. Fall prevention system.
 - d. Loose steel lintels.
 - e. Extruded aluminum stair nosings.
 - f. Cast-in-place shelf angle supports.
 - g. Shelf angles.
 - h. Cast-in-place reglets.
 - i. Cast-in-place continuous channel inserts.
 - j. Expansion shield fasteners.
 - k. Miscellaneous framing and supports.
 - l. Manhole steps.
 - m. Truck bollards.
 - n. Emergency scuppers.
 - o. Miscellaneous accessories and fasteners.
 - p. Ornamental grilles.

B. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 04201, Unit Masonry Construction.
3. Section 07619, Flashing and Trim.
4. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- ###### A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ASTM A 36, Structural Steel.
 2. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
 3. ASTM A 153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

4. ASTM A 167, Plate, Sheet and Strip, Type 304 or 316.
 5. ASTM A 240, Heat Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels.
 6. ASTM A 276, Bars and Shapes, Type 304 or 316.
 7. ASTM A 320, Alloy Steel Bolting Material for Low Temperature Service.
 6. ASTM A 386, Zinc Coating (Hot-Dip) on Assembled Steel Products.
 7. ASTM A 500-84, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 8. ASTM B 209, Aluminum-Alloy Sheet and Plate.
 9. ASTM B 211, Aluminum-Alloy Bars, Rods and Wire.
 10. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 11. ASTM B 308, Structural Aluminum.
 12. ANSI A14.3, Safety Requirements for Fixed Ladders.
 13. AWS D1.1, Structural Welding Code.
 14. AISI Standards for Stainless Steel.
- B. Design Criteria: The size and spacing of expansion bolts, anchor bolts, cast-in-place inserts and similar items shown or specified shall be considered the minimum acceptable size. Final selection of these items shall be based upon the actual design load times a minimum safety factor of four. Where the size and spacing of expansion bolts, anchor bolts, cast-in-place inserts and similar items are not shown or are not specified CONTRACTOR shall provide such items of sufficient size, length, load carrying capacity and spacing required to carry the design load times a minimum safety factor of four. Provide non-corrodible materials for all such items.
- C. Field Measurements: Take field measurements where required prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- D. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 SUBMITTALS

- A. Samples: Submit for approval sets of representative samples of materials including nosings, rungs and other finished products as may be requested by ENGINEER. Review will be for color, texture, style, and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for the fabrication and erection of all assemblies of miscellaneous metal fabrications Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Include setting drawings and templates for location and installation of miscellaneous metal fabrications items and anchorage devices.

2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions for products to be used in miscellaneous metal fabrications Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel Sheet and Plate: ASTM A 240.
- B. Stainless Steel Bars and Shapes: ASTM A 276.
- C. Steel Plates, Bars and Shapes: ASTM A 36.
- D. Aluminum:
 1. Alloy and Temper: Provide alloy and temper as shown or specified, or as otherwise recommended by the aluminum producer or finisher.
 2. Extruded Shapes and Tubes: ASTM B 221.
 3. Plate and Sheet: ASTM B 209.
 4. Bars, Rods and Wire: ASTM B 211.
 5. Finish: Provide Architectural Class I anodized finish AA-M32C22A41 Clear as specified in the NAAMM Manual.
- E. Stainless Steel Fasteners and Fittings: ASTM A 320. The threads of stainless steel bolts shall be coated, prior to installing the nut, with Never-Seez manufactured by Never Seez Compound Corporation; WLR No. 111 manufactured by Oil Research, Inc.; or equal.
- F. Zinc Coated Hardware: ASTM A 153.
- G. Structural Steel Tubing: ASTM A 500, Grade B.

2.2 MISCELLANEOUS METAL ITEMS

- A. Aluminum Ladders:
 1. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as shown and specified. Comply with the requirements of ANSI A14.3, except as otherwise shown or specified.
 - a. Unless otherwise shown, provide aluminum pipe, ASTM B 429, 554, 1.90-inch outside diameter, Schedule 80 side rails spaced 18 inches apart, minimum.
 - b. Provide solid aluminum square rungs, spaced 12 inches on centers, maximum, with non-slip surface on the top of each rung.
 2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
 3. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on centers. Use welded or bolted brackets, designed for adequate support and anchorage, and to hold the ladder clear of the wall surface with a minimum of 7 inches clearance from wall to centerline of rungs. Extend rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided. If the adjacent structure does not extend above the top rung, goose-

neck the extended rails back to the structure to provide secure ladder access.

- B. Aluminum Ladder Safety Cages:
1. Fabricate ladder safety cages from flat bars, assembled by welding. Unless otherwise shown, provide 1/2-inch by 3-inch top, bottom and intermediate hoops spaced not more than 5 feet on centers; and 3/8-inch by 2-inch vertical bars, secured to each hoop. Space vertical bars approximately 9 inches on centers. Fasten assembled safety cage to ladder rails and adjacent construction as shown. Grind all welds, sharp edges and projections smooth.
 2. Comply with the requirements of ANSI A14.3.
- C. Fall Prevention System: All ladders shall be provided with a fall prevention system. The system shall meet OSHA standards.
1. The system shall consist of a rail permanently attached to the ladder to which a harness belt is attached. The rail shall be notched and constructed of aluminum. Ladder attachments shall be provided as required by the manufacturer. A removable extension section shall be provided at the top of the ladder.
 2. Product and Manufacturer: Provide system as manufactured by one of the following:
 - a. Saf-T-Climb by Norton Company.
 - b. Or equal.
- D. Loose Steel Lintels: Provide loose hot dipped galvanized structural steel lintels for openings and recesses in masonry walls and partitions as shown. Where not shown provide loose steel lintels as specified. Weld adjoining members together to form a single unit and grind welds smooth where exposed in the finished Work. Provide not less than 4 inches bearing at each side of openings, unless otherwise specified. Unless otherwise shown size loose lintels as follows:

<u>Clear Span (Max)</u>	<u>Exterior Angle</u>	<u>Interior Angles</u>
4'-0"	3-1/2-inches x 3-1/2-inches x 5/16-inches	(2) 3-1/2-inches x 3-1/2-inches x 5/16-inches
6'-0"	4-inches x 3-1/2-inches x 5/16-inches	(2) 4-inches x 3-1/2-inches x 5/16-inches
8'-0"	5-inches x 3-1/2-inches x 5/16-inches	(2) 5-inches x 3-1/2-inches x 5/16-inches
Greater than 8'-0"	Submit calculations prepared, signed and stamped with the seal of a Registered Professional Engineer licensed to practice in the State of Arizona and recognized as an expert in the required Work.	

- E. Extruded Aluminum Stair Nosings for Concrete Stairs:
1. Fabricate of sizes specified. Provide all concrete treads with specified nosings.
 2. Provide barrier-free nosings with radiused edge and with minimum exposure of aluminum to the walking surface.
 3. Provide nosing meeting criteria of MIL-D24483 for resistance to wear and ability to retain non-slip safety surface.
 4. Unless otherwise shown, provide abrasive filled type. Provide complete selection of manufacturer's standard and custom colors.

5. Provide anchors for embedding in concrete, integral with the non-slip nosing.
 6. Product and Manufacturer: Provide one of the following:
 - a. Type DSA3 Amcolun by American Abrasive Metals Company.
 - b. Or equal.
- F. Shelf Angles: Provide galvanized steel shelf angles of sizes shown for attachment to concrete and masonry construction. Provide horizontal slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and not more than 2 foot-6 inches on centers. Weld adjoining members together to form a single unit and grind welds smooth where exposed in the finished Work.
- G. Cast-In-Place Shelf Angle Supports:
1. Provide hot dipped galvanized malleable iron wedge-type concrete inserts, complete with fasteners, for attachment of shelf angles to cast-in-place concrete.
 2. Provide hot dipped galvanized steel shims, washers and other accessories.
 3. Provide stainless steel askew head bolts.
 4. Product and Manufacturer: Provide one of the following:
 - a. 7/8-inch Standard Concrete Wedge Insert by Hohmann and Barnard, Incorporated.
 - c. Or equal.
- H. Cast-In-Place Flashing Reglets:
1. Provide 0.015-inch stainless steel reglets, minimum 1-inch deep with 1/4-inch opening.
 2. Provide foam filler to prevent concrete intrusion.
 3. Provide 45 degree slot.
 4. Product and Manufacturer: Provide one of the following:
 - a. Type A by Cheney Flashing Company.
 - b. Type 234 by Heckmann Building Products, Incorporated.
 - c. Or equal.
- I. Cast-In-Place Continuous Channel Inserts:
1. Provide hot-dipped-galvanized steel continuous channel inserts with integral anchors and spring-loaded stainless steel bolts, serrated-grooved nuts, washers, shims capable of accommodating threaded stainless steel eyebolt rods as shown.
 2. Product and Manufacturer: Provide one of the following:
 - a. No. CS-H insert by Hohmann & Barnard Incorporated.
 - b. Or equal.
- J. Emergency Scuppers:
1. Provide 1/4-inch thick Type 304 stainless steel plate.
 2. Fabricated Emergency Scupper Size: 6-inches high by 12-inches long by width of parapet.
 3. Construction: Provide box-shaped emergency scuppers with open front and back fabricated with all joints continuously welded and with 2-inch wide by 1/4-inch thick 4-inch long stainless steel masonry anchors welded to emergency scupper assemblies 8 inches on centers for embedding in masonry construction.

- K. Miscellaneous Framing and Supports:
1. Provide miscellaneous metal framing, supports and other metal items required which are not a part of the structural steel framework and are required to complete the Work.
 2. Fabricate miscellaneous units to the sizes, shapes and profiles shown or, if not shown, of the required dimensions to receive adjacent grating, plates, tanks, doors, or other work to be retained by the framing. Except as otherwise shown, fabricate from structural shapes, plates, and bars, of all welded construction using mitered corners, welded brackets and splice plates and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.
 3. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.
 - a. Except as otherwise shown, space anchors, 24 inches on centers, and provide units and equivalent of 1-1/4-inch by 1-1/4-inch by 8-inch strips.
 - b. Galvanize all exterior miscellaneous framing and supports.
 - c. Galvanize interior miscellaneous framing and supports where shown.
- L. Manhole Steps: Provide steel reinforced plastic manhole steps which will resist pullout force of 1500 pounds and impact of 300 pounds. Step shall be 14-inches minimum wide, 5-inches minimum from concrete face, with anti slip construction and end lugs.
- M. Truck Bollards: Provide 8-inch diameter, double extra strong galvanized steel pipe, 3 foot-4 inches above grade, 3 feet below grade. Fill with concrete and mound top.
- N. Primer Paint: Unless otherwise shown or specified, prepare surfaces and prime steel items as required under Section 09900, Painting.
- O. Galvanizing: All galvanizing of fabricated steel items shall comply with the requirements of ASTM A 123. Galvanized structural steel or iron shall be hot-dip galvanized after fabrication in accordance with ASTM A123. Electro-galvanizing shall not be used unless specified. Galvanized items that bend or twist during galvanizing shall be restraightened. Cut or otherwise damaged galvanized surfaces shall be field repaired to equivalent original condition using Galvinox; Galvo-Weld; or equal.
- P. Aluminum Finish: Provide a natural mill finish for all aluminum Work unless otherwise shown or specified.
- Q. Expansion Shield Fasteners: Unless otherwise specified by materials or equipment manufacturer, expansion anchors shall conform to the following:
1. For items not anchored into concrete or masonry with integral anchors welded or bolted to the item, provide fasteners for anchoring made of stainless steel as specified.
 2. Install fastener in accordance with manufacturer's recommendations.

3. 1/2-inch diameter, 2-inches embedment length minimum.
 4. Power driven "pin" and "stud" type fasteners will not be permitted.
 5. Product and Manufacturer: Provide one of the following:
 - a. Molly Parabolts by USM Corporation.
 - b. Kwik-Bolt by Hilti Corporation.
 - c. Or equal.
- R. Ornamental Grilles: Provide aluminum ornamental grilles with module and pattern shown and as specified.
1. Materials: Formed and extruded aluminum 0.080-inches thick:
 - a. Extrusions: 6063-T52.
 - b. Sheet: 5005.
 - c. Hardware: 302 stainless steel.
 - d. Frames: Extruded aluminum 1-7/8-inches by 4-9/16-inches with mitered corners.
 - e. Intermediate Mullions: 4-inch deep extruded aluminum.
 2. Fabrication: Connections within ornamental grilles shall be accomplished without rivets, screws, pins, crimping or peening.
 3. Finish: Metallic polyvinylidene fluoride; complete selection of manufacturer's standard and custom colors.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) C/S Kynar 500 TRI-X.
 - 2) Or equal.
 4. Product and Manufacturer: Provide one of the following:
 - a. Myriad Diamond Ornamental Grilles by Construction Specialties Incorporated.
 - b. Or equal.
- S. Structural Aluminum: Conforms to requirements of Part B Specification, Sections 055100, 055110, 055120 and 055130.

2.3 SURFACE PREPARATION AND SHOP PAINTING

- A. Surface preparation and shop painting is required for all ferrous metals, equipment and accessories. Stainless steel shall not be painted.
- B. All ferrous metal surfaces shall be cleaned and provided with surface preparation and two coats of priming paint in accordance with the applicable requirements of Section 09900, Painting. All prime coat materials shall be compatible with the finish coat materials to be furnished under Section 09900, Painting.

PART 3 - EXECUTION

3.1 FABRICATION, GENERAL

- A. Use materials of the size and thicknesses shown or if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on Shop Drawings using proven details of fabrication and support. Use the type of materials shown or specified for the various components of Work.

- B. Form exposed Work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown or specified. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
- C. Welding shall be as specified in Part B Specification, Sections 050800, 050810, 050830 and 050850.
- D. Form exposed connections with hairline joints which are flush and smooth using concealed fasteners wherever possible. Use exposed fasteners of the type shown or if not shown, use flathead (counter-sunk) screws or bolts.
- E. Cut, reinforce, drill, and tap miscellaneous metal fabrications Work as may be required to receive finish hardware and similar items of Work.
- F. Use hot-rolled steel bars for Work fabricated from bar stock unless Work is otherwise shown or specified to be fabricated from cold-finished or cold-rolled stock.

3.2 INSTALLATION

- A. Set miscellaneous metal fabrications accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork where fabrications are to be built into concrete, masonry or similar construction.
- B. Anchor securely as shown or as required for the intended use, using concealed anchors wherever possible. Comply with the following:
 - 1. Drilling equipment used and installation of expansion anchors shall be in accordance with manufacturer's instructions.
 - 2. Assure that embedded items are protected from damage and are not filled in with concrete.
 - 3. Expansion anchors may be used for hanging or supporting 2-inch diameter pipes and smaller. Expansion anchors shall not be used for larger pipe unless otherwise shown or approved by ENGINEER.
 - 4. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
 - a. Minimum embedment depth in concrete: 5 diameters.
 - b. Minimum anchor spacing on centers: 10 diameters
 - c. Minimum distance to edge of concrete: 5 diameters.
 - d. Increase dimensions above if required to develop the required anchor load capacity.
- C. Fit exposed connections accurately together to form tight hairline joints. Weld steel connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind steel joints smooth and touch up shop paint coat. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

- D. Follow manufacturer's recommendations for installation of reglets, inserts and cast-in-place shelf angle supports. Lap ends of reglets as recommended by flashing manufacturer.
- E. Install cast-in-place shelf angle supports as specified in Section 03300, Cast-In-Place Concrete and as shown. Space cast-in-place shelf angle supports maximum of 2 foot-6 inches on centers. Develop strength of cast-in-place shelf angle supports by providing extra reinforcing bars as recommended by the manufacturer.
- F. Protection of Aluminum from Dissimilar Materials: Using approved washers, strips or sheets of felt, and coating specified in Section 09900, Painting, protect all surfaces of aluminum from contact with dissimilar materials such as concrete, masonry, steel, nonferrous metals, etc.

+ + END OF SECTION + +

SECTION 05523

ALUMINUM HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install aluminum handrail and railing Work. The Work also includes:
 - a. Providing openings in and attachments to railing to accommodate the Work under this and other Sections and providing for the handrail and railing all items such as anchor bolts, fasteners, studs and all items required for which provision is not specifically included under other Sections.
2. The extent of each type of aluminum handrail and railing is shown and specified.
3. The types of aluminum handrail and railing Work required includes, but is not necessarily limited to, the following:
 - a. Top and two intermediate horizontal railing.
 - b. Handrail.
 - c. Toeboards.
 - d. Anchors and fasteners.
 - e. Sleeves, castings, reinforcing inserts, wall brackets, and other miscellaneous accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with or attached to the aluminum handrail and railing Work.

C. Related Sections:

1. Section 03600, Grout.
2. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single firm, with undivided responsibility for performance of the aluminum handrail and railing Work.
2. Engage a firm which can show five years previous successful experience in the fabrication and erection of aluminum handrail and railing systems of scope and type similar to the required Work.
3. Provide manufacturer capable of fabricating custom details shown.

B. Design Criteria:

1. Provide adequate expansion within the fabricated system which allows a thermal change of 100 F above installation temperature without warp or bow. Provide 0.1 inch space for each 20 feet of length of rail for each 25 F difference of thermal change specified or use manufacturer's published formulas for determining

expansion joint movement and spacing. Limit the exposed width of each expansion joint to 1/4 inch.

2. Provide expansion joint in aluminum handrail and railing system Work where systems cross expansion joints in structure.
3. Aluminum handrail and railing is shown to indicate general locations where handrail and railing is required by ENGINEER. All aluminum handrail and railing shown shall be as specified herein regardless of the number of intermediate horizontal rails shown. In addition, where handrail or railing is required by either the Uniform Building Code or the Occupational Safety and Health Act of 1970, aluminum handrail and railing of the type specified herein shall be provided at no additional cost to OWNER, whether or not shown.
4. Configuration of all handrail and railing details shall be as shown on the General Railing and Handrail Sheet regardless of symbolic indication which may be otherwise shown.
5. Provide aluminum handrail and railing system Work that conforms to OSHA, Part 1910.23, including the 200 pound loading requirement. In addition, the system shall conform to the following requirements of ANSI A12.1:
 - a. Completed aluminum handrail and railing system Work to withstand a load of 25 pounds per linear foot applied in any direction at the top of the handrail and railing.
 - b. Intermediate rails to withstand a horizontal load of 20 pounds per linear foot.
 - c. All above loads are not additive.
6. Select systems components and post spacing so that specified applied loads produce no permanent set in the completed aluminum handrail and railing system Work.
7. All railing system posts shall be provided with a circular profile solid reinforcing bar with outside diameter equal to inside diameter of post. All posts shall receive one reinforcing bar. Select schedule of pipe using alloys, minimum diameter, loadings and maximum post spacing specified in order to limit deflection in each single-span of handrail and railing to 1.5-inches maximum and on railing posts to 1.4-inches maximum and with a safety factor of 1.65:1 for all Work.

C. Codes: Comply with the applicable requirements of the Uniform Building Code and the Occupational Safety and Health Act of 1970 for types of aluminum handrail and railing system Work shown and specified.

D. Allowable Tolerances:

1. Limit variation of cast-in-place inserts, sleeves and field-drilled holes to the following:
 - a. Spacing: $\pm 3/8$ inch.
 - b. Alignment: $\pm 1/4$ inch.
 - c. Plumbness: $\pm 1/8$ inch.
2. Limit variation of completed railing system alignment to 1/4 inch in 12 feet.
3. Set rails horizontal or parallel to rake of steps or ramp to within 1/4 inch in 12 feet.

- E. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM B 26, Aluminum-Alloy Sand Castings.
 2. ASTM B 210, Aluminum-Alloy Drawn Seamless Tubes.
 3. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
 4. ASTM B 241, Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.
 5. ASTM B 247, Aluminum-Alloy Die and Hand Forgings.
 6. ASTM B 429, Aluminum-Alloy Extruded Structural Pipe and Tube.
 7. AWS D10.7, Gas Shielded-Arc Welding of Aluminum and Aluminum-Alloy Pipe.
 8. The Aluminum Association, Aluminum Standards and Data; and Standards for Anodized Architectural Aluminum.
 9. NAAMM, Metal Finishes Manual".
 10. NAAMM, Pipe Railing Manual.
 11. ANSI A12.1, Safety Requirements for Floor and Wall Openings, Railings, and Toeboards.
 12. OSHA Part 1910.23 - Guarding Floor and Wall Openings and Holes.
- F. Field Measurements: Take field measurements, where required, prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work.
- G. Shop Assembly: Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the project site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinate installation.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Full size sample of assembled post and rails intersections with all associated components including mounted toeboard and socket, all with specified metal finish, including typical welded or bolted connections, with rails not less than 6-inches long. Samples will be reviewed for finish, color, joinery tolerances, workmanship and general component assembly only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
 2. Color Samples: Maximum range of clear anodized aluminum that shall appear in finished Work. Prepare range samples, to show the highest level of color control feasible for actual aluminum handrail and railing system Work, as determined by the licensor of the finishing process selected, on actual extrusions and castings of the Work.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for the fabrication and erection of aluminum handrail and railing system Work. Include all plans and elevations identifying the location of all handrail and railing, and details of sections and connections. Show all anchorage items.

2. Calculations for the complete structural design of the aluminum handrail and railing system Work including calculations showing compliance with design criteria specified.
 3. Manufacturer's complete catalogs showing complete selection of standard and custom components and miscellaneous accessories for selection by ENGINEER.
 4. Maintenance Manuals: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning, including cleaning materials, application methods and precautions as to use of materials that may be detrimental to finish when improperly applied.
- C. Certification: Furnish certification by manufacturer that load tests have been performed on the aluminum handrail and railing systems Work and that they conform to all applicable OSHA, ANSI and building code requirements for loading and deflections and meet minimum criteria specified herein.
- D. Finish: Furnish a written certificate confirming specified coating film thickness, coating weight, sealing treatment and stain test.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver materials to the site in good condition and properly protected against damage to finished surfaces.
- B. Storage of Materials:
1. Store all materials in clean, dry location, away from uncured concrete and masonry.
 2. Cover all materials with waterproof paper, tarpulin or polyethylene sheeting.
- C. Handling of Materials:
1. Keep on-site handling to a minimum.
 2. Maintain protective covering on handrails and railings until installation is complete.

1.5 JOB CONDITIONS

- A. Protection: Protect cast-in-place sleeves and field-drilled holes from debris and water intrusion by use of temporary covers or removable foam inserts.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Extruded Aluminum Architectural and Ornamental Shapes: ASTM B 221, Alloy 6063-T52.
- B. Aluminum Forgings: ASTM B 247.
- C. Extruded or Drawn Aluminum Pipe and Tube:
 - 1. ASTM B 429 or ASTM B 241, Alloy 6063-T5, 6063-T52 or 6063-T832 as required by loadings, deflections and post spacings specified.
 - 2. Provide all rails and posts with minimum outside diameter of 1.900-inches.
- D. Reinforcing Bars: Solid 24-inch long 6061-T6 circular cross section aluminum reinforcing bars with outside diameter same as inside diameter of post.
- F. Anchors and Fastenings: Stainless steel of the type recommended by the manufacturer of the aluminum handrail and railing system. Provide minimum of four bolt fasteners per post where surface mounted posts are shown.
- G. Castings:
 - 1. Provide high strength aluminum alloy brackets, flanges and fittings suitable for anodizing as specified.
 - 2. Aluminum-Alloy Sand Castings: ASTM B 26.
- H. Connector Sleeves: Schedule 40, 5-inches long by 1.610-inches diameter.
- I. Brackets and Flanges: Provide manufacturer's complete selection of standard and custom brackets and flanges for railing posts and for handrail supports.
- J. Sockets: Provide 6-inch deep by 2-1/2-inch outside diameter aluminum sockets with 3-1/2-inch wide socket cover on bottom of all sockets and on top and bottom of removable post sockets.
- K. Hinges: Provide two self-closing aluminum hinges for each railing system gate shown.
- L. Latches and Stops: Provide one latch and stop with rubber bumper and 1-inch diameter plastic knob for each railing system gate shown.
- M. Chain, Snaps and Eye Bolts: Provide oblong 0.250-inch welded link, Type 316 stainless steel chain weighing 57 pounds per cubic foot, each link 1-1/8-inch by 7/16-inch. Provide stainless steel eyebolts, 1/4-inch stainless steel threaded quick links and heavy duty swivel snaps with spring loaded latch.

- N. Cover Flanges: Provide 1-inch high by 4-inch diameter aluminum cover flanges for all non-removal posts and 3-1/2-inch wide by 1-1/8-inch high aluminum pipe collars with 1/4-inch set screws for all removable posts.
- O. Components and Miscellaneous Accessories: Provide a complete selection of manufacturer's standard and custom aluminum handrail and railing components and miscellaneous accessories.
- P. Adhesive: Epoxy type as recommended by handrail and railing manufacturer.

2.2 FABRICATION

- A. Form exposed Work true to line and level with accurate angles, surfaces and straight edges.
- B. Form bent-metal corners to the radius shown without causing grain separation or otherwise impairing the Work. Form all change in handrail and railing direction with radius bends.
- C. Remove burrs from all exposed edges.
- D. Form elbow bends and wall returns to uniform radius, free from buckles and twists, with smooth finished surfaces, or use prefabricated bends.
- E. Locate intermediate rails equally spaced between top rail and finished floor.
- F. Close aluminum pipe ends by using prefabricated fittings.
- G. Weep Holes:
 - 1. Fabricate joints which will be exposed to the weather so as to exclude water.
 - 2. Provide 15/64 inch diameter weep holes at the lowest possible point on all railing system posts.
 - 3. Provide pressure relief holes at closed ends of handrails and railings.
- H. Toeboards:
 - 1. Provide extruded 6063 alloy aluminum toeboards for railings, unless railing is mounted on curbs or other construction of sufficient height and type to meet the requirements of OSHA 1910.23. Bars or plates are not acceptable and shall not be approved by ENGINEER.
 - 2. Unless otherwise specified, toeboards shall meet requirements of OSHA Part 1910.23, Section (e).
 - 3. Provide manufacturer's toeboard detail which accommodates movement caused by thermal change specified without warping or bowing toeboards.

- I. Reinforcing Bars: Provide circular profile solid reinforcing bar friction-fitted at all railing system posts. Extend reinforcing bars 6-inches into cast-in-place sleeves or other types of supporting brackets.
- J. Mechanically Fitted Component Pipe Handrail and Railing:
 1. Use a nonwelded pipe handrail and railing system with posts, top and intermediate rail(s) and flush joints.
 2. Provide a top and two intermediate horizontal rails, equally spaced.
 3. Blind rivets, pop rivets or other exposed fastening devices shall not be used in the Work. Fasteners used for side mounting fascia flanges where shown or specified may be exposed in the Work. Provide internal threaded tubular aluminum rivets, stainless steel through bolts with lock nuts, stainless steel sheet metal screws with lockwashers and epoxy adhesive for fastening all components of the Work.
 4. Product and Manufacturer: Provide one of the following:
 - a. Custom Fabricated Connectorail System by Julius Blum & Company, Incorporated.
 - b. Custom Fabricated Series 500 Non-Welded Aluminum Pipe Railing by Superior Aluminum Products, Incorporated.
 - c. Or equal.

2.3 ALUMINUM COATINGS

- A. General:
 1. Prepare surfaces for finishing in accordance with recommendations of the aluminum producer and the finisher or processor.
 2. Adjust and control the direction of mechanical finishes specified to achieve the best overall visual effect in the Work.
 3. Color and Texture Tolerance: ENGINEER reserves the right to reject aluminum materials because of color or texture variations, which are visually objectionable, but only where the variation exceeds the range of variations established by the manufacturer prior to the Work, by means of range samples which have been accepted by ENGINEER.
 4. Anodize all aluminum components of the Work.
- B. Exposed Aluminum Anodic Coating: Provide anodic coatings as specified which do not depend on dyes or impregnation processes to obtain color. Apply architectural Class I coatings using only the alloy and electrolyte to obtain specified colors. Comply with the following:
 1. Chemically finish aluminum by etching to a medium matte finish, Aluminum Association Designation - C22.
 2. Desmut by bathing the aluminum in either nitric acid solution or as recommended by the coating applicator.
 3. Clean and rinse between steps as recommended by the aluminum manufacturer.
 4. Provide architectural Class I high density anodic coating, Aluminum Association Designation A41, for clear coatings.
 5. Coating Thickness, ASTM B 244: Minimum of 0.7 mils thick.
 6. Coating Weight, ASTM B 137: Minimum of 32 mg/sq. in.
 7. Resistance to Staining, ASTM B 136: No stain after 5 minutes dye solution exposure.

8. Salt Spray, ASTM B 117: 30,000 hours exposure with no corrosion or shade change.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and conditions under which the aluminum handrail and railing system Work is to be performed and notify ENGINEER in writing of unsatisfactory tolerances which exceed specified limits and other conditions detrimental to proper and timely completion of the Work. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Fastening to In-Place Construction:
 1. Adjust aluminum handrail and railing system Work prior to securing in place, to ensure proper matching at butting joints and correct alignment throughout their length. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
 - a. Anchor posts in concrete by means of sockets and side mounted fascia flange brackets, set and anchored into the concrete floor slabs and sides of concrete walls and raised walkways. Provide closure secured to the bottom of sleeve. Before installing posts remove all debris and water from sleeves. Verify that reinforcing bars have been inserted into posts before installation. Do not install posts without reinforcing bar. For all nonremovable railing sections, after the posts have been inserted into the sockets, fill the annular space between posts and sockets solid with grout as specified in Section 03600, Grout.
 - b. Anchor posts to stair stringers with stringer or support flanges, angle type or floor type as required by conditions, shop connected to posts and bolted to the supporting members. Flanges shall be as recommended by manufacturer. Verify that reinforcing bars have been inserted into posts before installation. Do not install posts without reinforcing bar.
 - c. Provide removable railing sections where shown. Removable railing posts shall be provided with friction fitted reinforcing bar in each post. Provide sockets with socket covers stored in extruded toeboard. Provide aluminum pipe collars for all removable posts. Accurately locate sleeves to match post spacings.
 - d. All posts set in concrete shall be provided with an aluminum floor cover flange.
 2. Use devices and fasteners recommended by the aluminum handrail and railing manufacturer.

B. Cutting, Fitting and Placement:

1. Perform cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
2. Fit exposed connections accurately together to form tight hair-line joints. Do not cut or abrade the surfaces of units which have been finished after fabrication, and are intended for field connections.
3. Permanent field splice connections shall be made using manufacturer's recommended epoxy adhesive and 5-inch minimum length connector sleeves. Tight press-fit all field splice connectors and install in accordance with manufacturer's written instructions. Follow epoxy manufacturer's recommendations for requirements of installation and conditions of use.
4. Make all splices as near as possible to posts but not exceeding 12 inches from nearest post.
5. Space posts 6 foot-0 inch minimum on centers and 8 foot-0 inch maximum on centers, based on loading and deflection criteria specified and manufacturer's suggested maximum spacing except where details shown dimension required locations for posts. Where details show post location requirements at or near end of runs, uniformly space intermediate posts as required to meet loading and deflection criteria specified but not greater than maximum spacing specified.
6. Provide hinged railing sections as shown. Provide hinges and latch for connection to adjacent railing.
7. Provide chain sections as shown. Provide one chain length with fastening accessories for top and each intermediate railing.
8. Secure handrails to walls with wall brackets and end fittings as shown. Locate brackets as shown or, if not shown, at not more than 5 feet on centers.
9. Secure wall brackets to building construction as follows:
 - a. For concrete and solid masonry anchorage, use bolt anchor expansion shields and lag bolts.
 - b. For hollow masonry anchorage, use toggle bolts having square heads.
10. Securely fasten toeboards in place with not more than 1/4 inch clearance above floor level.
11. Drill one 15/64 inch diameter weep hole not more than 1/4 inch above the top of location of solid reinforcing bar or tube in each post.

C. Expansion Joints:

1. Provide slip joint with internal sleeve extending 2 inches minimum beyond joint on each side.
2. Construct expansion joints as for field splices except fasten internal sleeve securely to one side of rail only.
3. Locate joints within 6 inches of posts.
4. Submit locations and details of all expansion joints to ENGINEER.

D. Protection from Dissimilar Materials:

1. Coat all surfaces of aluminum in contact with dissimilar materials such as concrete, masonry and steel as specified in Section 09900, Painting.

2. Remove coating where exposed in the finished Work.

3.3 CLEANING AND REPAIRING

- A. Remove protective plastic as recommended by manufacturer immediately after installation.
- B. Remove all stains, dirt, grease or other substances by washing railings thoroughly using clean water and soap; rinse with clean water.
- C. Do not use acid solution, steel wool or other harsh abrasives. If stain remains after washing remove defective sections and replace with new material meeting the requirements of the Specification.
- D. Remove all damaged or otherwise defective Work and replace with material that meets specification requirements.

+ + END OF SECTION + +

SECTION 05532

ALUMINUM GRATING AND CHECKERED PLATE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals as shown, specified and required to provide aluminum grating, checkered plate and frames as shown and specified.
2. The Work also includes providing grating and checkered plate to accommodate the Work under this and other Sections and attaching to the grating and checkered plate all items such as sleeves, bands, studs, fasteners and all items required including embedded angles for which provision is not specifically included under other Sections.

B. Related Work Specified Elsewhere:

1. Section 03300, Concrete.
2. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM B 209, Aluminum Alloy Sheet and Plate.
2. ASTM B 210, Aluminum-Alloy Drawn Seamless Tubes.
3. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. NAAMM, Metal Finishes Manual, and Metal Bar Grating Manual.
5. Aluminum Association Standards.

B. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the Work.

1.3 SUBMITTALS

A. Samples: Submit representative samples of plate, grating, appurtenances and other finished products requested by the ENGINEER. His review will be for type and finish only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

B. Shop Drawings: Submit for approval the following:

1. Shop Drawings for the fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
2. Setting drawings and templates for location and installation of anchorage devices.
3. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

4. The Work shall not be fabricated until the CONTRACTOR submits field measurements of the openings and until the manufacturer's drawings based upon the CONTRACTOR'S measurements have been approved by the ENGINEER.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. The manufacturer shall furnish grating to conform the following criteria:

1. Design Loads: Uniform live load or a concentrated load on any area 24 inches square, whichever gives the greatest stresses.

<u>Live Load</u>	<u>Concentrated Load</u>	<u>Location</u>
200 psf	2000 lbs	All

2. Maximum Clear Span Deflection: 1/120 of span or 1/4 inch, whichever is smallest.
3. Maximum Fiber Stress: 12,000 psi.
4. Bearing bars shall be a maximum of 1-3/16 inches on center and 3/16 inches minimum thickness.
5. Cross bars or bent connecting bars shall not exceed 7 inches on center.

- B. The manufacturer shall furnish removable checkered plate to conform to the following criteria:

1. Minimum Thickness: 1/4 inch.
2. Design Uniform Load: 200 pounds per square foot.
3. Maximum Clear Span Deflection: 1/120th of the span or 1/4 inch, whichever is the smallest.

2.2 MATERIALS

- A. Bearing Bars: Alloy 6061-T6 or Alloy 6063-T6, conforming to ASTM B 221.
- B. Cross Bars or Bent Connecting Bars: Alloy conforming to either ASTM B 221 or ASTM B 210.
- C. Rivets: Aluminum-Alloy as recommended by the manufacturer.
- D. Aluminum Checkered Plate:
 1. Provide aluminum checkered plate as shown and specified. Plate to conform to ASTM B 209. Provide anodized finish.
 2. Raised Pattern Floor Plate: Provide pattern standard with the manufacturer. Alloy and temper to be 6061-T6.

2.3 FABRICATION

- A. Use materials of the minimum size and thickness as specified above unless shown otherwise. Work to the dimensions shown on approved Shop Drawings.

- B. Grating shall be as shown and shall comply with the NAAMM "Metal Bar Grating Manual", except as specified herein.
- C. Grating may be I-bar type, welded or pressure locked.
- D. Provide non-slip exposed surface.
- E. Type of Finish: Clear anodized with a minimum coating of 0.0008 inch in accordance with Aluminum Association Standard A41.
- F. Provide grating sections with end-banding bars welded about 4 inches on centers for each panel, 4 saddle clip or flange block anchors designed to fit 2 bearing bars, and 4 stud or machine bolts with washers and nuts, unless otherwise indicated.
- G. Cut gratings for penetrations as indicated. Layout units to allow grating removal without disturbing items penetrating grating.
 - 1. For openings in grating separated by more than 4 bearing bars, provide banding of same material and size as bearing bars, unless otherwise indicated. Weld band to each bearing bar.
 - 2. Notching of bearing bars at supports to maintain elevations will not be permitted.
- H. Weld stainless steel stud bolts to receive saddle clip or flange block anchors to supporting steel members. Drill for machine bolts when supports are aluminum.
- I. Gratings in concrete floors shall be removable or hinged and shall be arranged in sizes to be readily lifted. Provide gratings in concrete with aluminum angle frames having metered corners and welded joints. Grind exposed joints smooth. Frames shall have welded anchors set into concrete. Angle size shall match grating depth selected to assure flush fit.

2.4 CHECKERED PLATES

- A. Provide removable checkered plates in the locations and sizes indicated on the Drawings. Also provide perforated plates where shown.
- B. Each plate shall be provided with two lifting handles as recommended by the manufacturer. The lifting handles shall be of the recessed, drop handle type.
- C. Plates shall have a checkered, nonslip surface.
- D. The aluminum plates shall be anodized finished. Protect finish with a factory-applied coating of lacquer standard with the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fastening to In-Place Construction: Use anchorage devices and fasteners to secure grating to supporting members or prepared openings, as recommended by the manufacturer.

- B. Cutting, Fitting and Placement:
 - 1. Perform all cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack. Do not use wedges or shimming devices.
 - 2. Making cutouts or openings in the plate or grating in the field will not be allowed.
 - 3. Divide the panels into sections only to the extent required for installation wherever grating is to be placed around previously installed pipe, ducts, and structural members.
 - 4. Fit exposed connections accurately together to form tight hairline joints.
 - 5. Wherever gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and attach a strap collar not less than 1/8-inch thick to the cut ends of the bars.

- C. Protection of Aluminum from Dissimilar Materials: Using approved asphaltic or zinc chromate paint, provide two heavy coats on aluminum surfaces in contact with dissimilar materials such as concrete, masonry, steel and other metals.

+ + END OF SECTION + +

SECTION 05540

CASTINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish castings.
 2. Castings include metal items which are not a part of the miscellaneous metal fabrications or metal systems in other Sections of these Specifications.
- B. Castings shall be for the following types of construction:
1. Manholes.
 2. Catch basins.
 3. Trenches.
- C. Related Sections:
1. Section 02601, Manholes
 2. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

- A. Standard Specifications and Details:
1. CONTRACTOR shall conform to all applicable requirements of Part Nos. 600 and 700 of the Uniform Standard Specifications for Public Works Construction and all applicable requirements of the Uniform Standard Details for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. If there is a conflict between MAG Standards as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM A 48, Standard Specification for Gray Iron Castings.
- C. Shop Assembly:
1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Fabrication and erection of all casting assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.

- a. Include setting drawings for location and installation of castings and anchorage devices.
2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cast Iron: ASTM A 48, Class 30A.
- B. Manhole Frames with Covers:
 1. Roadway standard with 24-inch opening and cast covers conforming to the MAG Uniform Standard Details for Public Works Construction, Detail No. 424, except where otherwise shown.
 2. Provide lettering as shown on Drawings.
- C. Stop Plank Guides:
 1. Stop plank guides of the style shown or required shall be provided for all stop planks, to the size and dimension required to accommodate the stop planks provided.
 2. Stop plank guides and/or the anchorage devices shall be integrally cast into the structure walls.
 3. Stop plank guides shall be manufactured by one of the following:
 - a. Neenah Foundry Company, R-4999; for Part B use R-7500, types E and L.
 - b. Or equal.
- D. Cast iron trench grate and frame shall be designed for H-20 truck loading. Frame and grate shall be as manufactured by:
 1. Neenah Foundry Co., R-4999.
 2. Or equal.

2.2 DESIGN AND FABRICATION

- A. Design round frames and covers to prevent rocking and rattling under traffic.
- B. Fabricate castings true to pattern so that component parts fit together.

2.3 FINISH

- A. Iron: Coat with asphaltic paint standard with the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Follow manufacturer's printed instructions and approved Shop Drawings.

- B. Set castings accurately to required location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork.

+ + END OF SECTION + +

SECTION 05805
EXPANSION JOINT COVERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish expansion joint covers.
 2. The extent of expansion joint covers is shown on the Drawings, including notes and details indicating style and types of installation.
 3. The types of expansion joint covers include the following:
 4. Floor expansion joint covers.
 5. Wall expansion joint covers.
 6. Ceiling expansion joint covers.
- B. Related Sections:
1. Section 07619, Flashing and Trim.

1.2 QUALITY ASSURANCE

- A. All expansion joint covers shall be the products of a single manufacturer. Covers from more than one manufacturer will not be permitted.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM B 209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 2. ASTM B 221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.

1.3 SUBMITTALS

- A. Samples:
1. Submit for approval the following:
 - a. Each type of metal finish. Sample not less than 6 inches long.
 - b. Available elastomer colors.
 2. Samples will be reviewed by ENGINEER for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following: Dimensioned plans of all joint cover locations, details of fabrication and installation, including anchorage method. Include setting drawings and templates for location and installation of expansion joint covers.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: ASTM B 221 alloy 6063-T5 for extrusions; ASTM B 209, alloy 6061-T6, sheet and plate.
- B. Joint Covers:
 - 1. Provide aluminum expansion joint covers of the profiles shown or specified.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Floor Expansion Joint Covers:
 - 1) Architectural Art Mfg., Incorporated.
 - 2) Construction Specialties, Incorporated.
 - 3) Or equal.
 - b. Wall Expansion Joint Covers:
 - 1) Architectural Art Mfg., Incorporated.
 - 2) Construction Specialties, Incorporated.
 - 3) Or equal.
 - c. Ceiling Expansion Joint Covers:
 - 1) Architectural Art Mfg., Incorporated.
 - 2) Construction Specialties, Incorporated.
 - 3) Or equal.
- C. Accessories: Manufacturer's standard anchors, fasteners, set screws, spacers, flexible seal and filler materials, and other accessories compatible with material in contact; as shown or required for complete installations.
- D. Provide a one piece, flexible vinyl condensation barrier with all floor joint covers, in maximum lengths of 100 feet.
- E. Finishes:
 - 1. Aluminum contact surfaces on concrete; zinc chromate primer, except where anodic coating required.
 - 2. Aluminum floor covers; mill finish.
 - 3. Aluminum covers, except floors; manufacturer's standard satin, clear anodic coating.
 - 4. Exterior Aluminum Covers: Fluorocarbon paint finish standard with the manufacturer.
- F. Wearing Surfaces: Manufacturer's standard, of the type as shown or specified.
- G. Protection: Cover exposed metal surfaces of wall and ceiling covers with factory-applied adhesive paper or polyvinyl chloride (PVC) protective strippable coating.

2.2 FABRICATION

- A. General:
 - 1. Furnish the basic profile for expansion joint covers of joint widths shown or specified. Furnish the longest practicable lengths to minimize the number of joints, unless otherwise specified.

2. Butt joints for elastomeric covers shall be 20 feet apart, maximum. For sealing of joints during installation, use manufacturer's standard butt joint sealing method. Shop miter, weld, and pour all corners, cross-connections or other special transitions to meet the required conditions.
- B. Wall and Ceiling Joint Cover Assemblies:
1. Furnish members fastened to wall or ceiling only on one side of the joint. Extend cover to lap each side of joint, with free movement. Attach cover to the anchor member, with the cover in close contact with adjacent contact surfaces.
 2. For elastomeric covers, provide flush or surface mounted, factory poured covers for securing to each side of joint.
- C. Floor Joint Cover Assemblies:
1. Attach cover plate to anchor members, with cover in close contact with adjacent surfaces.
 2. Provide members to be fastened firmly to floor, or floor and wall, at each side of joint.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the areas and conditions under which the joint covers are to be installed. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Manufacturer's Instructions: In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, applying materials, and protection of installed units.
- B. Cutting, Fitting and Placement:
1. Perform all cutting, drilling and fitting required for the installation of the items. Set the work accurately in location, alignment and elevation, plumb, level, true, measured from established lines and levels. Provide temporary bracing or anchors in formwork if items are to be built into concrete, masonry or similar construction. Coordinate this with work specified under other Sections of these Specifications.
 2. Install joint cover assemblies in true alignment. Set floor covers at elevations to be flush with adjacent finished floor materials. Locate wall and ceiling covers in continuous contact with adjacent surfaces. Securely attach in place with all required accessories. Locate anchors approximately 3 inches from each end, 12 inches on centers between ends for set screws, and 18 inches on centers between ends for other fasteners, unless closer spacing is recommended by the manufacturer.

3. Hold end joints to the minimum; make end joints with strong, rigid, mechanical splice plate in true alignment, with hairline joints.
4. For joint cover frames installed in blockouts in concrete, grout covers in place with a nonshrink epoxy grout recommended by the joint cover manufacturer.

3.3 CLEANING AND PROTECTION

- A. Do not remove strippable protective material until finish work in adjacent areas is complete. When protective material is removed, clean exposed metal surfaces in accordance with manufacturer's instructions.

+ + END OF SECTION + +

WOOD AND PLASTICS

Division 6

CITY OF PHOENIX
SQUAW PEAK WATER TREATMENT PLANT
GENERAL PLANT IMPROVEMENTS
PART A - MODIFICATIONS AND IMPROVEMENTS

SECTION 06100
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work included in Part A of this project that is covered in this Section of the Specifications shall be as specified in the Part C Specification Sections titled: "Rough Carpentry" 06100.

+ + END OF SECTION + +

SECTION 06220

MILLWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, material, equipment and incidentals as shown, specified and required to furnish and install all millwork Work. The Work also includes:
 - a. Providing openings in millwork to accommodate the Work under this and other Sections and building into the millwork all items such as sleeves, anchor bolts, inserts and all other items to be embedded in millwork for which placement is not specifically provided under other Sections.
2. The extent of the millwork is shown.
3. The types of millwork Work required includes, but is not necessarily limited to, the following:
 - a. Custom fabricated plastic laminate covered chair rails.
 - b. Custom fabricated plastic laminate window stools.
 - c. Custom fabricated shelving and cabinets.
 - d. Adhesives, core materials, and wood blocking and fasteners.
 - e. Miscellaneous wood treatments.
 - f. Millwork hardware.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the millwork Work.

C. Related Sections:

1. Section 06100, Rough Carpentry.
2. Section 08211, Wood Doors.
3. Section 09900, Painting.

1.2 QUALITY ASSURANCE

A. Fabricator Qualifications: Millwork shall be provided by a fabricator with documented experience in the successful fabrication and installation of custom fabricated items of the type specified. Only the highest quality custom fabrication techniques shall be employed for the Work.

B. Design Criteria:

1. Millwork Standard: AWI "Quality Standards".
2. Quality Marking: Mark each unit of millwork with mill's or fabricator's identification and grade mark, located on surfaces which will not be exposed after installation.
3. Fire-Retardant Marking: Mark each unit of fire-retardant treated wood with producer's label and UL label, showing grade and rating. Mark on surface which will not be exposed after installation.

4. The State of Arizona Uniform Building Code.
 5. Plywood: American Plywood Association Grading Specifications PS-1-66.
 6. Plastic Laminate: NEMA LD3-1980, part 4, Architectural Woodwork Quality Standard, NAPF, and ANSI 161.2-1979.
 7. Design custom fabricated shelving and cabinets, and plastic laminate covered chair rails to support a minimum loading of 200 pounds per square foot or 150 pounds per linear foot, whichever is greater, without permanent deflection. No internal supports or stiffeners are shown. Fabricator shall use details consistent with the requirements of this Section to achieve the load resistance specified.
 8. Comply with Formica Corporation Standard Specifications and Details, Custom Grade requirements of the A.W.I. Quality Standards Section 400, and A.W.I. publication Architectural Casework Details.
 9. All countertops, window stools, worktops and receptionist desk top shall have square edges.
 10. Countertop at Lunch Room shall have full height backsplash to underside of wall cabinets.
- C. Source Quality Control: Manufacturer's of "or equal" plastic laminate material shall provide exactly the same colors, finishes, dimensions and textures as the manufacturer specified.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
1. Architectural Woodwork Institute, "Quality Standards".

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. One of each type of millwork hardware specified.
 2. 12-inch by 12-inch color cards of each plastic laminate color within the series specified for final selection by ENGINEER. ENGINEER will select a maximum of four colors of plastic laminate for the Work.
 3. ENGINEER'S approval will be for color, texture and profile only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Copies of chemical treatment manufacturer's instructions for proper use of each type of treated material.
 2. For water-borne preservatives, include statement that moisture content of treated materials was reduced to maximum of 19 percent prior to shipment to project site.
 3. Indicate compliance with specified Standard and other specified requirements for materials and workmanship.
 4. Plan and sections indicating location for each item of millwork, including large scale details of all intersections, terminations and fastening of the Work.

5. Dimensioned plans, elevations, large scale details, attachment devices and other components of the custom fabricated plastic laminate covered window stool and the custom fabricated plastic laminate covered chair rails, and the custom fabricated shelves, drawers and cabinet in Lunch Room.
6. Plastic laminate manufacturer's published general fabrication data and data relative to the fabrication of plastic laminate covered casework and handling of plastic laminate.

C. Certificates: Pressure Treatment:

1. For type specified, include certification by treating plant stating chemicals and process used, net amount of salts retained and conformance with applicable standards.
2. Include certification by treating plant that treatment material complies with governing ordinances and that treatment will not bleed through finished surfaces.
3. Submit copies of certificate signed by mill or woodwork shop, certifying that millwork complies with quality grades and other requirements specified. Submit certificate in form recommended by applicable Standards.

1.4 PRODUCT DELIVERY STORAGE AND HANDLING

A. Delivery of Materials:

1. Do not deliver millwork until wet work, gypsum wallboard, acrylic stucco and similar operations which could damage, soil, or deteriorate millwork have been completed in installation areas.

B. Storage of Materials:

1. Protect against exposure to weather and contact with damp or wet surfaces.
2. If millwork must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

C. Handling Materials:

1. Handle all treated products as specified in American Wood Preservers's Association M4.
2. Protect millwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration. Keep covered with heavy-duty polyethylene film or other protective covering.

1.5 JOB CONDITIONS

A. Environmental Conditions:

1. The installer shall advise CONTRACTOR of temperature and humidity requirements for millwork installation areas. Do not install millwork until the required temperature and relative humidity have been stabilized and will be maintained in installation areas.

2. Maintain temperature and humidity in installation area as required to maintain moisture content of installed millwork within a 1.0 percent tolerance of the optimum moisture content, from the date of installation through the remainder of the construction period. The installer of the millwork shall determine the optimum moisture content and required temperature and humidity conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Plastic Laminate:
 1. Provide horizontal general purpose standard grade 0.050-inches thick.
 2. Physical Properties: Provide plastic laminate assembly components complying with the following:
 - a. Flame Spread, ASTM E 84: 30 maximum.
 - b. Smoke Development, ASTM E 84: 15 maximum.
 3. Provide manufacturer's recommended backing sheet for all plastic laminate work.
 4. Product and Manufacturer: Provide one of the following:
 - a. GP50 Micarta by Westinghouse Corporation.
 - b. Or equal.
- B. Plastic Laminate Fire-Rated Adhesive:
 1. Provide adhesive recommended by plastic laminate manufacturer for the applications and criteria specified.
 2. Product and Manufacturer: Provide one of the following:
 - a) G1149A/G1131B by Koppers Incorporated.
 - b) Or equal.
- C. Plastic Laminate Core Materials:
 1. Custom Fabricated Receptionists Desk: 3/4-inch fire-rated particle board complying with FS-CS 236-66-IB2.
 2. Custom Fabricated Toilet Room Vanity Countertops, Window Stools and Door Trim: 3/4-inch fir plywood with "B" sanded face veneers bonded with a waterproof adhesive.
- D. Complete selection of transparent and semi-opaque oil base stains for final selection by ENGINEER.
- E. Fasteners and Cabinet Hardware:
 1. Provide size and type as shown or as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices.
 2. Drawer Slides: Two per draw; full extension drawer slides with captive roller design and soft rear stop extension. Provides units sized for 20-inch deep drawers and 90 pound load capacity each set for bottom mounting.
 - a. Product and Manufacturer provide one of the following:
 - 1) Softroller Drawer Slides by Hafele Incorporated.
 - 2) Or equal.

3. Provide concealed fastening system for all wood shelves and cabinet doors. Provide hinges capable of adjustment without loosening the mounting screws.
 - a. Product and Manufacturer provide one of the following:
 - 1) Minifix Connectors and Metallamat Hinge System by Hafele Incorporated.
 - 2) Or equal.
4. Provide solid stainless steel 5/16-inch diameter drawer and cabinet door pulls with No. 4 finish. Provide units 5-inch long by 2-1/2-inches deep recommended by the manufacturer for use in barrier free drawer and door pull design.

2.2 FABRICATION

- A. Machine and sand millwork to comply with the requirements of Standards for specified grade.
- B. Fabricate millwork to dimensions, profiles and details shown and specified. Rout or groove back of flat trim members.
- C. Miter joints by joining, splining and gluing to comply with requirements for the specified grade.
- D. Except as otherwise indicated fabricate plastic laminate Work to comply with Architectural Woodwork Quality Standards and Guide Specifications by AWI, Premium Grade, High-Pressure Decorative Laminates, Publication No. LD-3, by NEMA, and laminate manufacturer's published standards and specifications for the Work. No fasteners shall be visible in the finished Work.
- E. Comply with details shown and specified for profiles and construction of plastic laminate Work. Where not otherwise shown, comply with applicable Quality Standards and design criteria specified.
- F. Fabricate plastic laminate Work with precut openings. Locate openings accurately and finish with plastic laminate.
- G. Take field measurements before proceeding with the plastic laminate Work.
- H. Comply with plastic laminate manufacturer's written material use recommendations.
- I. Fabricate joints between panels to provide tight splined joints. Do not expose fasteners; use glued joints and concealed fasteners.
- J. Ease all exposed edges of plastic laminate sheet.
- K. Fabricate all edges of plastic laminate Work with matching plastic laminate.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates and supporting structure and the conditions under which the Work is to be installed, and notify ENGINEER in writing of the conditions detrimental to the Work. Do not proceed with the installation until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Insure that substrate is properly installed and aligned before installation.

3.3 INSTALLATION

- A. General:
 - 1. Discard units of material with defects which might impair the quality of the Work, and units which are too small to fabricate the Work with minimum joints or the optimum joint arrangement.
 - 2. Set millwork accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
 - 3. Securely attach millwork to substrates by anchoring and fastening as shown and as required by recognized standards. Make tight connections between members. Install fasteners without splitting of wood, predrill as required.
- B. Install the Work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8 inch in 8 feet-0 inches for plumb and level and with 1/16 inch maximum offset in flush adjoining surfaces, 1/8 inch maximum offsets in revealed adjoining surfaces.
- C. Millwork shall be secured to ground, otherwise fastened in position to hold correct surfaces, lines and levels.
- D. Soil, stain and extraneous material, whether caused by millwork handling or from adjacent surfaces, shall be removed.
- E. Scribe and cut Work to fit adjoining Work, and refinish cut surfaces or repair damaged finish at cuts.
- F. Trim: Install with 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, miter at corners, and comply with Quality Standards for joinery.
- G. Anchor millwork to anchors or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

3.4 ADJUSTMENT, CLEANING AND PROTECTION

- A. Repair damaged and defective millwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace millwork. Adjust joinery for uniform appearance.
- B. Clean exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.
- C. Complete the finishing work specified in Section 09900, Painting, to whatever extent not completed at the shop or prior to installation of millwork.
- D. Protection: The installer of the millwork shall advise CONTRACTOR of final protection and maintained conditions necessary to ensure that the Work will be without damage or deterioration at the time of Final Acceptance.

+ + END OF SECTION + +

SECTION 06611

FIBERGLASS REINFORCED PLASTIC GRATINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall furnish all labor, materials, equipment and incidentals as shown, specified and required to provide fiberglass grating in the Leachate Pumping Manhole as shown on the Drawings. The Work also includes:
 - a. Providing grating to accommodate the Work under this and other Sections and attaching to the grating and all items such as fasteners and all items required including embedded angles for which provision is not specifically included under other Sections.

B. Related Work Specified Elsewhere:

1. Section 02601, Manholes.
2. Section 05503, Anchor Bolts, Expansion Anchors and Concrete Inserts.
3. Section 05504, Miscellaneous Metal Fabrications.
4. Section 06612, Fiberglass Structural Members.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 1. Standards of the Reinforced Plastic/Composites Institute.
 2. National Bureau of Standards, PS 15-69.
- B. Field Measurements: Takes field measurements prior to preparation of Shop Drawings and fabrication where required, to ensure proper fitting of the Work.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. Representative samples of grating, fasteners and other finished products. ENGINEER review will be for type and finish only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Shop Drawings for the fabrication and erection of all Work. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
 2. Setting drawings and templates for location and installation of anchorage devices.
 3. Manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

4. The Work shall not be fabricated until CONTRACTOR submits field measurements of the openings and until the manufacturer's drawings based upon CONTRACTOR's measurements have been approved by ENGINEER.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

- A. The manufacturer shall furnish grating to conform to the following criteria:
 1. Rectangular mesh grating.
 - a. Pattern 1-1/2 inch on center with 1/2 inch openings.
 - b. Thickness: 2 inches.
 - c. Bar width: 1 inch.
 2. Maximum Clear Span Deflection (under uniform load equal to 250 pounds): 1/200 of span or 1/4 inch, at four feet, whichever is smaller.
 3. Fire Resistance: 25, ASTM E-84; self-extinguishing ASTM D 635.
 4. Sheet size: As shown.

2.2 MATERIALS

- A. Fiberglass Reinforced Plastic: Premium grade, fire retardant vinyl ester resin with glass reinforcement. Provide a non-skid surface for chemical service.
- B. Attachment and Clips: Type 304 stainless steel clips, bolts, nuts and washers.
- C. Color: Yellow.
- D. Manufacturing Method: Grating shall be constructed by the pultrusion method.
- E. Product and Manufacturer: Provide one of the following:
 1. Duradek, by Morrison Molded Fiberglass Co.
 2. Or equal.

2.3 FABRICATION

- A. Use materials of the minimum size and thickness as specified above unless shown otherwise. Work to the dimensions shown on approved Shop Drawings.
- B. Grating shall be as shown and shall comply with the standards of the Reinforced Plastic/Composites Institute, except as specified herein.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fastening to In-Place Construction: Use Type 304 stainless steel anchorage devices and fasteners to secure grating to supporting members or prepared openings, as recommended by the manufacturer.
- B. Cutting, Fitting and Placement:
 - 1. Perform all cutting, drilling and fitting required for installation. Set the Work accurately in location, alignment and elevation, plumb, level, true and free of rack. Do not use wedges or shimming devices.
 - 2. Making cutouts or openings in the field shall be approved by OWNER.
 - 3. Secure grating to Fiberglass Structural Members, as shown on the Drawings and as specified by the manufacturer.
 - 4. Fit exposed connections accurately together to form tight joints.
 - 5. Secure edges of grating to each other with end panel clips.
 - 6. Secure clips to grating with Type 304 stainless steel bolts such that the grating shall act as a unit. Place bolts not more than 3 inches from each plate section end and not more than 24 inches on center.

+ + END OF SECTION + +

SECTION 06612

FIBERGLASS REINFORCED PLASTIC
WEIR PLATES AND BAFFLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals required to furnish and install FRP weir plates and stop logs and accessories as shown and specified. Anchor bolts, fasteners and all accessories required for installation are included in this Section.
- B. Related Sections:
 - 1. Section 03300, Cast-in-Place Concrete.
 - 2. Section 03600, Grout.
 - 3. Section 05504, Miscellaneous Metal Fabrications.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. Standards of the American Society for Testing and Materials.
 - a. ASTM D256, Impact Resistance of Plastics.
 - b. ASTM D 570, Water Absorption of Plastics.
 - c. ASTM D 638, Tensile Properties of Plastics.
 - d. ASTM D 696, Coefficient of Linear Thermal Expansion of Plastics.
 - e. ASTM D 790, Flexural Properties of Plastics.
 - f. ASTM D 2583, Indentation Hardness of Plastics (Barcol).
 - 2. Standards of the Reinforced Plastic/Composites Institute.
 - 3. National Bureau of Standards, PS 15-69.
- B. Manufacturers Qualifications:
 - 1. Manufacturer shall maintain a continuous quality control program in the manufacture of articles under the Specifications.
 - 2. Provide letter or certificate describing quality control program.
 - 3. Manufacturers shall have been a minimum of 5 years in production of required equipment and materials similar to those specified.
- C. Shop Tests:
 - 1. Each article shall be furnished with certified test reports in accordance with the following methods of ASTM as a minimum:
 - a. ASTM D 256, Impact, Notched Izod.
 - b. ASTM D 570, Water Absorption.
 - c. ASTM D 570, Sulfuric Acid Absorption.
 - d. ASTM D 638, Tensile Strength.
 - e. ASTM D 696, Coef of Linear Thermal Expansion.
 - f. ASTM D 790, Flexural Strength.
 - g. ASTM D 790, Flexural Modulus.
 - h. ASTM D 2583, Barcol Hardness.

2. Each test shall be witnessed by a member of the ASTM or a Registered Professional Engineer, who may be an employee of the manufacturer. He shall sign and seal all copies of the test reports.
3. Articles shall not be shipped until the ENGINEER has approved the test reports.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 1. Manufacturer's literature, illustrations, specifications and engineering data including: materials, dimensions, weight and performance.
 2. Documentation that the manufacturer has manufactured, supplied and put into satisfactory service articles substantially similar to those specified. Criteria shall be a minimum of five installations in service for a minimum of five years.
 3. Shop Drawings showing: Methods of installation with detailed mounting information. Drawings shall indicate provisions for thermal expansion and the capability to sustain all external and internal loads that may be applied during construction and service operation.
 4. Samples of materials of each article furnished, about 4 inches by 6 inches.
 5. Operation and Maintenance Manuals including: Installation and calibration instructions, operation and maintenance data including copies of all approved Shop Drawings.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay that Work.
 2. Package materials to avoid damage during handling and shipment.
 3. Inspect all items immediately upon delivery to site. Report damaged equipment to ENGINEER who will determine action to be taken.
- B. Storage of Materials:
 1. Store materials to permit easy access for inspection and identification. Keep materials off the ground using pallets, platforms, or other supports. Support materials continuously to prevent warpage or distortion. If units are stored more than one unit high, succeeding units shall be stored level and uniformly supported by blocks and spacers.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

- A. Articles furnished in this Section shall be specifically designed, constructed and installed for the service intended. Sizes shall be as shown except where otherwise specified or approved.
- B. Design Conditions of Weir Plates:
Location: Flocculation Basins and Filter overflow
Minimum Wall Thickness (inches): 0.25
Maximum ambient temp: 120° F
Minimum ambient temp: 30° F
- C. Design Condition of Stop Logs:
Location: Raw Water Pump Station
Maximum ambient temp: 120° F
Minimum ambient temp: 30° F
Maximum Head: 13 feet
Maximum Deflection: 1/360 of the gate width at maximum head

2.2 DETAILS OF CONSTRUCTION

- A. General Material of Construction:
1. Fiber Reinforcement: Fiber reinforcement shall be woven glass, cleaned and finished with chrome or silane complexes. The yarns used in the manufacture of the fabrics shall be continuous filament E-glass (relatively alkali-free, lime-alumina-borosilicate glass). The color of the finished fabric shall be uniform and shall be characteristic of natural glass that has been cleaned and finished. Chopped strand glass and woven roving shall be as specified for the glass fabric.
 2. Plastic Resin: A high, industrial quality, general-purpose polyester resin shall be used in the laminate manufacture. It shall be translucent blue-green, rigid and contain an ultraviolet blocking agent. A maximum of 0.25 percent of ultraviolet absorber may be added to the resin. The resin shall not contain fillers except as required for viscosity control. For viscosity control a thixotropic agent up to 5 percent by weight may be added to the resin.
 3. Laminate: The laminate shall consist of an exterior layer and an interior layer.
 - a. Exterior Layer: The exterior surface shall be free of cracks and crazing with a smooth finish. This surface shall consist of 0.01 to 0.02 inch of resin-rich layer reinforced with chopped strand glass. Other methods of surface protection shall be submitted to the ENGINEER for approval.
 - b. Interior Layer: The interior layer shall be constructed to provide the necessary physical properties. Where separate layers such as mat, cloth or woven roving are used, all layers shall be lapped a minimum of one inch. Laps shall be staggered. If woven roving or cloth is used, a layer of chopped strand glass shall be placed as alternate layers. A minimum of 0.1 inch of the laminate next to the exterior

surface shall be reinforced with non-continuous glass strands having fiber lengths from 0.5 to 2.0 inches.

- c. Laminate glass to resin ratio shall be 30 percent glass and 70 percent resin.
 - d. Cut Edges: All cut or machined edges shall be coated with resin with all voids filled and no glass fibers exposed.
4. Laminate shall have the following minimum physical properties:
- | | |
|----------------------|-----------------------|
| Tensile Strength | 15,000 psi |
| Flexural Strength | 25,000 psi |
| Flexural Modulus | 1.0×10^6 psi |
| Impact, Notched Izod | 13 ft. - lb per in |
| Barcol Hardness | 40 |
- The following physical properties shall not be exceeded:
- | | |
|-------------------------------------|--|
| Thermal Expansion | 10×10^{-6} in/in/ 1° F |
| Water Absorption
(24 hrs @ 23 C) | 0.1% |

B. Method of Manufacturer: Parts shall be formed in matched molds under a minimum of 10 psig pressure.

C. Metal Attachments: All metal fasteners, bolts, nuts, washers, anchors, straps shall be Type 316 stainless steel.

2.3 MANUFACTURED PRODUCTS

A. Weir Plates:

1. Weir plates shall be as shown on the Drawings. Plates shall be 1/4-inch minimum thickness and provided with holes for mounting hardware. Holes shall provide for vertical adjustment. Plates shall be secured to attaching surfaces by 316 stainless steel 5/8-inch diameter anchor bolts and suitable fiberglass washers. Ends of weir plates shall be secured with butt plates arranged for horizontal expansion. All weir plates shall be of standard length not to exceed 12 foot, except for closure plates. Weir plates produced from fabricated plate stock with cut edges and notches will not be acceptable.

B. Stop Logs and Accessories

1. Stop logs shall be manufactured of fiberglass reinforced polyester, totally encapsulating an internal reinforcing structure. The resins shall be ultraviolet stabilized and seamless to protect the inner structural members from corrosion. The surface layers shall have a composition of approximately 95% (by weight) resin to a depth of 0.01 inches to 0.020 inches. Structural reinforcing shall be utilized to meet deflection requirements and encapsulated by not less than 1/4 inch of laminate. Stop logs shall be flat and level. Warpage shall not produce a crown of more than 1/16 inch in any direction. Stop log shall be furnished with stainless steel lifting pins that extend through the logs. Each pin and the area surrounding the pin shall be capable to withstand a lifting force of 5,000 pounds.
2. Guide frames shall be made of T-304 stainless steel and shall have tabs for anchorage into the concrete.

3. Seals and Sealing Surfaces: Neoprene seals shall be provided on the stop logs for sealing between the logs and on the guide frame for a seating surface for the stop logs. Seals shall be designed to limit leakage to a minimum.
4. Stop Log Lifting Beam shall be provided. The lifting beam shall be constructed with hooks which automatically hook onto the stop logs when lowered into the guide frames. A tagline release mechanism shall be furnished. Hooks and pins shall be constructed of T-304 stainless steel. The beam shall be of galvanized steel. A harness shall be provided for attaching the lifting beam to the hook of a hoist being furnished in Section 14310.
5. Provide one set of stop logs for each of the channel widths at the Raw Water Pump Station. Stop logs shall be of sufficient length to span the channel plus the depth of the guide frame. Width of stop logs shall not exceed 16-inches each. The total height of stop logs shall be 14 feet.

C Products and Manufacturers:

1. Fiberglass reinforced plastic weirs shall be the product of one manufacturer. Products shall be as manufactured by the following:
 - a. Glass-Steel, Division of Morrison Molded Fiberglass Co.
 - b. F.B. Leopold Co., Subsidiary of Muller Company.
 - c. Warminster Fiberglass Co.
 - d. Or equal.
2. Stop logs shall be the product of one manufacturer. Products shall be as manufactured by the following:
 - a. Plasti-Fab, Inc.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect all items immediately upon delivery to site. All surfaces shall be smooth, free of voids, and porosity, without dry spots, crazes or unreinforced areas. Raw or machined edges shall be covered with a coating of rich resin.
- B. Do not install damaged items until repairs are made in accordance with manufacturers written instructions and approval by ENGINEER. Only minor repair work shall be permitted in the field, or other repair work shall be sent to factory for repair or replacement.

3.2 INSTALLATION

- A. Install all Work in complete conformance with manufacturer's instructions.
- B. Install at locations and elevations shown, unless otherwise approved by ENGINEER.
- C. Set all weir plates level within plus or minus 1/16 inch throughout.

3.3 START-UP AND TEST

- A. CONTRACTOR shall verify that all Work furnished and installed is compatible with design function.
- B. CONTRACTOR shall make all adjustments required to place all Work in proper operating conditions.
- C. Provide a manufacturer's factory-trained serviceman to check and approve all installations before operation. He shall instruct plant personnel on care and maintenance of the materials and equipment.

+ + END OF SECTION + +

THERMAL AND MOISTURE PROTECTION

Division 7

SECTION 07210
BUILDING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all building insulation Work.
2. The extent of each type of building insulation is shown or is specified herein.
3. The types of building insulation Work required include, but are not necessarily limited to, the following:
 - a. Glass fiber insulation.
 - b. Loose granular perlite insulation.
 - c. Sound attenuation mineral fiber blanket insulation.
 - d. Fire safing insulation and gas and smoke tight-fire resistant sealants and other fire stop system components for each kind and condition of penetration through fire rated construction.
 - d. Miscellaneous materials and accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the insulations.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 04220, Concrete Unit Masonry.
3. Section 07220, Roof Insulation.
4. Section 07222, Exterior Wall Insulation and Finish System.
5. Section 09291, Glass Fiber Cement Wallboard.
6. Section 09513, Suspended Metal Ceiling.

1.2 QUALITY ASSURANCE

- A. Design Criteria: Thermal Conductivity: The thicknesses shown are for the thermal conductivity, k-value at 75 degrees F., specified for each material. Provide adjusted thicknesses as directed for the use of material having a different thermal conductivity.
- B. Requirements of Regulatory Agencies: Comply with fire-resistance and flammability ratings as shown and specified; and comply with code interpretations by governing authorities.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
 1. ASTM C 165, Standard Method for Measuring Compressive Properties of Thermal Insulations.

2. ASTM C 177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
3. ASTM C 240, Testing Cellular Glass Insulation Block, Method of.
4. ASTM C 303, Density of Preformed Block-Type Thermal Insulation, Test Method for.
5. ASTM C 518, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
6. ASTM C 520, Standard Test Method for Density of Granular Loose Fill Insulations.
7. ASTM C 549, Standard Specification for Perlite Loose Fill Insulation.
8. ASTM C 553, Specification for Mineral Fiber Blanket and Felt Insulation.
9. ASTM C 612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
10. ASTM C 665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
11. ASTM D 2842, Standard Test Method for Water Absorption of Rigid Cellular Plastics.
12. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.
13. ASTM E 96, Standard Test Method for Water Vapor Transmission of Materials.
14. ASTM E 136, Behavior of Materials in Vertical Tube Furnace at 750 C, Test Method for.
15. Federal Specification FS HH-I-515D, Insulation, Thermal (Loose Fill for Pneumatic or Poured Applications); Cellulosic or Wood Fibers.
16. Federal Specification, FS HH-I-558B, Insulation, Blocks, Boards, Blankets, Felts, Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber Industrial Type).
17. Federal Specification, FS HH-I-574B, Insulation, Thermal, (Perlite).

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. 12-inch by 12-inch samples of each required type of building insulation.
 2. Samples will be reviewed by ENGINEER for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Copies of manufacturer's specifications and installation instructions for each type of building insulation specified, including data substantiating that the materials comply with specified requirements.
 2. Complete selection of fire stop manufacturer's recommended systems for each condition and kind of penetration encountered in the Work. Coordinate with equipment manufacturers for required number and kind of penetrations through fire rated

construction. Provide a schedule of penetrations and the fire stop system to be included in the Work for each condition and kind of penetration encountered.

3. Indicate by copy of transmittal form that Installer has received copy of manufacturer's installation instructions.

1.4 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work.
- B. Comply with manufacturer's recommendations for handling, storage and protection during the progress of the Work.

1.5 JOB CONDITIONS

- A. Protection:
 1. Do not allow building insulation materials to become wet or soiled, or covered with ice or snow.
 2. Protect foam plastic building insulation from exposure to sunlight.
 3. Do not allow building insulation to come into contact with welding operations or other fire or ignition sources.
- B. Scheduling:
 1. Do not deliver building insulation materials to the project site ahead of scheduled dates of installation.
 2. Do not store more building insulation on site than is necessary to insure uninterrupted progress of the Work.
 3. Proceed with building insulation Work only when preceding Work is ready to receive the Work of this Section.
- C. Environmental Conditions:
 1. Complete the installation and concealment of building insulation materials as rapidly as possible in order to avoid damage from adjacent construction operations and adverse weather conditions.
 2. Do not apply pressure sensitive tape when temperature is below 35 F or above 110 F.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Glass Fiber Insulations: Provide the following types:
 1. General: Provide insulations formed from glass fibers and resinous binders fabricated into flexible blankets, semi-rigid and rigid sheets complying with ASTM C 665, ASTM C 553, ASTM C 612 and FS HH-I-558B.
 2. Flame-Resistant Vapor Barrier Faced Batt Insulation: Provide thermal batt insulation, faced on one side with a foil-reinforced-kraft laminate vapor barrier complying with ASTM C 665, Type III, Class A.

- a. Physical Properties.
 - 1) Thermal Conductivity (k), ASTM C 518: 0.32.
Btu/in./hr./sf/°F.
 - 2) Density, ASTM C 303: 1.5 pcf.
 - 3) Water Vapor Transmission, ASTM E 96: 0.10 perm/inch.
 - 4) Flame Spread, ASTM E 84: 25.
 - 5) Smoke Developed, ASTM E 84: 50.
 - 6) Fuel Contributed, ASTM E 84: 50.
 - b. Thickness: 3-1/2-inches; 6-1/4-inches; 9-1/2-inches.
 - c. Width: 23-inches; with stapling flanges.
 - d. Product and Manufacturer: Provide one of the following:
 - 1) FS-25 FRK Faced Thermal Batt Insulation by Owens-Corning Fiberglass Corporation.
 - 2) Or equal.
- B. Loose Granular Perlite Insulations: Provide the following:
- 1. Loose Fill Insulation: Provide inert asbestos-free volcanic glass-like perlite aggregates expanded by a special heat process and treated with non-flammable silicone complying with FS HH-I-515D and FS HH-I-574B.
 - a. Physical Properties:
 - 1) Thermal Conductivity (k), ASTM C 549: 0.37 Btu/in./hr./sf/°F.
 - 2) Density, ASTM C 520: 5-8 pounds per cubic foot.
 - 3) Flame Spread, ASTM E 84: 0.
 - 4) Fuel Contributed, ASTM E 84: 0.
 - 5) Smoke Development, ASTM E 84: 0.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Permalite by Grefco Incorporated.
 - 2) Or equal.
- C. Mineral Fiber Insulation: Provide the following types:
- 1. General: Provide insulations formed from inorganic mineral fibers extrusion spun at 2500 F complying with ASTM C 665 and ASTM C 764.
 - 2. Sound Attenuation Fire Blanket Insulation: Provide insulation containing non-asbestos, non-combustible compounds of spun mineral fiber felt formed into flexible, resilient blankets with extra width to allow creased installation complying with ASTM C 665, Type I.
 - a. Physical Properties:
 - 1) Thermal Conductivity (k), ASTM C 518: 0.27
Btu/in./hr./sf/°F.
 - 2) Density, Manufacturer's Certified Test: 2.5 pcf.
 - b. Thickness: 3-inches.
 - c. Width: 16-inches.
 - 3. Product and Manufacturer: Provide one of the following:
 - a. Creased Thermafiber SAFB by USG Interiors, Incorporated.
 - b. Or equal.
- D. Fire Safing Insulation: Provide the following:
- 1. Semi-rigid non-asbestos compounds of spun mineral fiber felt, meeting FS HH-I-521F, Type I, Class A and FS HH-I-558B, Form A, Classes 1 and 2. Nominal density of 4 pounds per cubic foot and a thermal conductivity (k) of 0.24.

2. Fire Performance Properties:
 - a. Flame Spread Rating, ASTM E 84: 15 maximum.
 - b. Fuel Contributed, ASTM E 84: 1 maximum.
 - c. Smoke Development, ASTM E 84: 0 maximum.
 - d. Fire Resistance Rating, ASTM E 119: 3 hours minimum.
 3. Product and Manufacturer: Provide one of the following:
 - a. Thermafiber Fire-Safing Insulation by USG Interiors Incorporated.
 - b. Or equal.
- E. Miscellaneous Materials and Accessories: Provide the following:
1. Adhesive for Bonding Insulation: The type recommended by the insulation manufacturer, and complying with fire-resistance requirements.
 2. Mechanical Anchors: Type and size shown or, if not shown, as recommended by the insulation manufacturer for the type of application shown and condition of substrate.
 3. Impaling Clips: Provide galvanized steel impaling clips complying with requirements of governing code authorities and as recommended by the insulation manufacturer for full system responsibility.
 4. Wire Arch Insulation Supports: Manufacturer's standard 11 gage galvanized spring-steel clip wire arches, for self-anchoring into wood joists; length as needed for joist spacing.
 5. Adhesive Tapes: Complete selection of insulation manufacturer's recommended taping materials.
 6. Bitumen: Asphalt, ASTM D 449.
 7. Fire-Stop Sealants and Other Fire-Stop System Components: Provide the following:
 - a. Complete selection of fire stop manufacturer's recommended silicone rubber fire stop systems. Provide complete systems complying with UL 1479 with a two or three hour fire rating. Provide equal fire protection as provided by fire-rating of construction penetrated.
 - b. Provide multiple component systems coordinated to meet actual conditions encountered in the Work and as recommended by the fire stop manufacturer. In addition to providing fire-resistance the fire stop systems shall also be gas and watertight.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Fire Stop Systems by Dow Corning Corporation.
 - 2) Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which the Work is to be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, submit to ENGINEER specific recommendations from manufacturer for approval before proceeding with the Work.
2. Extend all insulations full thickness over entire surface to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.
3. Apply a single layer of insulation of the required thickness or the required thickness to provide the thermal value indicated, unless otherwise shown or required, to make up the total thickness.

B. Unit-Type Building Insulation:

1. Apply insulation units of the type shown to the substrate by the method indicated. If not otherwise indicated and except for units resting on horizontal surfaces, bond units to substrate with mechanical anchorage to provide permanent placement and support of units.
2. Set vapor barrier faced units with vapor barrier to warm side of construction, (usually toward inside), except as otherwise shown. Do not obstruct ventilation spaces, except for firestopping.
3. Tape joints and ruptures in vapor barriers, using adhesive tape of type recommended by insulation manufacturer, and seal each continuous area of insulation to surrounding construction so as to ensure vapor-tight installation of the units.
4. Set reflective foil-faced units accurately with air space in front of foil as shown. Provide not less than 0.75 inch air space where ever possible.

C. Safing Insulations and Fire Stop Systems:

1. Install safing insulation and fire stop systems to present a continuous fire-rated fire barrier at the perimeter of all fire-rated partitions, poke through floor and wall penetrations, to maintain the continuity of fire-rated construction and in areas shown.
2. Install fire stop sealants and other fire stop system components in thicknesses recommended by the manufacturer at all locations where poke through penetrations occur, all locations where other penetrations such as ducts, pipe cables, cable trays and conduit occur and at the perimeter of all fire rated walls.
3. Include all components of manufacturer's fire/smoke stop systems for complete system responsibility installed in accordance with manufacturer's written recommendations and specifications.

D. Loose-Fill Type Insulation:

1. Pour granular insulation into spaces and onto surfaces as shown to completely fill all void spaces. Screed horizontal applications to uniform thicknesses indicated.

3.3 ADJUSTMENT AND CLEANING

- A. Protect insulations from damage or abuse from other work until Final Acceptance.

+ + END OF SECTION + +

SECTION 07220

ROOF INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof insulation Work.
2. The extent of roof insulation is shown.
3. The types of roof insulation Work required includes, but is not necessarily limited to, the following:
 - a. Tapered glass fiber board roof insulation.
 - b. Board-type roof insulation.
 - c. Mechanical fastening systems approved by primary roofing system manufacturer in order to maintain uniform ballast cover.
 - d. Miscellaneous materials and accessories.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation of items that must be installed or coordinated with the roof insulation.

C. Related Sections:

1. Section 06100, Rough Carpentry.
2. Section 07530, Elastic Sheet Roofing.
3. Section 07619, Flashing and Trim.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Subcontract roof insulation Work to the installer of the associated roofing for undivided responsibility.

B. Design Criteria:

1. The thicknesses shown are for the thermal conductivity, k-value at 75 F specified for each material.
2. Comply with Factory Mutual Technical Advisory Bulletin 1-29 for recommendation concerning combined ballast and fastening requirements for I-90 securement.

C. Requirements of Regulatory Agencies: Comply with fire-resistance ratings as required by governing authorities and the Uniform Building Code, and with the following roof insulation requirements:

1. U.L. requirements for Roof Deck Constructions which are rated "UL Construction No. 1".
2. Factory Mutual requirements for "Class I" construction, for fire hazard and wind resistance.

- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM C 355, Water Vapor Transmission of Thick Materials.
 2. ASTM C 518, Thermal Conductivity of Materials by Means of Heat Flow Meter.
 3. Federal Specification, HH-I-526C, Thermal (Mineral Fiber) Insulation Board.
 4. FM, Approval Guide.
 5. U.L., Building Materials Directory.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Each type of screw and plate fastener to be used in the Work.
 2. 12-inch by 12-inch sample of specified rigid board-type insulation.
- B. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications and installation instructions for type of insulation required. Include data substantiating that the materials comply with specified requirements.
 2. Weights of all equipment to be used on roof.
 3. Copies of written guarantee, as specified.
 4. Complete layout of all roof insulation showing sizes, placement, number of courses, methods of fastening and statement that fastening method has been approved by elastic sheet roofing manufacturer.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Do not deliver roof insulation materials to the project site before time of installation.
- B. Storage of Materials: Do not allow roof insulation materials to become wet or soiled, or covered with ice or snow.
- C. Handling of Materials: Comply with manufacturer's recommendations for handling, storage and protection.

1.5 JOB CONDITIONS

- A. Environmental Requirements: Do not install roof insulation when weather conditions are such that the deck is not completely dry, or where there is no assurance that the roof insulation can be completely covered with the complete roofing system by the end of the day.
- B. Protection: Do not overload the building structures with the weight of stored materials or use of equipment.
- C. Sequencing:
1. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the roofing membrane over the roof insulation are at the site and are ready

- to follow with this Work immediately (same day) behind the tapered board-type and rigid board-type roof insulation Work.
2. Do not install any more roof insulation each day than can be covered with complete elastic sheet roofing system by the end of that working day.

1.6 SUBSTITUTIONS

- A. Manufacturer of the primary roofing system shall be a manufacturer who finds the generic types of roof insulation specified herein as acceptable and bondable if installed according to the roofing manufacturer's standards for complete product and performance responsibility.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Tapered Glass Fiber Board Roof Insulation:
 1. Composed of glass fibers and water-resistant binders formed into rigid, non-combustible boards with glass fiber reinforced asphalt saturated top surface and bearing a FM Class I rating. Size 36-inches by 48-inches. Provide the following physical properties:
 - a. Thermal Conductance (k), ASTM C 518: 0.27.
 - b. Vapor Transmission, ASTM C 355: Highly permeable.
 - c. Meet requirements of Federal Specification HH-1-526C.
 2. Thickness:
 - a. Base Layer: 2-inches.
 - b. Tapered Top Layer: Varies from 3-inches to 0-inches.
 3. Provide minimum slope to drain of 1/4-inch per foot.
 4. Provide custom pre-cut factory-formed corners, crickets, hips and valleys.
 5. Product and Manufacturer: Provide one of the following:
 - a. Tapered FIBERGLAS Roof Insulation System by Sibco Incorporated.
 - b. Or equal.
- B. Glass Fiber Board Roof Insulation:
 1. Composed of glass fibers and water-resistant binders formed into rigid, non-combustible boards with glass fiber reinforced asphalt saturated top surface and bearing a FM Class I rating. Size 48-inches by 96-inches by 1-5/8-inches thick. Provide the following physical properties:
 - a. Thermal Conductance (k), ASTM C 518: 0.27.
 - b. Vapor Transmission, ASTM C 355: Highly permeable.
 - c. Meet requirements of Federal Specification HH-1-526C.
 2. Where 3-inches of rigid insulation is indicated on the Plans, provide a layer of 3/4-inch thick perlite board (Fesco Board by Manville, or equal) over a layer of 2.4-inch thick fiberglass faced, closed cell phenolic foam core board (UltraGard Premier Board by Manville, or equal). Installed thermal resistance factor "R" shall not be less than 22.08 for the total insulation thickness of 3-inches.

3. Product and Manufacturer: Provide one of the following:
 - a. FIBERGLAS Roof Insulation by Owens-Corning Fiberglas Corporation.
 - b. Fesco Board/UltraGard Premier by Manville Corp.
 - c. Or equal.
- C. Miscellaneous Materials:
 1. Joint Tape: 6-inch wide glass fiber tape.
 2. Adhesive for Bonding Insulation: The type recommended by the insulation manufacturer, and complying with fire-resistance requirements.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which the insulation Work is to be performed, and notify ENGINEER in writing of any unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General:
 1. Tapered glass fiber board roof insulation system shall be designed and totally precut at the factory.
 2. Comply with manufacturer's instructions for the particular conditions of installation in each case. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer's technical representative for specific recommendations before proceeding with the Work.
 3. Coordinate heights of masonry and wood blocking to provide flush, smooth transitions between roof insulation Work and perimeter wood blocking.
 4. Extend roof insulations full thickness as shown and specified over entire surface to be insulated.
 5. Cut and fit roof insulation Work tightly around obstructions, and fill voids with insulation. Keep back 1/4-inch for all vertical flashings.
- B. Laying Roof Insulation Units:
 1. Set units in adhesive and mechanically fasten in accordance with the requirements of the applicable fire and insurance ratings and roofing membrane manufacturer's recommendations, and applied in accordance with the recommendations of the manufacturer of the insulation, adhesive and completed roofing system.
 2. Apply two courses of rigid glass fiber board roof insulation. Provide tapered rigid board roof insulation at crickets and sloped areas shown to provide 1/4-inch per foot positive slope to drains. Provide a minimum of two courses of roof insulation at low points.
 3. Apply two courses of rigid glass fiber board roof insulation over entire surface of the roof.

4. Stagger joints between courses.
5. Install all roof insulation board with the long joints between boards parallel with incline of deck.
6. Keep joints continuous in both directions.

3.3 PERFORMANCE

- A. Roof insulation Work shall withstand the uplift forces of wind, as defined by the roofing guarantee. Refer to Section 07530, Elastic Sheet Roofing. Failures of the roof insulation Work in bond or anchorage to the substrate, or within the insulation, will be considered failures of materials or workmanship under the Roofing Guarantee.

3.4 PROTECTION

- A. Do not permit construction period traffic over completed roof insulation Work, except as required to install roofing and flashing Work.
- B. Protect roof insulation Work from exposure to moisture, damage and deterioration, primarily by prompt installation of roofing Work to be placed over the roof insulation.

3.5 INSPECTION AND ACCEPTANCE

- A. Roof insulation which has become wet, damaged, or deteriorated, as determined by ENGINEER, shall be promptly removed from the job.
- B. Correct all improperly sloped, ridged or rough areas in the roof insulation Work to provide insulation acceptable to roofing manufacturer.

+ + END OF SECTION + +

SECTION 07222

EXTERIOR WALL INSULATION AND FINISH SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all exterior wall insulation and finish system Work.
2. The extent of the exterior wall insulation and finish system is shown.
3. The types of exterior wall insulation and finish system Work required includes, but is not necessarily limited to, the following:
 - a. A ready-mixed acrylic-based textured wall coating system including double layers of reinforcing mesh and all additives and components as recommended by the manufacturer for application over rigid insulation board, concrete unit masonry and cast-in-place concrete.
 - b. Key coats, ground coats and finish coats of reinforced plaster materials with mechanical finish specified.
 - c. Double-layer reinforcing meshes and applicable matrixes for all surfaces receiving rigid insulation board to full height and width.
 - d. Single-layer mesh and applicable matrixes for all surfaces not receiving rigid insulation board.
 - e. Insulation board.
 - f. All additives and miscellaneous components necessary to complete the Work.
 - g. Custom fabrication of all system components as required to reproduce the architectural features shown to the allowable tolerances specified.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to the exterior wall insulation and finish system Work.
2. Review installation procedures under other Sections and coordinate the Work to produce substrate surfaces free from contaminants incompatible with the exterior wall insulation and finish system Work, and substrates acceptable to the exterior wall insulation and finish system installer for completely acceptable product performance.

C. Related Sections:

1. Section 07210, Building Insulation.
2. Section 09291, Glass Fiber Cement Wallboard.

1.2 QUALITY ASSURANCE

- A. **Installer Qualifications:** Engage a single installer regularly engaged in exterior wall insulation and finish systems Work, and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Engage an installer approved by the manufacturer.
- B. **Design Criteria:**
1. Comply with the recommendations of the Plasterer's Manual, by the Portland Cement Association and the applicable Building Code, except where more stringent requirements are shown or specified.
 2. In order to insure complete product compatibility and bondability of the completed exterior wall insulation and finish system Work, CONTRACTOR may, with the approval of ENGINEER, submit manufacturer sub-components of the exterior wall insulation and finish system Work which the manufacturer certifies in writing to ENGINEER, to be more appropriate to the substrate or job conditions encountered. All such approved substitutions shall be at no additional cost to OWNER. No reduction in number of layers or types of reinforcing mesh shall be approved by ENGINEER.
 3. Final selection of products shall be made from manufacturer's complete selection of highest quality products at no additional expense to OWNER.
 4. A fully adhesive-based system is specified herein. Where, on new work, acceptability of substrate adhesive bond cannot be determined or made acceptable to the exterior wall insulation and finish system installer, provide exterior wall insulation and finish system manufacturer's standard sheathing dowel system for the Work of this Section.
- C. **Allowable Tolerances:**
1. Flat or Curved Surfaces: Do exceed 1/8-inch in 8 feet for bow or warp of surface, and for plumb or level.
 2. Color Breaks: Do not exceed 1/8-inch in 8 feet out-of-alignment from color break lines shown on the Drawings.
- D. **Source Quality Control:** Obtain all materials from the same manufacturer. Obtain materials only from manufacturers who will:
1. Provide the services of a qualified manufacturer's representative at the project site at the commencement of Work and during the time when the mock-up Work is being done to advise on materials, installation and finishing techniques.
 2. Certify long term compatibility of all coatings with the substrates.
 3. Do not use air entraining agents, air entrained lime, or air entrained portland cement.
- E. **Job Mock-Ups:**
1. Prior to the installation of the exterior wall insulation and finish system Work, but after ENGINEER'S approval of the samples of each type of material, build free-standing 4 foot by 6 foot sample panels of each type of complete exterior wall insulation and finish system on same substrate material that will be used

in the Work, to show a representative installation of each complete exterior wall insulation and finish system Work including final texture and colors. Stage sample panel Work to leave exposed a 12-inch wide band of each component required in the Work. Obtain ENGINEER'S acceptance of visual qualities of the mock-ups before start of exterior wall insulation and finish system Work. Retain and protect mock-up during installation as a standard for judging completed exterior wall insulation and finish system Work. Do not alter approved mock-ups. Build as many sample panels as required to obtain ENGINEER'S acceptance of the Work.

2. Exterior wall insulation and finish system Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material, as required by ENGINEER.
3. Job Mock-ups that do not have an exposed portion of each system component shall be rejected.

F. Reference Standards: Comply with applicable provisions and recommendations, except as otherwise shown or specified.

1. ASTM C 150, Portland Cement.
2. ASTM C 177, Steady-State Thermal Transmission Properties by Means of Guarded Hot Plate.
3. ASTM C 203, Breaking Load and Calculated Flexural Strength of Preformed Block-Type Thermal Insulation.
4. ASTM C 272, Water Absorption of Core Materials for Structural Sandwich Constructions.
5. ASTM C 303, Density of Preformed Block-Type Thermal Insulation.
6. ASTM C 518, Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
7. ASTM C 550, Measuring Trueness and Squareness of Rigid Block Thermal Insulation.
8. ASTM D 696, Coefficient of Linear Thermal Expansion of Plastics.
9. ASTM D 968, Abrasion Resistance of Organic Coatings by the Falling Abrasive Tester.
10. ASTM D 1621, Compressive Properties of Rigid Cellular Plastics.
11. ASTM D 1623, Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
12. ASTM E 72, Strength Tests of Panels for Building Construction.
13. ASTM E 84, Surface Burning Characteristics of Building Materials.
14. ASTM E 96, Water Vapor Transmission of Materials.
15. ASTM E 330, Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. 12-inch by 12-inch samples of each type of complete exterior wall insulation and finish system showing finished colors and textures on substrate simulating each actual project substrate.
2. Each component material to be used in the Work.
3. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.

- B. Shop Drawings: Submit for approval the following:
 - 1. Manufacturer's specifications and installation instructions for each component of the exterior wall insulation and finish systems for each substrate.
 - 2. Manufacturer's complete selection of standard and custom colors and textured finish coats.
 - 3. Fully coordinated Shop Drawings showing 1/4-inch scale elevation of all walls to receive the Work of this Section and all termination details at 1-1/2 inch scale between this Work and the work of other sections. Also include details of system components and control joint locations and details and all custom architectural shapes required for the Work.
- C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.
- D. Certification: Certify that all coatings are compatible with substrates as specified.
- E. Maintenance Manual: Submit copies of bound maintenance manual for the exterior wall insulation and finish Work. Include instructions for cleaning, repair and general maintenance Work. Include manufacturer's data on all components of the exterior wall insulation and finish Work and name, address and telephone number of manufacturer, installer and local product distributor.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver materials in exterior wall insulation and finish system manufacturer's original unopened packages.
 - 2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Formula or specification number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life and curing time when applicable.
 - 3. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by ENGINEER, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to OWNER.
- B. Storage of Materials:
 - 1. Store materials so as to preclude the inclusion of foreign materials.
 - 2. Store in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.
 - 3. Store materials out of direct sunlight and at a temperature of not less than 40 F.
- C. Handling:
 - 1. Handle materials carefully to prevent inclusion of foreign materials.

2. Do not open containers or mix components until necessary preparatory Work has been completed and installation will start immediately.
3. Do not expose combustible or sensitive material to excessive heat or open flame.
4. Materials shall be used in the Work only when the material being incorporated into the Work bears the same name and formulation as the container or package in which it is contained.
5. CONTRACTOR shall not change containers or use material from unmarked or incorrectly labeled containers.
6. Failure to comply with this requirement will be cause for ENGINEER requiring the product to be removed from the site and the area wherein the product has been incorporated to be removed and rebuilt with material complying to the specified requirements. This requirement shall govern even if CONTRACTOR certifies or proves that the material was appropriate for incorporating into the Work.

1.5 JOB CONDITIONS

A. Environmental Conditions:

1. Proceed with the exterior wall insulation and finish system Work only when weather conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the Specification requirements and with the recommendations of the exterior wall insulation and finish systems materials manufacturer.
2. Do not proceed with the installation of exterior wall insulation and finish system under adverse weather conditions, or when temperatures are below 40 F or expected to fall below 40 F within 24 hours after installation.
3. Do not apply in hot sun or on heated walls unless walls are cooled first by hosing with clean water until cool.
4. Under extremely windy or hot conditions, where too rapid drying occurs, cure finished surface by fog spraying with water. Comply with manufacturer's recommendations to prevent color variation.
5. Proceed only when CONTRACTOR and his installer are willing to guarantee the Work as required and without additional reservations and restrictions.

B. Scheduling:

1. Proceed with the exterior wall insulation and finish system Work only after all glass fiber cement board construction, cast-in-place concrete and framing for projections through the substrate construction are completed.
2. Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the exterior wall insulation and finish system Work are at the site and have sufficient materials and resources to complete the Work in a manner which shall reveal no inconsistencies of texture, color or allowable tolerance in the finished Work greater than that which has been approved on the sample panel by ENGINEER.

C. Protection:

1. Do not allow finish system Work to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining materials.
2. Draw all color break lines accurately and to the tolerances specified.
3. Protect materials against damage by construction traffic.

1.6 GUARANTEE

- A. CONTRACTOR shall execute his own written guarantee direct to OWNER warranting all exterior wall insulation and finish system Work weather and watertight, color fast, and non-crazing, cracking or delaminating for a period of three years after the date of conditional acceptance thereof by OWNER. Imperfections, by reason of defective materials, workmanship or arrangement of the various parts shall be made good to the satisfaction of OWNER at CONTRACTOR'S expense.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Insulation Board: Provide the following:
1. Rigid: 100 percent virgin expandable polystyrene modified resin bead board with bead fusion of 80 percent minimum with no visible voids.
 2. Molded blocks air dried for minimum of six weeks with less than 0.5 percent residual pentane prior to fabrication.
 3. Dimension Tolerances, ASTM C 550:
 - a. Length: $\pm 1/16$ inch.
 - b. Width: $\pm 1/16$ inch.
 - c. Thickness: $\pm 1/16$ inch.
 - d. Squareness: $\pm 1/16$ inch.
 - e. Flatness: $\pm 1/32$ inch.
 4. Physical Properties:
 - a. Density, ASTM C 303: 0.91-1.10 lbs/cu.ft.
 - b. Thermal Resistance, (R at 75 F), ASTM C 177 and ASTM C 518: R=3.85 s.f./F/hr/BTU.
 - c. Thermal Conductivity (k at 40 F), ASTM C 177 and ASTM C 518: U=0.25 BTU/in.hr/s.f./F.
 - d. Coefficient of Thermal Expansion, ASTM D 696: 3.5×10^{-5} in/in./F.
 - e. Compressive Strength (10% deflection), ASTM D 1621: 13-17 psi.
 - f. Flexural Strength, ASTM C 203: 28-35 psi.
 - g. Tensile Strength, ASTM C 1623: 16-20 psi.
 - h. Water Vapor Transmission, ASTM E 96: 1.2-2.2 perms.
 - i. Water Vapor Absorption, ASTM C 272: Less than 2 percent.
 - j. Flame Spread, ASTM E 84: 5.
 - k. Smoke Developed, ASTM E 84: 40-85.
 5. Thicknesses: 1-inch and as required to provide architectural features shown.

6. Rigid insulation shall be as approved by the exterior wall insulation and finish system manufacturer for complete product system responsibility.
 7. Where insulation board is shown with non-standard profiles provide custom fabricated rigid polystyrene resin boards fabricated to the profiles shown, complying with the tolerances specified. Provide continuous pre-molded inside and outside corner shapes.
 - a. Product and Manufacturer: Provide one of the following:
 - 1) Custom Foam Products by Treadway Industries Incorporated.
 - 2) Custom Foam Products by Associated Foam Manufacturers, Incorporated.
- B. Primers: Provide the following primers and sealers for the substrate encountered and as recommended by the manufacturer of the complete exterior wall insulation and finish system:
1. Over Ground Coat: Provide manufacturer's recommended acrylic co-polymer emulsion primer with titanium dioxide extenders and calcium carbonate and quartz fillers, as an adhesion and water-resistance-enhancing intermediary coat over the ground coat. Provide primer tinted to match finish coat. Primer shall prevent efflorescence which may otherwise be present due to portland cement additives and to improve water resistance of the completed Work.
 2. Over Exterior Grade Glass Fiber Cement Wallboard Sheathing: Provide a solvent based, unpigmented co-polymer resin surface sealer and adhesion intermediary to provide uniform absorption.
 3. Over Concrete Unit Masonry: Provide an acrylic co-polymer emulsion primer, with titanium dioxide extenders and calcium carbonate and quartz fillers, tinted to match the color of the finish coat.
 4. Over Portland Cement Plaster and Cast-In-Place Concrete: Provide a solvent based acrylic polymer substrate hardener and sealer capable of consolidating and preventing saponification.
- C. Adhesives: Provide the following adhesives as required for the substrate encountered and as recommended by the manufacturer of the complete exterior wall insulation and finish system:
1. Over Primed and Sealed Exterior Grade Glass Fiber Cement Wallboard Sheathing: Provide acrylic co-polymer emulsion primer, with titanium dioxide extenders and calcium carbonate and quartz fillers, tinted to match the color of the finish coat.
 2. Over Primed Concrete Unit Masonry and Primed and Hardened Cast-In-place Concrete: Same as ground coat specified under 2.1.D.1. below.
- D. Ground Coats: Provide the following ground coat as required for the substrate encountered and as recommended by the manufacturer of the complete exterior wall insulation and finish system:
1. Over Primed Cast-In-Place Concrete and Primed Concrete Unit Masonry: Provide a water based co-polymer emulsion, capable of bridging hairline cracks in concrete, containing quartz sands and other special fillers and requiring the addition of 20 percent by weight of portland cement. Use to level and smooth concrete as specified.

- E. Reinforcing Meshes: Provide the following two types:
1. Heavy Duty Reinforcing Mesh:
 - a. Alkali-resistant glass fiber double strand interwoven mesh made from twisted multi-end strands.
 - b. Glass fibers coated with a minimum of 20 grams of styrene butadiene per square yard.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Armor Mat by STO Energy Conservation Incorporated.
 - 2) Or equal.
 2. Standard Reinforcing Mesh:
 - a. Alkali-resistant glass fiber symmetrically interlaced, made from twisted multi-end strands.
 - b. Glass fibers coated with a minimum of 20 grams of styrene butadiene per square yard.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Reinforcing Fiber Mesh by STO Energy Conservation Incorporated.
 - 2) Or equal.
- F. Textured Wall Finish: Provide a ready-mixed water-based co-polymer acrylic wall coating capable of achieving a uniform textured sandblast effect, containing marble aggregate, fine pigments and fillers. Comply with the following:
1. Particle Size: 2.0 millimeter.
 2. Color: Complete selection of manufacturer's standard and custom colors. ENGINEER shall select a maximum of 5 different colors or tones.
 3. Texture: Textured stucco effect. Final exact texture to be selected by ENGINEER from manufacturer's complete selection of standard and custom textured finishes.
 4. Weather Resistance: Extremely resistant.
 5. Hardness: Very resistant to mechanical stress. Scratch and impact resistant.
 6. Flexibility: Very flexible; capable of bridging normal shrinkage cracks.
 7. Manufacturer's of "or equal" products and systems shall provide exactly the same complete selection of standard and custom colors and textures as the manufacturer specified.
 8. Product and Manufacturer: Provide the following:
 - a. STOLIT by STO Energy Conservation Incorporated.
 - b. Or equal.
- G. Miscellaneous Materials: Provide the following:
1. Sheathing Dowels: Plastic, wing-tipped type fasteners with a thermal cap to prevent uneven thermal and vapor diffusion.
 2. Water: Free from injurious amounts of impurities and potable.
 3. Portland Cement: ASTM C 150, Type I.

2.2 MIXES

- A. Stir co-polymer based adhesive, ground coat and leveler following manufacturer's written instructions, prior to the addition of Type I portland cement.

- B. Add 20 percent portland cement by weight to co-polymer based adhesive, ground coat and leveler.
- C. Batch material as recommended by the manufacturer and add premeasured amounts of portland cement slowly to co-polymer based adhesive, ground coat and leveler material.
- D. Anti-freeze, acclerators and rapid binders shall not be approved.
- E. Primer: Mix thoroughly with 10 percent by weight of clean water.

2.3 FABRICATION

- A. Product and Manufacturer: Provide the following:
 - 1. Heavy-duty exterior insulation systems by STO Energy Conservation Incorporated.
 - 2. Or equal.
- B. Fabricated System Physical Properties: Provide the following:
 - 1. Structural Load Testing of Mechanically Fastened System, ASTM E 330 and ASTM E 72: 40 psf negative pressure with no apparent damage or failure.
 - 2. Mildew Resistance, MIL 80B: No growth of mildew.
 - 3. Rain Test, MIL E5272: No weight gain or other deleterious effects.
 - 4. Accelerated Weathering, Federal Test Standard 141 Method 6151: 2000 hours, no change.
 - 5. Abrasion Resistance, ASTM D 968: 500 liters, no deleterious effects.
 - 6. Salt Spray Resistance, ASTM B 117: 300 hours, no deleterious effects.
 - 7. Impact Resistance, ASTM E 72: No cracks.
- C. Custom fabricate exterior wall insulation and finish system to provide all arrises, returns, reveals and architectural features shown. Comply with allowable tolerances specified.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates to receive exterior wall insulation and finish system Work, and the conditions under which the Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and preformance of the exterior wall insulation and finish systems. Do not proceed with the exterior wall insulation and finish systems Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Prime and seal all exterior grade glass fiber cement wallboard sheathing with primer specified and coordinate fastener selection,

adhesives and finishes as required by exterior wall insulation and finish system manufacturer.

- B. Prime all concrete unit masonry and cast-in-place concrete using specified primers following manufacturer's written instructions.
- C. Tint primers to match finish color of wall following manufacturer's written instructions.

3.3 INSTALLATION

- A. General: General rules for application of finishes shall be as follows:
 - 1. Using a clean rust free high speed mixer, thoroughly stir finish to a uniform consistency (small amounts of clean water may be added to aid workability).
 - 2. Avoid application in direct sunlight.
 - 3. Apply finish in a continuous application always working to a wet edge.
 - 4. Finish may be applied over caulk joints, but not over expansion joints.
 - 5. Apply aggregate and textured finish coats following manufacturer's printed instructions.
- B. Over all primed and sealed substrate not shown as receiving insulation board:
 - 1. Level specified ground coat and embed standard reinforcing mesh into the wet ground coat.
 - 2. Overlap mesh seams a minimum of 2-1/2-inches and smooth surface with a large stainless steel trowel. Allow to dry 24 hours.
 - 3. Apply ground coat primer, tinted to match the finish coat, over the entire surface receiving the finish coat at the rate of approximately 0.05-0.06 pounds per square foot or more as required to visually eliminate construction joints. Let dry thoroughly before applying finish coat.
 - 4. Apply finish coat to provide colors and textures approved by ENGINEER using a clean plastic trowel following manufacturer's written instructions.
- C. Over all primed and sealed substrates shown as receiving insulation board:
 - 1. Level uneven surfaces using specified ground coat.
 - 2. Apply standard reinforcing mesh starter strip to the substrate at base line the termination of expanded polystyrene board using specified ground coat material and following manufacturer's written instructions.
 - 3. Provide starter strip wide enough to adhere 4-inches of mesh onto the substrate, and be able to wrap around board edge and cover approximately 4-inches on the outside surface of the expanded polystyrene board. Follow this procedure at all exposed expanded polystyrene board edges.
 - 4. Using specified adhesive apply adhesive to the back of the expanded polystyrene board using a 5/8-inch notched trowel. Provide uniform ribbons of adhesive applied horizontally with the building walls.

5. Place expanded polystyrene board horizontally on the walls starting from a level base line. Stagger vertical joints and interlock polystyrene board at all inside and outside corners.
6. Apply firm pressure over entire surface of the boards to insure uniform contact. Sufficient pressure must be applied to flatten the ribbons of adhesive to result in a minimum of 50 percent adhesion.
7. Butt all joints tightly together to eliminate all thermal breaks. Prevent adhesive from getting between joints of expanded polystyrene board. Allow adhesive to cure as recommended by the manufacturer.
8. All open joints in the expanded polystyrene board layer shall be filled with an approved spray foam.
9. Rasping of the expanded polystyrene board surface shall be required to achieve a smooth even surface, remove possible ultraviolet ray damage, meet tolerances specified, and to provide architectural features shown on the Drawings.
10. At all areas where the exterior wall insulation and finish system Work meets dissimilar material or terminates cut back the expanded polystyrene board from the adjoining material a minimum of 1/4-inch to form a calk joint and calk so that no water can penetrate through or behind the system. Follow manufacturer's applicable printed details. Prior to sealant installation all expanded polystyrene board edges shall be coated with ground coat and exterior wall insulation and finish coat and manufacturer's recommended primer.
11. Ground coat material shall be stirred to a uniform consistency. Apply ground coats, using a stainless steel trowel, to a uniform thickness of approximately 1/8-inch each. Work horizontally or vertically in strips of 40 inches, and immediately imbed the heavy duty reinforcing mesh into the wet ground coat. While ground coat is still wet, totally embed the heavy duty reinforcing mesh and feather out seams and edges. The finish thickness of the ground coat shall be such that the heavy duty reinforcing mesh is fully embedded yet mesh outline may be visible.
12. Do not overlap heavy duty reinforcing mesh. Tightly abut mesh with gaps no greater than 1/8-inch at seams. Allow to dry before applying standard reinforcing mesh.
13. Using a stainless steel trowel apply another layer of specified ground coat material over the cured heavy duty reinforcing mesh application to a uniform thickness of 1/16-inch. Work horizontally or vertically in strips, 40 inches and immediately embed the standard fiberglass of mesh into this wet ground coat. Mesh shall be double wrapped at all corners and overlapped not less than 2-1/2 inches at mesh joints. Avoid wrinkles in the mesh. The finish thickness of the ground coat shall be such that the reinforced fiberglass mesh is fully imbedded yet mesh outline may be visible. Allow ground coat to thoroughly dry before applying finish. Apply finish coat directly over the ground coats with primer, only after the ground coat has thoroughly dried to provide colors and textures approved by the ENGINEER. Finish shall be applied by troweling using a clean plastic trowel, depending on finish specified as recommended by the manufacturer.
14. Apply tinted ground coat primer specified before finish coat Work begins. Follow manufacturer's written instructions.

- D. Mechanical Fasteners: Provide the following:
 - 1. Where recommended by manufacturer for substrate conditions encountered install mechanical fasteners as recommended by the manufacturer.
 - 2. Spacing and selection of fasteners shall be as recommended in manufacturer's written installation instructions.
- E. Install backer rod (25 percent compression) in calk joint openings to provide a depth equal to the width of the joint. Install a manufacturer's approved sealant and tool flush with the ground coat surface. Allow sealant to set per manufacturer's specifications prior to applying finish coat.
- F. Expansion Joints: The exterior wall insulation and finish system Work does not require control or expansion joints except when the substrate has an existing control joint, expansion joint, or live building crack, or where the system is applied to dissimilar substrates. These joints shall extend through the full thermal system and shall be calked with a approved expansion joint sealant against a backer rod. On expansion joints, the reinforcing fiberglass mesh and ground coat shall completely wrap the edges of the insulation board so that the expansion joint calk is not in direct contact with the insulation board.

3.4 ADJUSTMENT, CUTTING AND PATCHING

- A. Cut, patch, and repair exterior wall insulation system and finish coat Work as required and as necessary to accommodate and provide acceptable substrate for other work. Repair cracks and indented surfaces. Point-up finish surfaces around items which are built into or penetrate exterior wall insulation system and finish coat Work.
- B. Repair or replace the Work to eliminate blisters, buckles, check cracking, dry outs, excessive pinholes, and similar imperfections. Repair or replace the Work as necessary to comply with specified tolerances and required visual effects.
- C. Protect exterior wall insulation and finish system Work so as to be clean and undamaged at the time of Final Acceptance.
- D. ENGINEER may require additional finish coats if, in the opinion of ENGINEER, the finish is inconsistent in color, texture, or has holidays, areas of unusual porosity or exhibits other imperfections.
- E. Only the installer shall repair or replace deteriorated or defective Work.
- F. Clean the exterior wall insulation and finish system Work as recommended by the manufacturer.

3.5 CLEANING AND PROTECTION

- A. Remove temporary covering and whatever other provisions were made to minimize spattering of ground, primer and finish coats on other work. Promptly remove ground primer and finish coats from surfaces which

are not to be finished as part of the Work of this Section. Repair surfaces which have been stained, marred or otherwise damaged during the exterior wall insulation and finish system Work. When exterior wall insulation and finish system Work is completed, remove unused materials, containers, and equipment and other debris caused by the Work of this Section.

- B. Protect exterior wall insulation and finish system Work from deterioration and damage during remainder of construction period.

+ + END OF SECTION + +

CITY OF PHOENIX
SQUAW PEAK WATER TREATMENT PLANT
GENERAL PLANT IMPROVEMENTS
PART A - MODIFICATIONS AND IMPROVEMENTS

SECTION 07530
ELASTIC SHEET ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The Work included in Part A of this project that is covered in this Section of the Specifications shall be as specified in the Part C Specification Section titled: "Elastomeric Sheet Roofing System" 07530.

+ + END OF SECTION + +

SECTION 07617

ELASTIC MASONRY FLASHING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all elastic masonry flashing Work.
2. The extent of elastic masonry flashing is shown.
3. The types of elastic masonry flashing Work required includes, but is not necessarily limited to the following:
 - a. Flexible flashing in exterior masonry wall construction.
 - b. Miscellaneous adhesives and sealants.

B. Coordination:

1. Review requirements and procedures under other Sections and coordinate with work related to this Section.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 07619, Flashing and Trim.
3. Section 07920, Calking and Sealants.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Obtain all flexible flashing materials from only one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM D 412, Test for Rubber Properties in Tension.
2. ASTM D 570, Water Absorption of Plastics.
3. ASTM D 746, Test for Brittleness Temperature of Plastics and Elastomers by Impact.
4. ASTM D 1499, Recommended Practice for Operating Light and Water - Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics.
5. ASTM D 2240, Test for Rubber Property-Durometer Hardness.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval copies of specifications, installation instructions and general recommendations from the flashing materials manufacturer, for the types of flashing products required. Include manufacturer's certification or other data substantiating that the materials comply with the requirements. Include documentation of improved performance claimed for products or methods which exceed the requirements.

1.4 PRODUCTS DELIVERY, STORAGE AND HANDLING

A. Delivery of Products:

1. Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
2. Remove items delivered in broken, damaged, rusted, or unlabeled condition from project site immediately.

1.5 JOB CONDITIONS

- ##### A. Coordinate elastic flashings with other Work to ensure secure anchorage and watertight seals, and to minimize exposure to puncture or other damage from the work of other trades. Refer to Section 04201, Unit Masonry Construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Sheet Flashing:

1. Virgin polyvinyl chloride with plasticizers and other modifiers, formed into uniform flexible sheets not less than 20 mils thick, black, complying with the following:
 - a. Hardness, ASTM D 2240: 60 to 80 Shore A.
 - b. Tensile Strength, ASTM D 412: 2,000 pounds per square inch.
 - c. Ultimate Elongation, ASTM D 746: 250 percent.
 - d. Brittleness Temperature, ASTM D 746: -20 F.
 - e. Weathering Resistance, ASTM D 1499: No significant change after 5,000 hours of cycled water spray, 150 F temperature and carbon-arc light.
 - f. Resistance to Ozone Aging: No cracks for 5,000 hours exposure of 20 percent elongated sample at 100 F and 50 ppm ozone.
 - g. Resistance to Water Absorption, ASTM D 570: Less than 0.5 percent weight gain for 48 hours of immersion at 122 F.
2. Provide custom factory-fabricated and preformed inside and outside corner boots.
3. Products and Manufacturers: Provide one of the following:
 - a. AA3250, AA3252 and AA3255 by AA Wire Products Company.
 - b. Or equal.

B. Miscellaneous Materials:

1. Adhesives: Provide the types of adhesive compounds and tapes recommended by the flashing sheet manufacturer for bonding of substrate, if required, for waterproof sealing of seams in the flashing, and for waterproof sealing of joints between flashing, membrane, adjoining surfaces, projections through the flashing, and for securing into cast-in-place reglets.
2. Sealants: Refer to Section 07920, Calking and Sealants.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which the elastic masonry flashing Work is to be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the elastic masonry flashing Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER. Commencement of the Work shall imply agreement by CONTRACTOR that the requirements of this Section can be fulfilled.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with manufacturer's instructions for handling and installation of the elastic flashing materials, except where more stringent requirements are shown or specified.
- B. Seal all joints between elastic masonry flashing membrane watertight.
- C. Coordinate the installation of flashing materials and associated Work so as to provide a complete system complying with the combined recommendations of manufacturers and installers involved in the Work.
- D. Refer to Section 04201, Unit Masonry Construction, for installation of flexible through wall elastic masonry flashing with masonry.
- E. Use only installation techniques approved by the elastic masonry flashing manufacturer.

3.3 FIELD TESTS

- A. Field test completed elastic masonry flashing Work for watertightness.

3.4 ADJUSTMENT

- A. Repair elastic masonry flashing at leaks.
- B. Masonry walls which leak due to improper elastic masonry flashing installation shall be corrected at no further expense to OWNER.

+ + END OF SECTION + +

SECTION 07619
FLASHING AND TRIM

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all flashing and trim Work. The Work also includes:
 - a. Providing openings in flashing to accommodate the Work under this and other Sections and building into the flashing all items such as sleeves, anchor bolts, inserts and all other items to be embedded in flashing for which placement is not specifically provided under other Sections.
2. The extent of the flashing and trim is shown.
3. The type of flashing and trim Work required includes, but is not necessarily limited to, the following:
 - a. Counterflashing at penetrations in roofing.
 - b. Snap-lock metal coping flashing.
 - c. Custom shop-fabricated metal coping corner intersections.
 - d. Screened continuous under-eave louver strips.
 - e. Miscellaneous flashings not supplied by other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the flashing and trim Work.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 07530, Elastic Sheet Roofing.
3. Section 07617, Elastic Masonry Flashing.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a single installer who is a recognized sheet metal contractor, skilled and experienced in the type of flashing and trim Work required, and equipped to perform workmanship in accordance with recognized standards so that there will be undivided responsibility for the performance of the Work. Submit name and qualifications to ENGINEER.

B. Design Criteria:

1. Except as otherwise shown, comply with recommendations of the elastic sheet roofing manufacturer concerning the installation of flashing.
2. Flashing and trim shall be permanently watertight, and not deteriorate in excess of manufacturer's published limitations.
3. Comply with fabrication details recommended by SMACNA.

- C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. Aluminum Association, Designation System for Aluminum Finishes.
 2. ASTM A 176, Stainless and Heat-Resisting Chromium Steel Plate Sheet, and Strip.
 3. ASTM B 29, Pig Lead.
 4. ASTM B 32, Solder Metal.
 5. ASTM B 117, Salt Spray (F06) Testing.
 6. ASTM B 136, Stain Resistance of Anodic Coatings on Aluminum, Measurement of.
 7. ASTM B 137, Weight of Coating on Anodically Coated Aluminum, Measurement of.
 8. ASTM B 209, Aluminum Alloy Sheet and Plate
 9. ASTM B 244, Thickness of Anodic Coatings on Aluminum with Eddy-Current Instruments, Measurement of.
 10. FS O-F-506C, Flux, Soldering, Paste and Liquid.
 11. FS SS-C-153, Cement, Bituminous, Plastic.
 12. FS QQ-L-201, Lead Sheet.
 13. SSPC - Paint 12, Specification for Cold-Applied Solvent Type Bituminous Mastic Coating.
 14. Sheet Metal and Air Conditioning Contractors National Association, Incorporated, SMACNA, Architectural Sheet Metal Manual.

1.3 SUBMITALS

- A. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's specifications, installation instructions and general recommendations for flashing and trim required. Include manufacturer's data substantiating that the materials comply with the requirements.
 2. Drawings showing large scale details of the profile and details of all flashing and trim Work, include all fastener location and material, cleats and other miscellaneous accessories necessary to complete the Work as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver flashing and trim materials in manufacturer's original, unopened containers and rolls with labels intact and legible.
- B. Storage of Materials:
1. Store materials in an area protected from construction traffic.
 2. Store materials in same package in which they were shipped.
- C. Handling of Materials: Protect flashing and trim from dents, scratches, warps or bends.

1.5 JOB CONDITIONS

- A. Scheduling:
1. Do not proceed with the flashing and trim Work until curb and substrate construction, blocking, and other construction to receive the Work is completed.

2. Schedule the installation of flashing and trim to coincide with the installation of roofing, waterproofing, drains, piping, blocking, nailers, framing at openings, curbs, parapets and other adjoining and substrate Work.

1.6 GUARANTEE

- A. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of 20 years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.
- B. In the event that the polyvinylidene fluoride based coating fails to meet the specified standards the manufacturer shall, at his own expense, replace or field paint, at the discretion of ENGINEER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.
- C. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel Flashing and Trim: Provide sheet stainless steel, Type 316 complying with ASTM A 176, with No. 2D dead soft, fully annealed finish, unless required to be harder temper for proper forming and performance for application indicated. Provide thickness of 26 gage.
- B. Lead Flashing: Provide sheet complying with FS QQ-L-201, Grade B and formed from common desilverized pig lead complying with ASTM B 29; weighing 4.0 pounds per square foot.
- C. Metal Coping Flashing and Trim: Provide stucco-embossed sheet of 16 gage, 5005-H134 aluminum alloy with full strength polyvinylidene fluoride based coating.
 1. Provide coping which provides for independent mounting and full expansion and contraction over prefabricated 6-inch wide aluminum retainer, compression clips 12 foot-0 inch mounted on centers, with 2-inch wide aluminum retainer plate with single compression pad mounted between dual durometer compression clips.
 2. Provide system with incorporates a gutter bar with dual compression gaskets at each joint to drain water.
 3. Systems shall not incorporate exposed sealants.
 4. Coping shall be installed with 3/8-inch wide butt joints 12 foot-0 inches on center.
 5. Provide internal face line-up splices at all joints.
 6. Provide coping sized as shown.

7. Provide all coping corners mitered and continuously heliarc welded watertight prior to in-plant finishing by coping manufacturer. Mechanical fasteners, pop rivets, sealants, asphalt and similar methods are not approved for this Work. Reinforce metal at welds as may be required to provide welded seams.
 8. Exposed fasteners shall not be used and are not approved for the Work. Concealed fasteners shall be as recommended by the manufacturer.
 9. Product and Manufacturer: Provide one of the following:
 - a. Style SL Snap-Lok Coping by Construction Specialties Incorporated.
 - b. Or equal.
- D. Screened Continuous Under-Eave Louver Strips: Provide white painted aluminum under-eave louvers with insect screening. Provide the following:
1. Size: 2-3/4-inches by 8 feet-0 inches.
 2. Free Area: 92 percent.
 3. Product and Manufacturer: Provide one of the following:
 - a. SAL-8W by Ampcor Anderson Metal Products Company.
 - b. Or equal.
- E. Miscellaneous Materials:
1. Burning Rod for Lead: Same composition as lead sheet.
 2. Solder for Stainless Steel: ASTM B 32 and FS O-F-506C, 60 percent tin and 40 percent lead alloy grade 60A, used with an acid flux of the type recommended by the stainless steel manufacturer. Use a non-corrosive rosin flux over tinned surfaces.
 3. Stainless Welding Rods: Type recommended by stainless steel sheet manufacturer for the type of metal sheets furnished.
 4. Nails, Screws and Rivets: Same material as flashing sheet, or as recommended by manufacturer of flashing sheet.
 5. Cleats: Same metal and gage as sheet being anchored, 2 inches wide, punched for 2 anchors.
 6. Bituminous Coating: SSPC-Paint 12, cold-applied solvent-type bituminous mastic coating for application in dry film thickness of 15 mils per coat.
 7. Sealants: Refer to Section 07920, Calking and Sealants.
 8. Roofing Cement: FS SS-C-153, Type I (asphaltic).

2.2 FABRICATION

- A. Fabricated Metal Flashing: Shop fabricate metal flashing and trim to comply with profiles and sizes shown, and to comply with manufacturer's recommended details. Except as otherwise shown or specified, provide soldered flat-lock seams, and fold back metal to form a hem on the concealed side of exposed edges. Comply with metal producers' recommendations for tinning, soldering and cleaning flux from metal.
- B. On all metal counterflashings and coping flashings provide completely shop fabricated corners and special flashings; heliarc welded to insure watertight joints. Grind welds smooth so as to be indistinguishable from adjacent surfaces.

- C. Where manufacturer does not recommend grinding welds smooth comply with SMACNA formed metal coping design details.

2.3 GRAVEL STOP AND COPING COATINGS

- A. Exposed Aluminum Polyvinylidene Fluoride Based Coating: Apply full strength polyvinylidene fluoride based coatings at the factory by coil coating for sheet material and spray coating for extruded or factory fabricated material. Provide the following three coat system complying with the following:
1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride based finish.
 2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.
 3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 - 0.4 mils.
 4. Apply color coat over the primer by roller coating for coil material and airless or Ransburg Elastostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440 F for a dry film thickness of 0.7 mils for coil coating and 1.2 mils for spray coating.
 5. Apply clear fluoropolymer top coat to provide a dry film thickness of 0.4-0.8 mils. The entire three coat system shall have a dry film thickness of 1.6 mils minimum.
 5. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to ENGINEER:
 - a. Weathering, ASTM D 659: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - b. Color Change, ASTM D 2244: No greater than 5 N.B.S units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - c. Humidity Resistance, ASTM D 2247; few scattered blisters no larger than ASTM No. 4, after 1000 hours.
 - d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16 inch creep from areas scribed to bare metal after 500 hours.
 - e. Dry Adhesion: No pick-off when tape tested over 1/16 inch cross hatch.
 - f. Wet Adhesion: No pick-off when tape tested over 1/16 inch cross hatch; extruded material only.
 - g. Boiling Water Adhesion: No pick-off when tape tested over cross hatch area after 1 hour immersion in distilled boiling water.
 - h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water $80 \pm 10F$ after 500 hours.
 - i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67 minimum.
 - j. Gloss, ASTM D 523: 30 ± 5 reflectivity at 60 F.

- k. Pencil Hardness: HB-B minimum.
 - l. Dry Film Thickness: Primer, 0.2-0.4 mils; polyvinylidene fluoride color coat, 0.7-1.5 mils; clear top coat, 0.4-0.8 mils.
 - m. Solvent Resistance: 100 Double MEK rubs minimum.
 - n. Flexibility, ASTM D 1737: No cracking prior to metal fracture.
 - o. Acid Resistance, ASTM D 1308: 16 hour spot test with 5% hydrochloric acid - no effect.
 - p. Alkali Resistance, ASTM D 1308: 16 hour spot test with 5% sodium hydroxide - no effect.
- B. Product and Manufacturer: Provide one of the following:
- 1. Duranar XL Exotic Color 3-Coat System by PPG Industries Coating and Resins Division, Incorporated.
 - 2. Or equal.
- C. Color: Complete selection of manufacturer's standard and custom colors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and the conditions under which the flashing and trim Work is to be performed, and notify the ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

3.2 PREPARATION

- A. Before installing flashing and trim, verify shapes, and dimensions to be covered.
- B. Prepare substrates as recommended by the sheet metal manufacturer.

3.3 INSTALLATION

- A. General
- 1. Separate dissimilar metals from substrates and from each other by painting each metal surface in the area of contact with a 15-mil thick application of bituminous coating, as recommended by the manufacturers of the dissimilar metals. Comply with manufacturer's recommendations for other forms of protection of the stainless steel and aluminum against corrosion.
 - 2. Provide thermal expansion for running trim, flashing and other items exposed for more than 15 feet-0 inches continuous length. Maintain a watertight installation at expansion seams. Locate expansion seams at 10 feet - 0 inch intervals, and 2 feet - 0 inch each side of corners and intersections.
 - 3. Fabricate and install the Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering

the temper and reflectivity of the metal. Provide uniform, neat flat-locked seams with minimum exposure of solder, welds and sealant. Except as otherwise shown, fold back the sheet metal to form a hem on the concealed side of exposed edges.

4. Conceal fasteners and expansion provisions wherever possible in exposed Work, and locate so as to minimize the possibility of leakage. Cover and seal Work as required for a watertight installation.
 5. Provide cleat-type anchorages for metal flashings and trim wherever practical, arranged to relieve stresses from building movement, and thermal expansion and contraction.
 6. On vertical surfaces lap 2-piece flashings a minimum of 4 inches.
 7. On sloping surfaces, for slopes of not less than 6 inches in 12 inches, lap unsealed flashings a minimum of 6 inches. For slopes less than 6 inches in 12 inches use soldered flat locked seams.
 8. For embedment of metal flashing flanges in elastic sheet roofing or flashing or stripping, extend flanges for a minimum of 4-inches embedment.
- B. Installation of Stainless Steel Flashing and Trim:
1. Tin the edges of plain stainless steel to be soldered, for a width of 1-1/2 inches, using solder for stainless steel and acid flux. Remove every trace of acid flux residue from the metal promptly after tinning or soldering.
 2. Provide welded joints. Provide upturned, 1/2-inch wide hooked flanges, and weld between adjoining sheets; lay seam flat.
- C. Installation of Metal Copings:
1. Install metal copings using concealed fasteners and plates in accordance with manufacturer's written recommendations.
 2. Use all items supplied by the manufacturer for a complete, water tight installation.
 3. Set all flashings straight and true.
 4. Install special flashings as specified.
- D. Installation of Lead Flashing and Trim:
1. Where prefabricated units of lead flashing are to be set in elastic sheet roofing plies flashing the under side shall be coated with asphaltic roof cement.
 2. Cut and shape lead sheet in place with minimum of 1-inch lapped joints, and from bends and folds to provide corners and intersections as shown. Shave or wire-brush joint areas immediately before sealing joint.
 3. Burn joint in lead sheets to provide true welded construction, exercising core to avoid reduction of sheet thickness.
- E. Installation of Continuous Under-Eave Louver Strips:
1. install in continuous runs full length of all roof overhangs.
 2. Install in compliance with manufacturer's written instructions.

3.4 FIELD QUALITY CONTROL

- A. Determine conformity of coping finish to the specifications as follows:
 - 1. The manufacturer of the coping shall set aside and label samples of the metal from each production lot for the job. Protect samples from weather.
 - 2. Make sample coping available at all times, for comparison with installed coping Work as requested by OWNER, for the full time of the warranty.
 - 3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.5 ADJUSTMENT AND CLEANING

- A. Protect flashing and trim Work until Final Acceptance of the Work.
- B. Do not permit workmen, or others, to step directly on flashing sheets in place, or to place or move equipment over flashing and trim surfaces. Protect surfaces during installation of permanent covering Work and adjoining Work.
- C. Neutralize excess flux as Work progresses with 5 percent to 10 percent washing soda solution and rinse thoroughly.
- D. Clean exposed surfaces of every substance which is visible or might cause corrosion or prevent uniform oxidation of the metal surfaces. Exercise extreme care to remove fluxes and ferrous metal particles, including welding splatter and grinding dust.

+ + END OF SECTION + +

SECTION 07632

ROOF DRAINAGE SPECIALTIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof drainage specialties Work.
2. The extent of the roof drainage specialties is shown.
3. The types of roof drainage specialties Work required includes, but is not necessarily limited to, the following:
 - a. Exposed surface-mounted aluminum fascia sumps, gutters and downspouts.
 - b. Polyvinylidene fluoride four coat finish system for all fascia sumps, gutters and downspouts.
 - c. All miscellaneous straps, fittings and fasteners.
 - d. Welded miters, and caps, downspout elbows and downspouts.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the roof drainage specialties Work.

C. Related Sections:

1. Section 07530, Elastic Sheet Roofing.
2. Section 07619, Flashing and Trim.

1.2 QUALITY ASSURANCE

A. Design Criteria:

1. Standards: Comply with applicable standards and recommendations of SMACNA, Architectural Sheet Metal Manual, for the fabrication and installation of roof drainage specialties Work, except to the extent more stringent requirements are specified.

B. Source Quality Control: Provide fascia sumps and downspouts as a complete unit produced by a single manufacturer specializing in the production of this type of Work, including hardware, accessories, mounting and installation components.

C. Source Quality Control: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. FS H-C-494, Coating Compound, Bituminous, Solvent Type, Acid Resistant.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Shop Drawings showing the manner of forming, jointing and securing the metal to form rain drainage specialties Work. Show expansion joint details and water proof connections to adjoining work and at obstructions and penetrations.
 2. Copies of manufacturer's specifications, recommendations and installation instructions for roof drainage specialties applications. Include manufacturer's certification or other data substantiating that the materials comply with the requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials to preclude denting, scratching or otherwise marring the surface and finish of the roof drainage specialties material.

1.5 JOB CONDITIONS

- A. Scheduling: Coordinate roof drainage specialties Work with roofing, flashing, trim, and the construction of decks, parapets and other adjoining work, to provide a permanently watertight, leak-proof, secure and non-corrosive installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide aluminum sheet or strip of 5005-H154 alloy, with smooth finish; gutter thickness 0.05-inches; downspout thickness 0.05-inches; fascia sump thickness 10 gage minimum.
- B. Color and Finish: Provide complete selection of manufacturer's standard and custom colored polyvinylidene fluoride finish for all Work.
1. Product and Manufacturer: Provide the following:
 - a. Duranar XL by PPG Industries, Incorporated.
- C. Size and Profile:
1. Fascia Sumps: 8-inch by 8- inches.
 2. Downspouts: 4-inches by 4-inches.
 3. Gutters: 4-inches by 6-inches.
- D. Miscellaneous Materials:
1. Provide the materials and types of fasteners, solder, welding rods, coatings, separators, sealants and accessory items as recommended by the sheet metal manufacturer for roof drainage specialties Work, except as otherwise indicated.
 2. Cleats and Straps: Same metal as roof drainage specialties Work being anchored or supported.
 3. Roofing Cement: Neoprene adhesive; compatible with substrate and adjoining work.

4. Bituminous Coating: Cold-applied asphaltic coating, FS TT-C-494, Type II, compounded for minimum thickness per coat of 15 mils (dry).
- E. Product and Manufacturer: Provide one of the following:
1. Fascia Sumps, Gutters and Downspouts by W.P. Hickman Aluminum Construction Products.
 2. Or equal.

2.2 FABRICATION

A. General:

1. The fabrication requirements for metal fascia sumps, gutters and downspout Work apply to both shop-fabricated and on-site-fabricated Work.
 2. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with the recommendations and instructions of the manufacturer of the sheet metal being fabricated.
 3. Provide for thermal expansion of exposed items. Maintain a water-tight seal at expansion joints. Locate expansion joints at the following maximum spacings:
 - a. Midpoint of run.
 4. Fabricate Work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves and avoidable tool marks, considering the temper and reflectivity of the metal. Provide uniform, neat seams with minimum exposure of solder, welds and sealant. Fold back the sheet metal to form a hem on the concealed side of exposed edges.
 5. Fabricate fascia sumps, gutters and downspouts and supports as shown.
 6. Provide strainer units at the outlets of conductor heads, fabricated of wire or wire mesh which is non-corridible and compatible with the sheet metal, with minimum 0.062-inch diameter wire and maximum 1/2 inch spacing of wires, in a beehive design unless otherwise indicated.
 7. Support and Anchorage: Fabricate units with adequate provisions for support and anchorage, of the types needed for the indicated method of installation.
- B. Aluminum Fascia Sumps, Gutters and Downspouts: Fabricate aluminum sheet using double flat-lock seams. Rivet joints where necessary for strength. Pop rivets are not acceptable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the supporting structure and other elements of the substrate and conditions under which the roof drainage specialties Work is to be performed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the fascia sumps and downspouts. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Wherever possible, take field measurements, prior to completion of shop fabrication and finishing of metal fascia sump, gutters and downspout Work. Do not delay job progress. Allow for erection tolerances corresponding with specified tolerances where final dimensions cannot be established before fabrication.

3.3 INSTALLATION

- A. Comply with manufacturer's recommendations and installation instructions.
- B. Separate dissimilar metals from each other by painting each metal surface in the area of contact with a 15-mil application of bituminous coating, or by other permanent separation as recommended by the manufacturers of the dissimilar metals.
- C. Conceal fasteners and expansion provisions wherever possible in exposed Work, and locate so as to minimize the possibility of leakage. Cover and seal Work as required for a tight installation.
- D. Provide concealed cleat-type anchorages wherever practical, arranged to relieve stresses in the roof drainage specialties Work resulting from building movement and thermal expansion.
- E. Splice and Expansion Units: Use 0.050-inches thick splice plates.
- F. Bed flashing flanges in a bed of roofing cement or other setting compound which is compatible with adjoining work and substrate.
- G. On vertical overlaps, lap sheet metal a minimum of 3 inches.
- H. On sloping overlaps, of slopes of not less than 6 inches in 12 inches, lap unsealed overlaps a minimum of 6 inches.
- I. For embedment of metal flanges in elastic sheet flashing or stripping, extend flanges for a minimum of 4 inches embedment.
- J. Support and anchor each unit of Work in the manner shown; but in no case in a manner which would be inadequate for thermal expansion stresses and the normal loading of water, ice, wind and similar loadings.
- K. Install units with lines and corners true and accurate in alignment and location. Install fascia sumps to assure positive drainage to downspouts.
- L. Apply 15-mil bituminous coating to aluminum surfaces which will be in contact with dissimilar metals, cementitious surfaces, wood or other absorptive substrates.

3.4 CLEANING AND PROTECTION

- A. Protect the metal fascia sumps and downspouts from all damage until Final Acceptance by OWNER.
- B. Fascia sumps, gutters and downspouts damaged before Final Acceptance shall be replaced with new material as specified herein at no further cost to OWNER.
- C. Clean exposed surfaces of every substance which is visible or might cause corrosion of the metal or deterioration of the finish.

+ + END OF SECTION + +

SECTION 07810

SKYLIGHTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all skylight Work.
2. The extent of the skylight is shown.
3. The types of skylight Work required includes, but is not necessarily limited to, the following:
 - a. Thermally separated anodized aluminum double-domed plastic skylight units with pyramid shaped outer dome.
 - b. Anchors, inserts, support brackets, expansion devices, gaskets, fasteners, flashings, weeps, and similar elements in conjunction with the above components.
 - c. Sealants, setting blocks, gaskets and other miscellaneous materials.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to the skylight Work.

C. Related Sections:

1. Section 08800, Glazing.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Engage a single firm, with undivided responsibility for performance and other requirements and components of the skylight Work.
2. Engage a firm which can show successful experience in the fabrication and erection of skylight systems of scope and type similar to the required Work.

B. Installer Qualifications:

1. Engage a single installer regularly engaged in skylight installation and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER.
2. Engage a single installer for the entire skylight Work with undivided responsibility for performance and other requirements.

C. Design Criteria:

1. Standards: Comply with the following applicable standards and recommendations except to the extent more stringent requirements are specified.

- a. Architectural Aluminum Manufacturers Association Standard 1603.1, "Voluntary Standard Test Method For Thermal Transmittance of Skylights".
 - b. ICBO Section 5207(a)(2) Class "B" burning brand test as specified in Uniform Building Code Standard No. 32-7. Glazing shall meet flame spread and smoke contribution performance requirements for Light Transmitting Plastics.
2. Thermal Efficiency: The total thermal loss of the entire skylight unit, due to conductivity and air infiltration shall not exceed 5.10 BTU/hr/F. Air infiltration shall be less than 0.1 cfm/ft.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Assembly and erection of the entire skylight system, showing all dimensions, gages, finishes, location of joints, connections, fasteners, and locations and types of glazing gaskets, and other related items as required. Provide full size detail sections of curb and skylight units.
 2. Copies of manufacturers' specifications and installation instructions for required materials and components which are not included in the other submittals specified in in other Sections of these Specifications. Coordinate the submittal of such other data with this submittal, and with the submittal of samples required by other Sections.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver products cartoned or crated to provide protection during transit and job storage.
- B. Inspect products upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new Work and acceptable to ENGINEER; otherwise, remove and replace damaged items.

1.5 JOB CONDITIONS

- A. Scheduling: Schedule the arrival of components and accessories to minimize the time they are stored at the site before installation.
- B. Coordinate with other work by furnishing Shop Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCT REQUIREMENTS

- A. Provide manufacturer's standard units, modified as necessary to comply with requirements. Shop fabricate each unit to greatest extent possible.

2.2 MATERIALS, GENERAL

- A. Zinc-Coated Steel: Commercial quality with 0.20 percent copper, ASTM A 525, G90 hot-dip galvanized, mill phosphatized.
- B. Stainless Steel: AISI Type 302/304, ASTM A 167, 2D annealed finish except as otherwise indicated, temper as required for forming and performance.
- C. Aluminum Sheet: ASTM B 209, alloy 3003, temper as required for forming and performance; AA-C22A41 clear anodized finish, except mill finish prepared for painting where indicated for painting.
- D. Extruded Aluminum: Manufacturer's standard extrusions of sizes and general profiles indicated, alloy 6063-T52; 0.078-inch minimum thicknesses for primary framing and curb member legs, 0.062-inch for secondary legs; AA-C22-A41 clear anodized finish on exposed members, except as otherwise indicated.
- E. Insulation: Manufacturer's standard rigid or semi-rigid board of glass fiber of thicknesses indicated.
- F. Wood nailers: Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2-inch thick.
- G. Fasteners: Same metal as metals being fastened, or nonmagnetic stainless steel or other noncorrosive metal as recommended by manufacturer. Match finish of exposed fasteners with finish of material being fastened.
- H. Gaskets: Tubular or fingered design of neoprene or polyvinyl chloride, or block design of sponge neoprene.
- I. Bituminous Coating: FS TT-C-494 or SSPC-Paint 12, solvent type bituminous mastic, nominally free of sulfur, compounded for 15-mil dry film thickness per coating.
- J. Elastomeric Sealant: Generic type recommended by unit manufacturer, which is compatible with joint surfaces; comply with FS TT-S-0027, TT-S-00230, or TT-S-001543.
- K. Roofing Cement: ASTM D 2822, asphaltic.

2.3 UNIT MATERIALS, FABRICATION

- A. Plastic Skylights:
 - 1. Sheet Thicknesses: Provide minimum thickness of 1/4-inch except where additional thickness is required for light transmittances, provide glazing plastic sheet thickness required for 40 pounds per square foot external loading and 20 pounds per square foot internal loading pressures; comply with thickness recommendations of AAMA Bulletin No. 1601.1.
 - 2. Plastic: Cast acrylic with abrasion-resistant coating on exterior surface, for 2 percent maximum haze increase of 100 rev.

- on 500g Taber abraser (ASTM D 1044); 14,500 pounds per square inch flexural strength; 180 F (82 C) continuous service temperature.
3. Profile: Pyramidal double-sheet insulating units with average 1-inch minimum air space between sheets, manufacturer's standard hermetic edge seal.
 4. Color, Exterior Sheet: Bronze tinted transparent sheet, 25 to 30 percent light transmittance (ASTM D 1003).
 5. Color, Interior Sheet: Colorless transparent sheet.
 6. Glazing Frame, Dome Retainer, Trim: Extruded aluminum.
 7. Curb Frame: Provide 9-inch high prefabricated curbs consisting of inner and outer aluminum skins thermally separated by a vinyl curb at the top, 1-inch unfaced fiberglass insulation in the body and a vinyl extrusion at the bottom. Provide fused corners, condensation gutter and a 4-inch wide continuous aluminum nailing mounting flange at base integral with outer aluminum skin.
 8. Glazing System: neoprene, closed-cell sponge neoprene, or PVC gasketing, or of partially vulcanized butyl tape or liquid-applied elastomeric sealant. Provide bronze tinted outer dome with clear inner dome.
 9. Condensation Control: Fabricate units with integral internal gutters and nonclogging weeps, for permanent control of condensation on inside of domes.
 10. Product and Manufacturer: Provide one of the following:
 - a. Super Thermalized Solar Energy Skydome Model No. LPDS-9898 with No. 2447 glazing system by Wasco Products Incorporated.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine the construction and the conditions under which the skylight Work is to be installed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with Work until unsatisfactory condition have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install skylight in accordance with manufacturer's written instructions and approved Shop Drawings. Install all components of the skylight system following skylight manufacturer's written recommendations and specifications.
- B. Anchor enclosures permanently to the substrate, by methods approved in the Shop Drawings adequate for the sizes and locations of the units and adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.
- C. Surface contact between aluminum components and dissimilar materials shall receive a protective coating or neutral, non-absorbitive isolator to prevent electrolysis and corrosion.

D. Seal all joints to provide a permanently watertight closure.

3.3 FIELD QUALITY CONTROL

A. After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4-inch garden hose, without nozzle, held perpendicular to wall face, 2 feet-0 inch from joint and connected to a water system with 30 pounds per square inch minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.

B. Test 100 percent of total joint system. Conduct test in the presence of ENGINEER.

3.4 ADJUSTMENT AND CLEANING

A. Clean exposed metal and plastic surfaces of skylight in accordance with manufacturer's instructions as required to prevent deterioration and uneven weathering.

B. CONTRACTOR shall advise ENGINEER, in writing, of protection and surveillance requirements that CONTRACTOR shall provide at no additional cost to OWNER, to insure that skylights will be without deterioration or damage at the time of Final Acceptance by OWNER.

C. Clean and polish plastic skylight units, inside and out, not more than 5 days prior to date of substantial completion.

+ + END OF SECTION + +

SECTION 07830
ROOF ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof accessories Work.
2. The extent of roof accessories is shown.
3. The types of roof accessories Work includes, but is not necessarily limited to, the following:
 - a. Ladder access roof hatch.
 - b. Miscellaneous hardware, safety posts, closures, fasteners and accessories.

B. Related Sections:

1. Section 07530, Elastic Sheet Roofing.
2. Section 07619, Flashing and Trim.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as shown or specified.

1. American Wood Preservers Bureau (AWPB) (LP-2), Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Above Ground Use.
2. ASTM A 570, Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.
3. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
4. NAAMM, Metal Finishes Manual.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's drawings, rough-in diagrams, specifications and installation instructions for roof accessory required. Include data substantiating that products comply with the requirements.

1.4 JOB CONDITIONS

- A. Coordinate the installation of roof accessories Work with roofing and flashing to obtain complete and permanent waterproof construction.
- B. Conform to applicable OSHA sections and the Uniform Building Code, latest edition requirements.

1.5 GUARANTEE

- A. CONTRACTOR shall furnish a written guarantee obtained from the manufacturer of the roof hatch. Guarantee shall state the following:
 - 1. Roof hatch is to operate properly and be free of defects in material and workmanship for a period of five years from date of purchase.
 - 2. Should any part fail to function, or break in normal use during this period, manufacturer shall furnish a new part at no charge to OWNER.

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Provide manufacturer's standard products except as otherwise shown or specified.
- B. Fabricate units to withstand 40 pounds per square foot live loading.

2.2 PRODUCTS

- A. Ladder Access Roof Hatch: Provide the following:
 - 1. General:
 - a. Provide manufacturer's standard units, modified as necessary to comply with the requirements. Custom fabricate units wherever necessary for size, type and profile, using manufacturer's standard detailing to the extent applicable.
 - b. Shop fabricate each unit complete with framing, gaskets, structure, curbs, flashing, well liner, hardware, accessories, anchorage provisions and other components. Disassemble only to the extent required for delivery and installation.
 - c. Provide manufacturer's recommended operable steel safety posts mounted at center of roof ladder rungs.
 - 2. Materials:
 - a. Galvanized Steel: Sheet specified by the manufacturer for strength, durability and proper application of finish.
 - 1) Cover and Curb: 14 gage, galvanized steel.
 - 2) Cover Liner: 22 gage, galvanized steel.
 - 3) Finish: Red oxide primer.
 - b. Insulation: One inch glass fiber, between panels.
 - c. Gaskets: Fingered design; polyvinyl chloride.
 - d. Equip units with standard self-lifting mechanism. Provide stainless steel hardware including hold-open devices, hinges, compression spring operators enclosed in telescopic tubes, latch, and operating handles for inside and outside operation.
 - e. Construct units for live loading specified, using manufacturer's standard gages of metal and fabrication details.
 - f. Product and Manufacturer: Provide one of the following:
 - 1) Type S with Ladder Up Safety Post by Bilco Company.
 - 2) Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates to receive roof accessories and the conditions under which the roof accessories Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the roof accessories. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Separate metal surfaces of roof accessories from dissimilar metals, and from wood and cementitious substrates, by a thick coating of fibrated bituminous compound or other separation as recommended by the metal manufacturer.
- B. Bed flanges of set-on accessories in mastic or compound which is compatible with roofing and flashing. On sloping decks, shingle flanges with other work for proper water shed.
- C. Anchor roof accessories permanently to the substrate, by approved methods which are adequate for the sizes and locations of units.

3.3 CLEANING AND PROTECTION

- A. Clean surfaces of roof accessories as required to prevent deterioration and uneven weathering.
- B. Protect roof accessories from damage until Final Acceptance by OWNER.

+ + END OF SECTION + +

SECTION 07860
EXPANSION JOINTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all roof expansion joint cover Work.
2. The extent of roof expansion joint covers is shown.
3. The types of roof expansion joint cover Work includes, but is not necessarily limited to, the following:
 - a. Prefabricated roof expansion joint covers.
 - b. All transition flashing, accessories, splice covers, end caps, sealing washers and gaskets, counter flashing flanges, fasteners and similar components.

B. Coordination:

1. Review installation procedures under other Sections and coordinate them with the Work specified herein.
2. Coordinate location of roof expansion joint cover manufacturer's recommended drain tube so that seepage and water from wind blown rain is conducted to building wall exterior through parapet wall expansion joint cover.
3. Coordinate prefabricated roof expansion joint cover system Work with elastic sheet roof and metal coping flashing. Provide Shop Drawing details of metal transition flashing in order to provide full movement capabilities while maintaining watertight conditions.

C. Related Sections:

1. Section 07530, Elastic Sheet Roofing.
2. Section 07619, Flashing and Trim.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Engage a single installer with experience in application of metal roof expansion joint cover systems Work and who agrees to employ trades men with specific skill and experience in this type of Work.

B. Design Criteria: Provide the following:

1. A complete system of components including metal transition flashings recommended by the manufacturer for expansion and building movement at the joint while maintaining watertight conditions.
2. Roof expansion joint cover system Work shall permit restrained movement of joint without disengagement of cover.
3. Roof expansion joint cover system shall incorporate a continuous water barrier and drain tube to remove wind blown rain and seepage from roof expansion joint cover system Work.

4. System shall be designed to withstand without damage a 200 pound per square foot load on roof expansion joint cover assembly.
 5. Provide roof expansion joint cover system without exposed fasteners which penetrate the elastic sheet roofing system.
- C. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as shown or specified.
1. ASTM D 751, Coated Fabrics.
 2. ASTM D 1149, Accelerated Ozone Cracking of Vulcanized Rubber.
 3. NAAMM, Metal Finishes Manual.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's drawings, rough-in diagrams, specifications and installation instructions for roof expansion joint cover system Work including specially fabricated transition flashings. Include data substantiating that products comply with the requirements.

1.4 JOB CONDITIONS

- A. Coordinate the installation of roof expansion joint cover Work with roofing and flashing to obtain complete and permanent waterproof construction.

PART 2 - PRODUCTS

2.1 FABRICATION, GENERAL

- A. Provide manufacturer's completely factory fabricated unitized watertight assembly with all transition covers, splice and end caps factory fabricated.
- B. Shop fabricate transition flashings at intersection with exterior wall insulation and finish system and snap lock metal coping to provide completely watertight closure and which does not interfere with joint movement capabilities.
- C. Take field measurements and submit data in coordinated Shop Drawing to ENGINEER.

2.2 PRODUCTS

- A. Prefabricated Roof Expansion Joint Covers: Provide the following:
1. A complete system acceptable to the supplier and manufacturer of the primary roofing system for full roofing system responsibility and guarantee.
 2. Aluminum: Extruded aluminum shall be 6063-T5. Components shall be supplied in minimum lengths of 20 foot-0 inch, complete with fasteners, splice covers, transition flashings and end caps.
 3. Water Barrier: 60 mil polyvinylchloride.
 4. Drain Tube System: All components necessary for a complete system of drainage to building drain system including, but not necessarily limited to, male fitting, washers, female coupling

with male connector, clamp and 1-inch polyvinylchloride hose of adequate length to route entrapped water to building exterior.

5. Finish: Mill.
- B. Product and Manufacturer: Provide one of the following:
1. Model LPR-210 by Metalines Incorporated.
 2. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates to receive roof expansion joint cover system Work and the conditions under which the roof expansion joint cover system Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the roof expansion joint cover system Work. Do not proceed with the roof expansion joint cover system Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Separate metal surfaces of roof expansion joint cover Work from dissimilar metals, and from wood and cementitious substrates, by a thick coating of fibrated bituminous compound or other separation as recommended by the metal manufacturer.
- B. Bed flanges of set-on roof expansion joint cover Work in mastic or compound which is compatible with roofing and flashing.
- C. Anchor roof expansion joint cover Work permanently to the substrate, by approved methods which are adequate for the sizes and locations of units.
- D. Install roof expansion joint cover Work following manufacturer's written instructions.

3.3 CLEANING AND PROTECTION

- A. Clean surfaces of roof expansion joint cover system Work as required to prevent deterioration and uneven weathering.
- B. Protect roof expansion joint cover system Work from damage until Final Acceptance by OWNER.

+ + END OF SECTION + +

SECTION 07920
CAULKING AND SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all caulking and sealants Work.
2. The extent of each type of caulking and sealant is specified herein.
3. The types of caulking and sealant Work required includes, but is not necessarily limited to, the following:
 - a. All joints between concrete members and masonry.
 - b. All concrete to concrete joints.
 - c. All joints between masonry and metal.
 - d. All control joints in masonry and concrete.
 - e. All isolation joints between equipment and other items.
 - f. All exterior wall insulation and finish system joints.
 - g. All locations whether or not shown required to render the building watertight.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the caulking and sealants.
2. Coordinate the final selection of caulking and sealants to be compatible with all caulking and sealant substrates specified.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a single installer regularly engaged in caulking and sealant installation and with experience in the application of the types of materials required, and who agrees to employ only tradesmen with specific skill and experience in this type of Work.
- B. Source Quality Control: Obtain materials from only manufacturers who will, if required:
 1. Send a qualified technical representative to the site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.
 2. Test caulking and sealants for compatibility with the substrates specified for conformance to FS-TT-S-0027, and recommend remedial procedures as required.
- C. Reference Standards: Comply with applicable provisions and recommendations, except as otherwise shown or specified.
 1. ASTM C 510, Test for Staining and Color Change of Single or Multicomponent Joint Sealers.

2. ASTM C 661, Test for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
 3. ASTM C 793, Test for Effects of Accelerated Weathering on Elastomeric Joint Sealants.
 4. ASTM C 794, Test for Adhesion-in-Peel of Elastomeric Joints Sealants.
 5. Federal Specification, FS TT-S-00227, Sealing Compound: Elastomeric Type, Multi-component for Caulking, Sealing, and Glazing in Buildings and Other Structures.
- D. Compatibility: Before purchase of each specified sealant, investigate its compatibility with the joint surfaces, joint fillers and other materials in the joint system. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Samples of each type of caulking and sealant specified, 12-inches long, in each of the manufacturer's standard colors.
 2. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval copies of manufacturer's specifications, recommendations and installation instructions for each type of sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, indicating that each material complies with the requirements and is intended for the applications shown.
- C. Test Reports: Submit for approval the following:
1. Compatibility tests for substrates, based on adhesion-in-peel standard test procedures and FS TT-S-0027.
 2. Copies of certified laboratory test reports indicating conformance with the requirements specified.
- D. Guarantee: Submit for approval copies of written guarantee agreeing to repair or replace sealants which fail to perform as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver materials in caulking and sealant manufacturer's original unopened containers.
 2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Formula or specification number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life and curing time when applicable.

3. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by ENGINEER, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to OWNER.

B. Storage of Materials:

1. Store materials so as to preclude the inclusion of foreign materials.
2. Do not store or expose materials to temperature above 90 F or store in direct sunshine.
3. Do not use materials which are outdated as indicated by shelf life.
4. Store sealant tape in a manner which will not deform the tape.
5. In cool or cold weather store containers where temperature approximates 75 F for 16 hours before using.
6. When high temperatures prevail store mixed sealants in a cool place.

C. Handling:

1. Handle materials carefully to prevent inclusion of foreign materials.
2. Do not open containers or mix components until necessary preparatory work and priming has been completed.

1.5 JOB CONDITIONS

A. Environmental Conditions:

1. Do not proceed with installation of caulking and sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.
2. Proceed with the Work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength.
3. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures.
4. When high temperatures prevail avoid mixing sealants in direct sunlight.

B. Protection: Do not allow caulking and sealants to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces including rough textured materials. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the caulking and sealant materials.

1.6 GUARANTEE

A. Provide a written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and watertight joints; 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 submitted manufacturer's data, as an inherent quality of the material for the exposure indicated. Provide guarantee signed by the installer and CONTRACTOR. Provide guarantee period of two years.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Exterior and Interior Joints in Vertical Planes:
1. Two-Component Urethane Sealant:
 - a. Urethane-based, 2-part elastomeric sealant complying with the following:
 - 1) FS TT-S-00227: Type 2 (non-sag) Class A.
 - 2) Adhesion-in-Peel, FS TT-S-00227 and ASTM C 794: Minimum 10 lbs/linear inch with no adhesion failure.
 - 3) Hardness (Standard Conditions), ASTM C 661: 24-35 (Shore A).
 - 4) Stain and color change, FS TT-S-00227 and ASTM C 510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C 793: No change in sealant characteristics after 250 hours in weatherometer.
 - 6) Rheological Vertical Displacement at 120 F, FS TT-S-002-27: No sag.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Vulkem 227 by Mameco International.
 - 2) Or equal.
- B. Exterior and Interior Joints in Horizontal Planes:
1. Two-Component Polyurethane Sealant:
 - a. Polyurethane-based, 2-part elastomeric sealant complying with the following:
 - 1) FS TT-S-00227, Type 1 (self-leveling) Class A.
 - 2) Water Immersion Bond, FS TT-S-00227: Elongation of 25% with no adhesive failure.
 - 3) Hardness (Standard Conditions), ASTM C 661: 30-40.
 - 4) Stain and Color Change, FS TT-S-00227 and ASTM C 510: No discoloration or stain.
 - 5) Accelerated Aging, ASTM C 793: No change in sealant characteristics after 250 hours in weatherometer.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) Vulkem 255 by Mameco International.
 - 2) Or equal.
- C. Provide colors selected by ENGINEER from caulking and sealant manufacturer's standard color charts. ENGINEER will select a maximum of six colors for the Work. Manufacturers supplying sealants other than those specified above must provide the same colors available from those specified.

D. Miscellaneous Materials:

1. Joint Cleaner: Provide the type of joint cleaning compound recommended by the sealant and caulking manufacturer, for the joint surfaces to be cleaned.
2. Joint Primer and Sealer: Provide the type of joint primer and sealer recommended by the caulking and sealant manufacturer, for the joint surfaces to be primed or sealed.
3. Bond Breaker Type: Polyethylene tape or other plastic tape as recommended by the caulking and sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of caulking and sealant. Provide self-adhesive tape wherever applicable.
4. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable nonabsorptive material as recommended for compatibility with caulking and sealant by the caulking and sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.
5. Low Temperature Catalyst: Provide the type recommended by the caulking and sealant manufacturer.

2.2 MIXING

- A. Comply with sealant manufacturer's written instructions for mixing 2-component sealants.
- B. Thoroughly mix components before use.
- C. Add entire contents of activator can to base containers. Do not mix partial units.
- D. Mix contents for a minimum of 5 minutes or as recommended by the sealant manufacturer, until color and consistency are uniform.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and the conditions under which the caulking and sealant Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the sealants. Do not proceed with the caulking and sealant Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 JOINT SURFACE PREPARATION

- A. Clean joint surfaces immediately before installation of sealant compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bonds of sealant compound as recommended by sealant manufacturer's written instructions.
- B. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's written instructions indicate that alkalinity does not interfere with sealant bond and performance.
 - 1. Etch with 5 percent solution of muriatic acid.
 - 2. Neutralize with dilute ammonia solution.
 - 3. Rinse thoroughly with water and allow to dry before sealant installation.
- C. If necessary, clean porous materials such as concrete and masonry by grinding, sand blasting or mechanical abrading. Blow out joints with oil-free compressed air, or by vacuuming joints prior to application of primer or sealant.
- D. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or wool to produce a dull sheen.

3.3 INSTALLATION

- A. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.
- B. Prime or seal the joint surfaces wherever recommended by the sealant manufacturer. Do not allow prime or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to application of sealants.
- C. Apply masking tape before installation of primer, in continuous strips in alignment with the joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.
- D. Do not install sealants without backer rods or bond breaker tape.
- E. Roll the back-up rod stock into the joint to avoid lengthwise stretching. Do not twist, braid, puncture or prime backer-rods.
- F. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

- G. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.
 - 1. For horizontal joints in sidewalks, pavements and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.
 - 2. For vertical joints subjected to normal movement and sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.
- H. Remove excess and spillage of compounds promptly as the Work progresses.
- I. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

3.4 FIELD QUALITY CONTROL

- A. Where questions of compatibility of sealants and substrate arise the sealant manufacturer shall test the substrate in question for compatibility with the specified sealant and report his findings, with recommendations, to ENGINEER. Any required sealant change shall be at no additional cost to OWNER.
- B. Do not proceed with installation of elastomeric sealants over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
- C. After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4-inch garden hose, without nozzle, held perpendicular to wall face, 2 feet-0 inch from joint and connected to a water system with 30 pounds per square inch minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
- D. Test approximately 5 percent of total joint system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct test in the presence of ENGINEER, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.
- E. Where nature of observed leakage indicates the possibility of inadequate joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints have been fully cured,

followed by natural exposure through both extreme temperatures and returned to the lowest range of temperature in which it is feasible to conduct testing. Perform testing as directed at any time within 24 months of installation date.

3.5 ADJUSTMENT AND CLEANING

- A. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation as directed.
- B. Clean adjacent surfaces of sealant or soiling resulting from the Work. Use solvent or cleaning agent recommended by the sealant manufacturer. Leave all finish work in a neat clean condition.
- C. Protect the sealants during the construction period so that they will be without deterioration, soiling, or damage at the time of OWNER'S Final Acceptance.

+ + END OF SECTION + +

DOORS AND WINDOWS

Division 8

SECTION 08116

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all hollow metal doors and frames Work.
2. The extent of hollow metal doors and frames is shown.
3. The types of hollow metal doors and frame Work required includes, but is not necessarily limited to, the following:
 - a. Flush doors and frames.
 - b. Fire-rated flush doors and frames.
 - c. Drywall frames.
 - d. Fire-rated drywall frames.
 - e. Stick systems.
 - f. Fire-rated stick systems.
 - g. Transoms, louvers and side light panels.
 - h. Fire-rated transoms, louvers and side light panels.
 - i. Miscellaneous fabrications, anchors, reinforcements, fasteners and trim.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate them with the Work specified herein.
2. Where hollow metal doors and frames Work require the building-in of plates, inserts and other items, furnish required inserts to avoid delay in the work of other trades. Provide setting drawings, templates, and directions for installation of plates, inserts and anchors, required by the Work of this Section but installed under other Sections of the Work.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 08710, Finish Hardware.
3. Section 08800, Glazing.
4. Section 09250, Gypsum Wallboard.
5. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Provide hollow metal doors and frames and accessories manufactured by a single firm specializing in the production of this type of Work and complying with all applicable standards of the Steel Door Institute, recommended specifications for Standard Steel Doors and Frames (S.D.I. 100).

- B. Requirements of Regulatory Agencies:
1. Fire-rated Assemblies: Wherever a fire-resistance classification is shown or scheduled for hollow metal doors and frames Work (3-hour, 1-1/2 hour, and similar designations), provide fire-rated hollow metal doors and frames Work investigated and tested as an complete assembly including type of fire door hardware to be used. Identify each fire door, frame and stick system assembly with recognized testing laboratory labels, indicating applicable fire rating of both door, frame and stick system assembly.
 2. Construct assemblies to comply with NFPA Standard No. 80, and applicable provisions of the Uniform Building Code.
 3. Temperature Rise Rating: Wherever a temperature rise rating is required provide doors for ratings as specified in accordance with UL 10(b).
 4. Oversize Assemblies: Wherever hollow metal assemblies are larger than size limitations established by NFPA, provide manufacturer's certification that assembly has been constructed with materials and methods equivalent to labeled construction.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
1. ASTM A 153, Zinc Coating on Iron and Steel Hardware.
 2. ASTM A 366, Carbon Steel Cold-Rolled Sheet.
 3. ASTM A 525, Steel Sheet, Galvanized by the Hot-Dip Process - General.
 4. ASTM A 526, Steel Sheet, Galvanized by the Hot-Dip Process - Specifications.
 5. ASTM A 568, Carbon Steel and High Strength Low Alloy Hot Rolled Sheet, Hot Rolled Strip and Cold-Rolled Sheet.
 6. ASTM A 569, Steel, Carbon Hot-Rolled Sheet and Strip.
 7. ASTM E 90, Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partition.
 8. ASTM E 152, Fire Tests of Door Assemblies.
 9. Steel Door Institute Standard Steel Doors and Frames.
 10. ANSI A115, Specification for Door and Frame Preparations for Hardware.
 11. NFPA 80, Standard for Fire Doors and Windows.
 12. NFPA 252, Fire Tests of Door Assemblies.
 13. UL 10(b), Fire Tests of Door Assemblies.
 14. UL 63, Fire Door Frames.
 15. UL Building Materials Directory.
 16. National Association of Architectural Metal Manufacturers (NAAMM), Hardware Locations for Custom Hollow Metal Doors.

1.3 SUBMITTALS

- A. Submit for approval the following:
1. Metal frame, 12-inch "L" section of frame showing corner detail of all types specified.
 2. Stick system frame, 12-inch by 12-inch "L" section of frame showing corner detail and molding and gasket of all types specified.

3. Door, 12-inch by 12-inch section of all door types specified showing internal construction, edge detail and reinforcement for butts.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for the fabrication and installation of hollow metal doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.
 2. Schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.
- C. Test Reports: Submit for approval the following:
1. Certification of labeled construction for fire doors and frames:
 2. Certification of label construction for doors not requiring labels but requiring labeled construction.
- D. Certificates: Submit for approval the following:
1. Oversize Fire-rated Doors and Frames: Certification for oversize fire-rated doors and frames that each assembly has been constructed with materials and methods equivalent to requirements for labeled construction.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver hollow metal doors and frames cartoned or crated to provide protection during transit and job storage.
 2. Inspect hollow metal Work upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new Work and acceptable to ENGINEER; otherwise, remove and replace damaged items as directed.
- B. Storage of Materials:
1. Store doors and frames at the building site under cover.
 2. Place units up off the floors in a manner that will prevent rust and damage.
 3. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrapper on the door becomes wet, remove the carton immediately.
 4. Provide a 1/4 inch space between stacked doors to promote air circulation.

1.5 SCHEDULING

- A. Coordinate with other work by furnishing Shop Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Frames: Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.
- B. Door Faces: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.
- C. Supports and Anchors: Sheet metal, hot-dip galvanized after fabrication complying with ASTM A 153, Class B.
- D. Inserts, Bolts and Fasteners: Sheet metal, hot-dip galvanized complying with ASTM A 153, Class C or D as applicable.

2.2 FABRICATION, GENERAL

- A. Fabricate hollow metal units to be rigid, neat in appearance and free of defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify Work, that cannot be permanently factory-assembled before shipment, to assure proper assembly at the project site. Weld exposed joints continuously, grind, dress, and make smooth, flush and invisible. Filler to conceal manufacturing defects is not acceptable.
- B. Exposed Fasteners: Unless otherwise specified, provide countersunk flat Phillips or Jackson heads for exposed screws and bolts.
- C. Finish Hardware Preparation:
 - 1. Prepare hollow metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115, Specifications for Door and Frame Preparation for Hardware.
 - 2. Reinforce hollow metal units to receive surface-applied and recessed finish hardware. Drilling and tapping for surface-applied finish hardware may be done at the site.
 - 3. Locate finish hardware as shown on approved Shop Drawings, in accordance with hardware templates provided by hardware manufacturer and in accordance with National Association of Architectural Metal Manufacturers, Hardware Locations for Custom Hollow Metal Doors. Refer to Section 08710, Finish Hardware.
- D. Shop Painting:
 - 1. Clean, treat and paint exposed surface of fabricated hollow metal units, including galvanized surfaces.
 - 2. Clean steel surfaces of mill scale, rust, oil grease, dirt and other foreign materials before the application of the shop coat of paint.

3. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution (SSPC-PT 2), hot phosphate solution (SSPC-PT 4) or basic zinc chromate-vinyl butyral solution (SSPC-PT 3).
4. Refer to Section 09900, Painting for field applied primer and finish paint for exterior or interior exposed ferrous, non-ferrous, or galvanized surfaces.
5. Apply shop coat of prime paint within time limits recommended by pretreatment manufacturer. Apply a uniform dry film thickness of not less than 1.5 mils.
6. Finish shall be rust inhibitive primer capable of humidity test in accordance with ASTM B 117 as certified by an independent laboratory.

2.3 FLUSH DOORS

- A. Door Types: Provide flush design doors, 1-3/4-inches thick, seamless hollow construction, unless otherwise shown or specified.
- B. Door Construction:
 1. Fabricate doors of two outer stretcher-leveled steel sheets galvanized with a G60 zinc coating of 0.60 ounces per square foot in accordance with ASTM A 525 and A 526 and not less than 16 gage. Construct doors with smooth, flush surfaces without visible joints or seams or exposed faces or stile edges, except around glazed or louvered panel inserts. Provide continuously welded seams for all door construction. No fillers shall be used. Provide weep hole openings in the bottom of exterior doors to permit the escape of entrapped moisture.
 2. Reinforce inside of doors with phenolic resin impregnated kraft 1-inch hexagonal cell honeycomb core completely filling the inside of the door and laminated to the inside of both face panels with an adhesive. The honeycomb material shall have a crushing strength not less than 4000 pounds per square foot and the lamination shall withstand not less than 1100 pounds per square foot in shear.
 3. Door reinforcement may be modified in fabrication method approved by ENGINEER in order to provide a UL labeled fire rated door.
 4. Reinforce tops and bottoms of doors with flushed mounted minimum 16 gage horizontal galvanized steel channels welded continuously to the outer sheets.
 5. Edge profiles shall be provided on both stiles of doors as follows: beveled 1/8 inch in 2 inches.
- C. Finish Hardware Reinforcement:
 1. Refer to Section 08710, Finish Hardware.
 2. Hardware supplier shall furnish hollow metal door and frame manufacturer approved hardware schedule, hardware templates, and samples of physical hardware where necessary to insure correct fitting and installation.
 3. Preparation includes sinkages and cut-outs for mortise and concealed hardware.
 4. Provide reinforcements for both concealed and surface applied hardware:
 - a. Drill and tap mortise reinforcements at factory, using templates.

- b. Install reinforcements with concealed connections designed to develop full strength of reinforcements.
- 5. Reinforce doors for required finish hardware, with minimum gages as follows:
 - a. Hinges: Steel plate 7 gage thick by 1-1/2-inches wide by 6-inches longer than hinge secured by not less than 6 spot or projection welds.
 - b. Mortise Locksets and Dead Bolts: 14 gage steel sheet, secured with not less than 2 spot or projection welds.
 - c. Flush Bolts: 12 gage steel sheet, secured with not less than 2 spot or projection welds.
 - d. Surface-Applied Closers: 12 gage steel sheet, secured with not less than 6 spot or projection welds.
 - e. Push Plates and Bars: 16 gage steel sheet secured with not less than 2 spot or projection welds.
 - f. Surface Panic Devices: 16 gage sheet steel secured with not less than 2 spot or projection welds.
 - g. Automatic Door Bottoms: Reinforce for mortise-type units with 14 gage steel, and 16 gage for surface-applied units.
- D. Product and Manufacturer: Provide one of the following:
 - 1. Series CH with DURA-WELD seams by Pioneer Industries, Division of SOS Consolidated, Incorporated.
 - 2. Or equal.

2.4 FIRE-RATED DOORS

- A. Provide the same construction specified above under door construction and within UL requirements as specified.
- B. Provide fire-rated doors in accordance with Underwriters' Laboratories Standard, UL 10(b), and NFPA No. 80 and as follows:
 - 1. For a UL 3-hour (A) classification provide doors with a temperature rise rating of not more than 250 F maximum to 30 minutes of exposure.
 - 2. For a UL 1-1/2 hour (B) classification provide doors with a temperature rise rating of not more than 450 F or 650 F maximum to 30 minutes of exposure.
- C. Provide fire-rated doors with metal labels permanently fastened to the door. Labels shall display all UL required information.
- D. Product and Manufacturer: Provide one of the following:
 - 1. Series CH Underwriters' Label Doors with DURA-WELD seams by Pioneer Industries, Division of SOS Consolidated, Incorporation.
 - 2. Or equal.

2.5 HOLLOW METAL PANELS

- A. Provide hollow metal panels of the same materials, construction, and finish as specified for hollow metal doors.
- B. Provide astragal integral with top of door.

- C. Provide panels which comply with fire-resistance requirements for doors and frames.

2.6 FRAMES

- A. Frame Types: Provide hollow metal frames for doors, transoms, side-lights, borrowed-lights and other openings of size and profile as shown or specified.
- B. Frame Construction:
1. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, continuously welded full depth and width of frame with exposed welds ground flush and smooth.
 2. Form frames of hot rolled prime quality carbon steel in accordance with ASTM A 568 and A 569 and galvanized with a G60 zinc coating of 0.60 ounces per foot in accordance with ASTM A 153, A 525, and A 526 or cold rolled steel sheets in accordance with ASTM A 366 and galvanized in accordance with ASTM A 153, A 525 and A 526.
 3. Gage thickness of steel: not less than 14.
 4. Finish Hardware Reinforcement: Reinforce frames for required finish hardware with minimum gages as follows:
 - a. Hinges and Pivots: Steel plate 10 gage thick by 1-1/2-inches wide by 6-inches longer than hinge, secured by not less than 6 spot or projection welds.
 - b. Strike Plate Clips: Steel plate 10 gage thick by 1-1/2-inches wide by 3-inches long.
 - c. Surface-Applied Closers: 12 gage steel sheet, secured with not less than 5 spot or projection welds.
 5. Mullions and Transom Bars: Provide closed mullions and transom bars where shown. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with and thickness as frame.
 6. Head Reinforcing: Where installed in masonry, leave vertical mullions in frames open at the top so they can be filled with grout.
 7. Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 16 gage galvanized steel.
 - a. Masonry Construction (except as otherwise shown): Adjustable, corrugated or perforated, T-shaped to suit frame size with leg not less than 2-inches wide by 10-inches long. Furnish at least 3 anchors per jamb up to 7 feet 6 inches height; 4 anchors up to 8 feet-0 inch jamb height; one additional anchor for each 24 inch or fraction thereof over 8 feet-0 inch height. Furnish UL construction where required.
 - b. Cast-In-Place Concrete: Anchor frame jambs with minimum 3/8-inch concealed bolts into expansion shields or inserts at 6-inches from top and bottom and 24-inches on centers. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts.

8. Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gage galvanized steel sheet, clip type anchors, with 2 holes to receive fasteners, welded to bottom of jambs and mullions.
9. Head Anchors: Provide 2 anchors at head of frames exceeding 42 inches wide frames mounted in drywall partitions.
10. Head Strut Supports: Provide 3/8-inch by 2-inch vertical steel struts extending from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.
11. Head Reinforcing: For frames over 4 feet-0 inch wide, in masonry openings, provide continuous steel channel or angle stiffener, not less than 12 gage for full width of opening, welded to back of frame at head.
12. Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.
13. Rubber Door Silencers: Drill stop to receive 3 silencers on single-door frames and 4 silencers on double-door frames. Install plastic plugs to keep holes clear during construction.
14. Plaster Guards: Provide minimum of 26 gage plaster guards or dust cover boxes to match metal of frame, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

- C. Product and Manufacturer: Provide one of the following:
1. Series F-14 by Pioneer Industries, Division of SOS Consolidated, Incorporated.
 2. Or equal.

2.7 FIRE-RATED FRAMES

- A. Provide the same construction specified above under frame construction and within UL and NFPA requirements as specified above.
- B. Provide fire-rated frames with metal labels permanently fastened to the frame. Labels shall display all UL required information.
- C. Provide fire-rated frames in accordance with UL Standards UL 10 (b) and UL 63 and NFPA Pamphlet No. 80 and as listed in UL.
- D. Product and Manufacturer: Provide one of the following:
 1. Series F-14 Underwriters' Label Frames by Pioneer Industries, Division of SOS Consolidated, Incorporated.
 2. Or equal.

2.8 DRYWALL FRAMES

- A. Provide frames specifically designed for drywall construction.
- B. Frames shall be knocked down, designed to be securely installed in the rough opening after the gypsum wallboard is installed.

- C. Frame jamb and head connection shall be neat flush miter with head securely locked to top of jamb.
- D. Mitered corners shall be reinforced with a concealed corner cup to provide a firm interlock of jamb to head.
- E. Jambs shall be provided with adjusting screws to adjust and secure frame to be square.
- F. Provide two anchors at head of frames exceeding 42-inches wide. Provide 3/8-inch by 2-inch vertical steel head support struts extending from top of frame at each jamb to supporting construction above. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable bolted anchorage to frame jamb members.
- G. Provide fire-rated drywall frames in accordance with UL Standards UL 10(b) and UL 63 and NFPA 80 and as listed in UL.
- H. Product and Manufacturer: Provide one of the following:
 - a. DW-14 by Pioneer Industries, Division of SOS Consolidated, Incorporated.
 - b. Or equal.

2.9 STICK SYSTEMS

- A. Provide the same construction specified above for frame construction.
- B. Provide stick system for interior window frames assembled as borrowed lights, sidelights, transom frames, or interior windows as shown. Fabricated from components similar to standard hollow metal frames.
- C. Product and Manufacturer: Provide one of the following:
 - 1. Series S-14 Stick System by Pioneer Industries, Division of SOS Industries, Incorporated.
 - 2. Or equal.

2.10 DOOR LOUVERS

- A. Fabricate louvers and mount flush into doors without overlapping mountings on surface of door facing sheets. Provide internal support as recommended by louver manufacturer. Prime paint after fabrication.
- B. Interior Louvers: Sightproof, stationary type, constructed of inverted Y-shaped blades formed of 20 gage cold-rolled steel.
- C. At fire-rated openings provide tightly fitted automatic closing, operable blades, equipped with fusible links, arranged so that metal overlaps metal at every joint. Provide UL approved louvers.

2.11 STOPS AND MOULDINGS

- A. Provide stops and mouldings around solid, glazed and louvered panels in hollow metal units and in frames to receive glass.

- B. Form fixed stops and mouldings integral with frame. Provide fixed stops on inside of hollow metal units exposed to exterior and on corridor side of interior units.
- C. Provide removable stops and molds at other locations, formed of not less than galvanized 20 gage steel sheets. Secure with countersunk machine screws spaced uniformly not more than 12 inches on center. Form corners with butted hairline joints.
- D. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated. Refer to Section 08800, Glazing of these Specification.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and conditions under which hollow metal doors and frames are to be installed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install hollow metal units and accessories in accordance with the final Shop Drawings, manufacturer's data, and as shown and specified.
- B. Place frames at fire-rated openings in accordance with NFPA Standard No. 80.
- C. Frames that are bowed, twisted or otherwise unacceptable shall be removed from the jobsite and replaced with properly constructed frames.
- D. Setting Masonry Anchorage Devices:
 - 1. In masonry construction, building in of anchors and grouting of frames is included in Section 04201, Unit Masonry Construction.
 - 2. Provide masonry anchorage devices and machine screws where required for securing hollow metal frames to masonry construction.
 - 3. Set anchorage devices opposite each anchor location, in accordance with details on approved Shop Drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed, and free from dust and debris.
 - 4. Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so shown on final Shop Drawings.
- E. Secure frames to concrete framing with reinforcement concealed in hollow metal frames.

F. Placing Frames:

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged. Remove spreader bars only after frames have been properly set and secured.
2. Make field splices in frames as detailed on approved Shop Drawings, welded and finished to match factory Work.

G. Protective Coating: Protect inside, concealed, faces of door frames in plaster or masonry construction using fibered asphalt emulsion coating. Apply over shop primer approximately 1/8 inch thick and allow to dry before handling.

H. Door Installation:

1. Fit hollow metal doors accurately in their respective frames, with the following clearances:
 - a. Jams and Head: 3/32 inch.
 - b. Meeting Edges, Pairs of Doors: 1/8 inch.
 - c. Bottom: 3/4 inch, where no threshold or carpet.
 - d. Bottom: At threshold, 1/8 inch.
2. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.
3. Finish hardware installation is specified under Section 08710, Finish Hardware.

3.3 ADJUSTMENT AND CLEANING

- A. Final Adjustments: Check and readjust operating finish hardware items in hollow metal Work just prior to final inspection. Leave Work in complete and proper operating conditions.
- B. Prime Coat Touch-Up: Immediately after erection, sand and apply touch-up of compatible air-drying primer.
- C. Protection: Protect installed hollow metal doors and frames against damage from other construction work.

+ + END OF SECTION + +

SECTION 08120

ALUMINUM DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all aluminum doors and frames Work.
2. The extent of aluminum doors and frames is shown.
3. The types of aluminum doors and frames Work required includes, but is not necessarily limited to, the following:
 - a. Flush doors and frames.
 - b. Miscellaneous accessories and fasteners.

B. Related Sections:

1. Section 08710, Finish Hardware.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide aluminum doors and frames manufactured by a single firm specializing in the production of this type of Work.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. Aluminum Association (AA), Standards and Finish Designations.
2. ANSI A115, Specifications for Door and Frame Preparations for Hardware.
3. Architectural Aluminum Manufacturing Association 701.1 Standard for Sliding Weatherstripping.
4. ASTM A 103, Zinc (hot-galvanized) Coatings on Products Fabricated From Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
5. ASTM A 123, Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
6. ASTM B 509, Cellular Elastomeric Preformed Gasket and Sealing Material.
7. ASTM D 2000, Classification for Elastomeric Materials for Automotive Applications.
8. ASTM D 2287, Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds.
9. NAAMM, Hardware Location for Custom Hollow Metal Doors.
10. NAAMM, Metal Finishes Manual.
11. SSPC-Paint 12, Cold Applied Asphalt Mastic (Extra Thick Film).

1.3 SUBMITTALS

- A. Samples: Submit for approval 3 samples of each required aluminum finish, on 12-inch long extrusions or 6-inch square sheets, of the alloys to be used for the Work. Where normal color and texture variations are to be expected, include 2 or more units in each sample, to show the range of such variations. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval Shop Drawings for the fabrication and installation of aluminum doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Drawings.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver aluminum doors and frames cartoned or crated to provide protection during transit and job storage.
 - 2. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the finish items are equal in all respects to new Work and acceptable to ENGINEER; otherwise, remove and replace damaged items as directed.
- B. Storage of Materials: Store doors and frames at the project site under cover. Place units up off the floors in a manner that will prevent corrosion and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrapper on the door becomes wet, remove the carton immediately. Provide a 1/4-inch space between stacked doors to promote air circulation.

1.5 GUARANTEE

- A. Submit for approval copies of written guarantee signed by the manufacturer, installer and CONTRACTOR, agreeing to replace aluminum doors and frames which fail in materials or workmanship within 3 years of the date of Final Acceptance. Failure of materials or workmanship shall include (but not be limited to) failures in operation of doors and hardware, excessive leakage or air infiltration, excessive deflections, delamination of panels, deterioration of finish or metal in excess of normal weathering, and defects in accessories, weatherstripping, and other components of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: Provide aluminum alloy 6063-T5 or equal for properties of strength (not less than 22,000 pounds per square inch ultimate tensile strength), corrosion resistance, abrasion resistance, application of required finish, and control of color.
- B. Aluminum Sheets:
 - 1. Provide aluminum alloy 5005 or equal for properties of strength corrosion resistance, abrasion resistance, application of required finish, and control of color.
 - 2. Provide smooth sheet for exposed faces of doors and panels, except as otherwise specified.
- C. Fasteners: Aluminum, non-magnetic stainless steel or other non-corrosive metal fasteners guaranteed by the manufacturer to be compatible with the doors, frames, stops, panels, hardware, anchors and other items being fastened.
 - 1. For exposed fasteners (if any), provide Phillips flat-head screws with finish matching the item fastened.
 - 2. Do not use exposed fasteners except where unavoidable for the assembly of units, and unavoidable for the application of hardware. Provide only concealed screws in glazing stops.
- D. Reinforcement and Brackets: Manufacturer's standard formed or fabricated aluminum units, of shapes, plates or bars.
- E. Inserts: For required anchorage into concrete or masonry work, furnish inserts of 12 gage steel hot-dip galvanized after fabrication.
- F. Expansion Anchor Devices: Galvanized, drilled-in, expansion bolt anchors.
- G. Bituminous Coatings: Cold-applied asphalt mastic complying with SSPC-PAINT 12, compounded for 30 mil thickness per coat.

2.2 FABRICATION

- A. General:
 - 1. Sizes and Profiles: The required sizes for door and frame units, and the profile requirements are shown on the Drawings. Variable dimensions for profiles (if any) are shown along with maximum and minimum dimensions as required to achieve design requirements and coordination with other work.
 - 2. The details shown are based upon standard details by one or more manufacturers. Similar details by other manufacturers will be acceptable, provided they comply with the size requirements, and with minimum/maximum profile requirements as shown.

B. Flush Type Aluminum Doors:

1. Provide tubular frames members with minimum wall thickness of 1/8-inch, fabricated with reinforced mechanical or welded joints in accordance with manufacturer's standard fabrication methods. Limit edge exposure and face molding exposure to 0.50 inch maximum width.
2. Fabricate flush doors with cores laminated between 2 sheets of 0.040-inch thick aluminum laminated to 1/8-inch thick tempered hardboard with epoxy adhesive to form a door thickness of 1-3/4-inch.
3. Provide cores of phenolic resin-impregnated Kraft paper honeycomb, (1/2-inch bell size) laminated with an epoxy adhesive between 2 sheets of 1/8-inch thick tempered hardboard.
4. Provide transom panels and frames of the same material, finish, thickness and gage as the door and frame material.
5. Product and Manufacturer: Provide one of the following:
 - a. Model 680 Endure-A-Door with Model D67 Frame System by Endure-A-Lifetime Products, Incorporated.
 - b. Or equal.

2.3 HARDWARE

- A. Flush Doors: Refer to Section 08710, Finish Hardware, and to the frame, door and hardware schedules and details, for the furnishing and installing of hardware items. Hardware templates only will be furnished to the manufacturer for the fabrication of door and frames to receive hardware not supplied by door manufacturer.
- B. Hardware Installation: Cut, reinforce, drill and tap frames and doors as required to receive hardware, except do not drill and tap for surface-mounted items until the time of installation. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.

2.4 ALUMINUM FINISHES

A. General:

1. Preparation: After fabrication of doors and frames, but before lamination of panels, prepare the aluminum surfaces for finishing in accordance with the aluminum producer's recommendations and standards of the finisher or processor. Process all components of each assembly simultaneously to attain complete uniformity of color.
2. Samples:
 - a. Comply with industry standard colors and texture samples. Establish samples of the required finish, for ENGINEER'S acceptance, prior to fabrication of the Work. ENGINEER reserves the right to reject material finishes with objectionable variations from the established samples.
 - b. Prepare samples on extrusions and sheets of the exact alloys to be used for the Work, and show range of natural variations to be expected in finished Work, by duplicate samples of varying color and texture.

- B. Anodized Finishes: NAAMM AA-M21C22A42, (minimum thickness of 0.7 mils), Dark Bronze.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and conditions under which aluminum doors and frames Work are to be installed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for the installation of aluminum doors and frames.
- B. Set units plumb, level and true to line, without warp or rack of frames, doors or panels. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Refer to Section 08860, Glazing, for installation of glass and other panels shown to be glazed into doors and frames.

3.3 ADJUSTMENT AND CLEANING

- A. Clean aluminum surfaces promptly after installation of frames and doors. Remove excess glazing and sealant compounds, dirt and other substances.
- B. Where protective coating has been supplied, remove coating completely as soon as the completion of construction activities no longer requires its retention.
- C. CONTRACTOR shall provide protective treatment and other precautions required as recommended by manufacturer, through the remainder of the construction period, to ensure that doors and frames will be without damage or deterioration (other than normal weathering) at the time of Final Acceptance.

+ + END OF SECTION + +

SECTION 08211

WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown specified and required to furnish and install all wood door Work.
2. The extent of wood doors is shown.
3. The types of wood door Work required includes, but is not necessarily limited to, the following:
 - a. Solid core flush wood doors with veneer faces for transparent finish and matching wood transoms with concealed mounting.
 - b. Hemlock core fully louvered bifold doors complete with finish hardwood.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the wood door Work.
2. Coordinate required material for each door and frame as shown.

C. Related Sections:

1. Section 08116, Hollow Metal Doors and Frames.
2. Section 08710, Finish Hardware.
3. Section 09900, Painting.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. Fire Rated Assemblies: Wherever a fire-resistance classification is shown or scheduled for wood door Work, provide doors which comply with the requirements of NFPA No. 80 "Standard for Fire Doors and Windows" and which have been investigated and tested as a fire door assembly complete with type of fire door hardware to be used. Identify each fire door and frame with recognized testing laboratory labels, indicating applicable fire rating of both door and frame.
2. Provide automatic closing door louvers, with fusible link as required by UL.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. Architectural Woodwork Institute, Quality Standards, Section 1300.
2. National Woodworkers Manufacturers Association, ANSI/NWMA Industry Standard I.S. 1, Wood Flush Doors.
3. NWMA, Care and Finishing of Wood Doors.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Veneer sheet from each available flitch to be used for face veneers.
 2. 3 foot-0 inch by 12-inch wide sample of actual wood door with veneer sheets of specie selected. Also submit strips of solid wood 1-inch by 3-inches of species to be used for exposed edges, trim and other solid wood components.
 3. Samples will be reviewed for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Copies of door manufacturer's specifications and installation instructions for each type of wood door required, including other data as may be required to show compliance with the specified requirements.
 2. Provide manufacturer's recommended clear finishing specifications.
 3. Details of core and edge construction, trim for openings and similar components.
- C. Guarantees: Submit copies of written agreement in door manufacturer's standard form signed by the manufacturer, and CONTRACTOR, agreeing to repair or replace defective doors which have warped, bowed, cupped or twisted, or which show photographing of construction below in face veneers, as defined in NWMA Standard Door Guarantee, except the NWMA provision for refunding the price received by the door manufacturer for any defective door shall not apply. The guarantee shall also include refinishing and reinstallation which may be required due to repair or replacement of defective doors. Guarantee shall be in effect for the entire life of the installation after the date of Final Acceptance.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with, On-Site Care, recommendations of NWMA pamphlet, Care and Finishing of Wood Doors, and with manufacturer's instructions.
- B. Protection of Material: Provide protective coverings for doors at the factory prior to shipping. Use heavy paper cartons and mark with identification required for proper installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide wood doors complying with the applicable requirements of ANSI/NWMA I.S. 1 for the kinds and types of doors specified.
1. Provide manufacturer's standard 5-ply face panels, unless otherwise indicated.

2. Exposed Surfaces: Provide same exposed surface material on both faces of each door.
 3. Exposed Surfaces for Semi-Transparent Finish: Provide manufacturer's standard thickness face veneers of the following quality.
 4. Quality: NWMA I.S. 1 premium quality exposed surfaces red oak face veneers. Plain sliced with even numbered pieces of veneer across door faces and with a joint occurring at the centerline of the door. Provide two pieces of veneer per 12-inches of door width. Provide exposed edges and other exposed solid wood components of the same species as face veneers.
- B. Wood Louvers: Provide sightproof solid wood door louvers of same species as face veneer.

2.2 SOLID CORE WOOD DOORS

- A. Adhesive Type: Type I waterproof bond.
- B. Core Construction: Fire retardant wood particleboard, 32 pound density, conforming to NWMA 1.5.1.2., and ANSI A208.1.
- C. For exterior doors provide manufacturer's standard recommended moisture stripping.
- D. Provide all 1-3/4-inch thick wood doors, unless otherwise scheduled as 1-3/8-inch.
- E. Product and Manufacturer: Provide one of the following:
 1. DPC-1 Timblend by Weyerhaeuser Company.
 2. Or equal.

2.3 FIRE RATED DOORS

- A. Provide doors labeled and classified by Underwriters' Laboratories', Incorporated as a 90-minute fire barrier.
- B. Adhesive Type I: Waterproof bond.
- C. Core Construction: Incombustible mineral with fire-retardant cross-banding.
- D. Provide fusible link louvers where louvers are scheduled.
- E. Provide all 1-3/4-inch thick wood doors.
- F. Product and Manufacturer: Provide one of the following:
 1. DFM-90 by Weyerhaeuser Company.
 2. Or equal.

2.4 WOOD TRANSOMS

- A. Same construction, finish and fire-rating as wood door.
- B. Provide all concealed mounting brackets and fasteners.

2.5 BIFOLD DOORS

- A. Provide 1-3/8-inch solid western hemlock core bifold doors with White Oak face veneers.
- B. Provide four door units with full height venting solid oak louver slats.
- C. Provide factory assembled units complete with all installation hardware.
- D. Product and Manufacturer: Provide one of the following:
 - 1. Oak (1423) by E.A. Nord Company.
 - 2. Or equal.

2.6 FINISH

- A. Provide complete selection of manufacturer's standard and custom factory applied transparent oil effect finishes with clear sealers and water repellent preservative for all doors.

2.7 PREFITTING AND PREPARATION FOR HARDWARE

- A. Prefit and premachine wood doors for hardware at the factory complete with louvers as scheduled.
- B. Comply with the tolerance requirements of NWMA for prefitting. Machine doors for hardware requiring cutting of doors. Factory install as much hardware as practicable.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and conditions under which wood door Work are to be installed and verify that openings are of the correct type and have been installed as required for proper hanging of corresponding doors. CONTRACTOR shall notify ENGINEER in writing of conditions detrimental to the proper and timely installation of wood door Work; do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Condition doors to average prevailing humidity in installation area prior to hanging.
- B. Manufacturer's Instructions: Install wood doors in accordance with manufacturer's instructions and as shown.
- C. Clearance: For non-fire doors provide clearances of 1/8 inch at jambs and heads; 1/8 inch at meeting stiles for pairs of doors; and 1/2 inch from bottom of door to top of decorative floor finish or

covering, except where threshold is shown or scheduled provide 1/4 inch clearance from bottom of door to top of threshold.

3.3 ADJUSTMENT AND CLEANING

- A. Operation: Rehang or replace doors which do not swing or operate freely.
- B. Finished Doors: Refinish or replace doors damaged during installation, as directed by ENGINEER, at no additional expense to the OWNER.
- C. Protection of Completed Work: Installer shall advise CONTRACTOR of proper procedures required for protection of installed wood doors from damage of deterioration until Final Acceptance of the Work.

+ + END OF SECTION + +

SECTION 08305

ACCESS DOORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install all access door Work.
 2. The extent of access doors is shown.
 3. The types of access door Work required includes, but is not necessarily limited to, the following:
 - a. Fire-rated wall doors.
 - b. Ceiling doors in cement plaster ceilings.
- B. Coordination:
1. Furnish inserts and anchoring devices which must be built into other work for the installation of access doors.
- C. Related Sections:
1. Section 09201, Furring and Lathing.
 2. Section 09221, Cement Plaster.
 3. Section 09250, Gypsum Wallboard.
 4. Section 09513, Suspended Metal Ceiling.

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's technical data and installation instructions for each type of access door assembly. Transmit copy of each instruction to the installer. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General:
1. Furnish access door assemblies manufactured as an integral unit, complete with all parts and ready for installation.
 2. Provide wall access door and frame with UL 3/4 hour "C" rating.
- B. Product and Manufacturer: Provide the following:
1. Stainless Steel Fire Rated Access Door and Ceiling Door by Inryco, Incorporated.
 2. Or equal.
- C. Frames:
1. Fabricate from 16 gage stainless steel with No. 4 finish for wall doors and 16 gage cold rolled steel for ceiling access doors.

2. Fabricate frame with exposed flange approximately 1-inch wide around perimeter of frame.
- D. Flush Panel Doors:
1. Fabricate wall door panels from not less than 20 gage sheet stainless steel with No. 4 finish, and with concealed spring hinges set to open to 175 degrees.
 2. Fabricate ceiling access door panels of not less than 18 gage cold rolled steel with concealed hinge allowing 90 degree operation.
- E. Locking Devices:
1. Provide knurled knob and mortise cylinder operation master keyed to match mortise locksets specified in Section 08710, Finish Hardware. Provide the number of locks required to hold door in flush, smooth plane when closed.
 2. Provide automatic panel closer for wall doors.
- F. Wall Doors Size: 16-inches by 16-inches.
- G. Ceiling Door Size: 24-inches by 24-inches.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which access doors are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with manufacturer's instructions for installation of access doors.
- B. Coordinate installation with work of other trades.
- C. Set frames accurately in position and securely attach to support with face panels plumb or level in relation to adjacent finish surfaces.

3.3 ADJUSTMENT AND CLEANING

- A. Adjust hardware and panels after installation for proper operation.
- B. Remove and replace panels or frames which are warped, bowed or otherwise damaged.

+ + END OF SECTION + +

SECTION 08410

ALUMINUM AND GLASS DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all aluminum and glass door and frame Work.
2. The extent of the aluminum and glass doors and frames is shown and is defined to include exterior aluminum window walls capable of structurally spanning between supports and all associated exterior doors, hardware trim and accessories.
3. The types of aluminum and glass doors and frames Work required includes, but is not necessarily limited to, the following:
 - a. Thermal barrier aluminum extrusion stick system with rain screen pressure equalization.
 - b. Gaskets, pressure plates and snap covers in conjunction with each of the above components.
 - c. Anchors, inserts, support brackets, expansion devices, fasteners, flashings, weeps, and similar elements in conjunction with each of the above components.
 - d. Wide stile entrance doors with concealed overhead closer and other finish hardware.
 - e. Miscellaneous trim, anchors, fasteners and others component for a completely functioning system.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the aluminum and glass door and frame Work.

C. Related Sections:

1. Section 08710, Finish Hardware.
2. Section 08800, Glazing.

1.2 QUALITY ASSURANCE

- ###### A. Manufacturer Qualifications:
- Provide aluminum and glass doors and frames finish applicator experienced in the handling and application of the finish coatings specified, acceptable to the coating or aluminum manufacturer.

B. Installer Qualifications:

1. Engage a single installer regularly engaged in aluminum and glass doors and frame installation and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER.

C. Design Criteria:

1. Standards: Comply with applicable standards and recommendations by NAAMM, Metal Curtain Wall Specifications Manual, except to the extent more stringent requirements are specified.
2. Performance Requirements: In addition to other requirements as shown and specified, fabricate materials and components of door units to withstand the anticipated traffic as follows for the life of the building (40 years), with normal maintenance:
 - a. Building Entrances: 4000 open/close cycles per day.
3. Weather Resistance: Fabricate aluminum and glass doors and frames system to prevent the uncontrolled penetration of air and water under normal severe weather conditions.
 - a. Uncontrolled penetration of water is defined as the interior accumulation in any one hour of more than 0.01 gallons of water per linear foot of operable door perimeter, during heavy rain (1 gallon per square foot per hour) with wind velocity of 25 mph.
 - b. Uncontrolled penetration of air is defined as the infiltration of air at a rate in excess of 0.5 cubic feet of air per minute per linear foot of operable door perimeter, during direct exposure to a wind velocity of 25 miles per hour.

D. Erection Tolerances:

1. Limit variations from plumb, level or dimensioned angle to the following:
 - a. 1/8 inch maximum deviation in 10 foot vertical or angular run, and in 20 foot horizontal runs.
 - b. 1/4 inch maximum deviation in 40 foot runs, all directions.
2. Limit variations from theoretical member locations shown, based on established floor lines and column lines, including variations from plumb and level, to the following:
 - a. 3/8 inch total maximum deviation for members at all locations.
 - b. 1/8 inch maximum change in deviation for members for 10 foot runs, all directions.
3. Limit offsets in end-to-end and edge-to-edge alignments of adjoining and consecutive members, which form planes, continuous runs and profiles, to the following:
 - a. 1/16 inch maximum offset in flush alignment, including members which are to be 1/2 inch or less out-of-flush, and including members which are separated 2 inches or less by a reveal or protrusion in the plane of the aluminum window wall.
 - b. 1/8 inch maximum offset in alignments which are to be out-of-flush by more than 1/2 inch or separated by a reveal or protrusion of more than 2 inch width.

E. Source Quality Control:

1. Obtain all aluminum and glass door and frame wall Work from the same manufacturer.
2. Use the same aluminum alloys throughout the Work. Choose sheet and extrusion alloys for color producing compatibility.

- F. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM A 123, Coatings or Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strip.
 2. ASTM B 117, Salt Spray (Fog) Testing.
 3. ASTM B 509, Cellular Elastomeric Preformed Gasket and Sealing Material.
 4. ASTM D 412, Rubber Properties in Tension.
 5. ASTM D 523, Specular Gloss.
 6. ASTM D 624, Rubber Property - Tear Resistance.
 7. ASTM D 659, Evaluating Degree of Resistance to Chalking of Exterior Paints.
 8. ASTM D 746, Brittleness Temperature of Plastics and Elastomers by Impact.
 9. ASTM D 968, Abrasion Resistance of Coatings of Paint, Varnish, Lacquer, and related Products by the Falling Sand Method.
 10. ASTM D 1149, Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimen).
 11. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 12. ASTM D 1737, Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus.
 13. ASTM D 2240, Rubber Property-Durometer Hardness.
 14. ASTM D 2244, Color Differences of Opaque Materials.
 15. ASTM D 2247, Coated Metal Specimens at 100 Percent Relative Humidity.
 16. AAMA 701.1, Standard for Sliding Weatherstripping.
 17. FS, FF-S-92B, Screw, Machine: Slotted, Cross-recessed Or Hexagon Head.
 18. NAAMM, Entrance Manual.
 19. NAAMM, Metal Finishes Manual.
 20. SSPC, Systems and Specifications Surface Preparation Guide and Paint Application Specification.
 21. AWS, D10.7, Recommended Practices for Gas Shielded-Arc Welding of Aluminum and Aluminum Alloy Pipe.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Samples of each required type and color of finish, on 12-inch long sections of extrusion shapes used in the Work, and 6-inch squares of sheet aluminum as required for the aluminum window wall units and accessories. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
 2. Door, 12-inch by 12-inch corner section of aluminum and glass type doors specified showing internal construction, edge detail and reinforcement for butts.
 3. ENGINEER reserves the right to require samples showing fabrication techniques and workmanship of component parts, and the design of accessories and other exposed auxiliary items for aluminum and glass door and frame Work, before fabrication of the Work proceeds.

4. One of each type fastener employed, with statement of intended use. Samples will be reviewed by ENGINEER for material and color only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for the assembly and erection of the entire aluminum and glass door and frame system showing all dimensions, gages, finishes, location of joints, connections, fasteners, expansion provisions, and locations and types of glazing gaskets, pressure plates and snap covers and other related items as required. Provide wall elevations at 1/4 inch scale, and full size detail sections of every typical composite member. Coordinate the submittal of Shop Drawings for component parts (as specified in other Sections) with this submittal. Show anchorages and alignments not shown on Shop Drawings of the components. Indicate clearly on Shop Drawings, all deviations from ENGINEER'S Drawings.
 2. Copies of manufacturers' Specifications and installation instructions for required materials and components.
 3. Maintenance Manual: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.
- C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.
- D. Guarantee: Submit for review copies of written guarantee agreeing to replace aluminum window wall Work which fail to perform as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver aluminum and glass doors and frame materials, components and accessories dry and undamaged, with manufacturers protective wrapping intact.
 2. Deliver aluminum and glass doors and frames cartoned or crated to provide protection transit and job storage.
 3. Inspect aluminum and glass doors and frames upon delivery for damage. Minor damage may be repaired provided the finished items are equal in all respects to new Work and acceptable to ENGINEER; otherwise remove and replace damaged items as directed.
- B. Storage of Materials:
1. Do not store aluminum and glass doors and frame components in contact with concrete or other materials that might cause corrosion or staining.

2. Store aluminum and glass doors and frame component in an area protected from the weather and with good air circulation around each piece. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the cardboard wrapper on the doors become wet, remove the carton immediately.
3. Provide a 1/4 inch space between stacked doors to promote air circulation.

C. Handling of Materials:

1. Do not subject aluminum and glass doors and frame components to bending or stress.
2. Do not damage edges or handle material in a manner that will cause scratches, warps or dents.

1.5 JOB CONDITIONS

A. Scheduling:

1. Schedule the arrival of aluminum window wall components and accessories to minimize the time they are stored at the site before installation.
2. Coordinate with other work by furnishing Shop Drawings, inserts and similar items at the appropriate times for proper sequencing of construction without delays.

1.6 GUARANTEE

- A. Provide written guarantee agreeing to replace aluminum and glass door and frame Work which fail in materials or workmanship within 3 years of the date of Final Acceptance. Failure of materials or workmanship shall include, but is not limited to, failure in operation of doors and hardware, excessive leakage or air infiltration, excessive deflections, deterioration of finish or metal in excess of normal weathering, and defects in accessories, weatherstripping, and other components of the Work.
- B. Guarantee that the polyvinylidene fluoride based coating meets all criteria specified and will not spall, check, craze, peel or otherwise lose adhesion for a period of 20 years from the date of installation, to the extent that such shall create unsightly conditions or otherwise impair the intended architectural qualities of the building.
- C. In the event that the polyvinylidene fluoride based coating fails to meet the specified standards the manufacturer shall, at his own expense, replace or field paint, at the discretion of ENGINEER, all areas affected by the failure. In the event that repainting is selected, it shall be done at mutually agreeable intervals throughout the term of the warranty.
- D. The warranty does not apply where failure is caused by accidents, or external conditions or forces beyond the control of the manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Extrusions:

1. Provide aluminum extruded mullions, pressure plates, snap covers, and glazing stops and trim, equal to 6063-T5 alloy and temper or as recommended by the aluminum window wall manufacturer to comply with the requirements of performance, fabrication, application of finish and control of color.
2. Provide thicknesses as follows:
 - a. Principal Extrusions: 0.125-inches minimum thickness.
 - b. Extruded Glazing Stops and Trim: 0.062-inches minimum thickness.
3. Provide extrusions within commercial tolerances, formed true to details shown and free of defects impairing strength, durability, color or finish.

B. Sheets:

1. Provide aluminum sheet flashings, closures and accessories, equal to 5005 alloy for exposed sheet and 3003 alloy for non-exposed sheet or as recommended by the aluminum and glass doors and frames manufacturer to comply with the requirements of performance, fabrication, application of finish and control of color.
2. Provide thicknesses as follows:
 - a. Principal Formed Sheet Members: 0.125-inches minimum thickness.
 - b. Formed Glazing Stops and Trim: 0.050-inches minimum thickness.
3. Provide sheet free of defects impairing strength, durability, color or finish.

C. Thermal Separators: Manufacturer's standard PVC thermal clips.

D. Non-Structural Gasket Glazing: Provide neoprene and EDPM glazing gaskets complying with either of the following:

1. Neoprene with the following physical properties:
 - a. Hardness, ASTM D 2240: 40 Shore A.
 - b. Tensile Strength, ASTM D 412: 1500 psi.
 - c. Tear Strength, ASTM D 624: 120 lbs/lin. in.
 - d. Elongation, ASTM D 412: 300%
 - e. Brittleness Temperature, ASTM D 746: -30F.

E. Sliding Weatherstripping: Provide manufacturer's standard replaceable stripping of wool, polypropylene or nylon woven pile, with nylon fabric and aluminum stripping backing, complying with AAMA 701.1. Sliding weatherstripping includes stripping at jamb rails, head rails and meeting rails, wherever there is no stop or lap to receive compression weatherstripping (wiping action as well as sliding action).

F. Fasteners: Provide type and size required for proper support and performance, fabricated in compliance with FS FF-S-92 of non-magnetic stainless steel. Provide Phillips flat-head screws where exposed, unless otherwise shown. Finish exposed aluminum fasteners to match aluminum Work.

- G. Brackets and Reinforcements and Splice Clips: Provide aluminum brackets and reinforcements wherever possible. Where steel units are required for higher strength or other unavoidable necessity, hot-dip galvanize the pieces after fabrication, with 2.0 ounces zinc coating, complying with ASTM A 123.
- H. Bituminous Paint: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30-mil thickness per coat.
- I. Slip-Joint Linings: Provide plastic sheets, spacers or bearing pads as required to ensure free movement between surfaces where expansion and deflection movements are intended. Provide fluorocarbon resin or equivalent plastic units of the sizes and thicknesses recommended by the manufacturer to permanently prevent "freeze-up" of joints.
- J. Expansion Anchor Devices: Where inserts have not been provided in supporting concrete structure, provide drilled-in expansion bolt anchors of either toothed-steel or lead shield design.

2.2 FABRICATION

A. Aluminum Frames:

1. Complete the fabrication and assembly of aluminum frame Work at the shop to the greatest extent possible, so as to minimize field cutting, splicing, fastening, sealing, finishing and similar Work. Maintain provisions for expansion and movement as required. Disassemble only as necessary for shipment and erection. Maintain true continuity of line and accurate relation of planes and angles. Provide secure attachment and support at mechanical joints, with hairline fit of contacting members.
2. Provide sizes, shapes and profiles required to fabricate aluminum and glass door and frame Work.
3. Provide mullions as shown, projecting inside the plane of the glass with one exterior pressure plate section per mullion. Attach covers with PVC isolators.
4. Provide mullions fabricated for field connection at intersections, using screws and channel clips furnished by the manufacturer.
5. Provide exterior snap covers to provide a total mullion depth of 6 inches.
6. Complete the cutting, fitting, forming, drilling and grinding of all metal work prior to cleaning, finishing, treatment, and application of coatings.
7. Follow recommendations of AWS D10.7, to avoid discoloration at welds. Grind exposed welds smooth and restore mechanical finish. Remove arrises from cut edges and ease edges and corners to a radius of approximately 1/64 inch.
8. Conceal fasteners wherever possible, except as otherwise shown.
9. Reinforce the Work as necessary for performance requirements, and for support of the system. Separate dissimilar metals with bituminous paint to prevent corrosion. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts which will permanently prevent "freeze-up" of the joint.

10. Provide aluminum and glass door and frame Work capable of accomodating 1-inch thick insulating glass. System shall accommodate exterior glazing and reglazing.
 11. Product and Manufacturer: Provide one of the following:
 - a. 1600 Curtain Wall by Kawneer Architectural Products, Subsidiary of Alumax Aluminum Company, Incorporated.
 - b. Or equal.
- B. Aluminum and Glass Doors:
1. Provide tubular frame members, fabricated with mitered or coped joints, structurally welded with reinforcing inserts to develop the full strength and maximum rigidity possible in the frame assembly.
 - a. Vertical Stiles: 5-inches wide by 0.125-inches thick minimum.
 - b. Top Rail: 5-inches wide by 0.125-inches thick minimum.
 - c. Bottom Rail: 6-1/2-inch wide by 0.125-inch thick minimum.
 2. Style of Doors: Except as otherwise shown or scheduled, provide door units 1-3/4-inches thick and of the specified style, as described in the NAAMM Entrance Manual; Wide stile.
 3. Glazing: Fabricate doors to facilitate replacement of glass or panels without disassembly of door stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.
 - a. Provide stops of standard, near-flush, square profile.
 - b. Equip stops to receive driven-in glazing gaskets.
 - c. Provide stops to accommodate 1-inch thick bronze tinted tempered reflective insulating glass.
 4. Product and Manufacturer: Provide one of the following:
 - a. 500 Series Paneline/Panic Guard Doors by Kawneer Company Incorporated.
 - b. Or equal.

2.3 HARDWARE

- A. Provide for aluminum and glass doors, door manufacturer's standard heavy-duty hardware units as specified or required for operation of each door, including the following items of the sizes, number and type recommended by the manufacturer for the service specified.
1. Three pair, off-set hung, forged bronze, top, bottom and intermediate pivot units with permanently lubricated, hardened steel pivots as specified in Section 08710, Finish Hardware.
 2. Two overhead concealed closers with hold open and delayed action feature.
 - a. Equip closers with hold-open device for 105 degree operation.
 3. Two 90 degree offset oil-rubbed bronze pull handles with 15-inch on center attachments.
 4. Integral panic exit devices for each leaf with full-length, concealed astragal bar interlocking the two door leaves.
 5. Two door holders for mounting on lower rail, flip-up type with rubber shoes.
 6. One threshold for exterior doors, complete with anchors and clips of manufacturer's standard size but not less than 4-inches wide by 1/2-inch high; aluminum.
 7. Cylinder: Coordinated with the hardware supplied in Section 08710, Finish Hardware and coordinated with the hardware require-

ments of this Section. Report discrepancies (in writing) to CONTRACTOR.

8. EPDM blade gasket sweep strip applied to the bottom door rails with concealed fasteners.
9. Product and Manufacturer: Provide one of the following:
 - a. Classic Hardware by Kawneer Company Incorporated.
 - b. Or equal.

B. Hardware Installation:

1. Cut, reinforce, drill and tap frames and doors as required to receive hardware, except do not drill and tap for surface-mounted items until the time of installation at the project site. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
2. Install all hardware, except surface-mounted hardware, at the fabrication plant. Remove only as required for final finishing operations, and for delivery and installation of the Work at the project site.

2.4 ALUMINUM AND GLASS DOOR AND FRAME COATINGS

A. Exposed Aluminum Polyvinylidene Fluoride Based Coating: Apply full strength polyvinylidene fluoride based coatings at the factory by coil coating for sheet material and spray coating for extruded material. Provide the following three coat system complying with the following:

1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride based finish.
2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.
3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 - 0.4 mils.
4. Apply color coat over the primer by roller coating for coil material and airless or Ransburg Elastostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440 F for a dry film thickness of 0.7 mils for coil coating and 1.2 mils for spray coating.
5. Apply clear fluoropolymer top coat to provide a dry film thickness of 0.4-0.8 mils. The entire three coat system shall have a dry film thickness of 1.6 mils minimum.
6. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to ENGINEER:
 - a. Weathering, ASTM D 659: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - b. Color Change, ASTM D 2244: No greater than 5 N.B.S units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - c. Humidity Resistance, ASTM D 2247; few scattered blisters no larger than ASTM No. 4, after 1000 hours.

- d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16 inch creep from areas scribed to bare metal after 500 hours.
- e. Dry Adhesion: No pick-off when tape tested over 1/16 inch cross hatch.
- f. Wet Adhesion: No pick-off when tape tested over 1/16 inch cross hatch; extruded material only.
- g. Boiling Water Adhesion: No pick-off when tape tested over cross hatch area after 1 hour immersion in distilled boiling water.
- h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water 80 ±10F after 500 hours.
- i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67 minimum.
- j. Gloss, ASTM D 523: 30±5 reflectivity at 60 F.
- k. Pencil Hardness: HB-H minimum.
- l. Dry Film Thickness: Primer, 0.2-0.4 mils; polyvinylidene fluoride color coat, 0.7-1.5 mils; clear top coat, 0.4-0.8 mils.
- m. Solvent Resistance: 100 Double MEK rubs minimum.
- n. Flexibility, ASTM D 1737: No cracking prior to metal fracture.
- o. Acid Resistance, ASTM D 1308: 16 hour spot test with 5% hydrochloric acid - no effect.
- p. Alkali Resistance, ASTM D 1308: 16 hour spot test with 5% sodium hydroxide - no effect.

B. Product and Manufacturer: Provide one of the following:

- 1. Kynar 500 TRI-X Fluoropon by DeSoto Incorporated.
- 2. Duranar XL by PPG Industries, Incorporated.
- 3. Or equal.

C. Aluminum and Glass Door and Frame: Metallic Dark Bronze.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the supporting structure and other elements of the substrate and conditions under which the aluminum and glass door and frame Work is to be performed and notify ENGINEER in writing of unsatisfactory tolerances which exceed specified limits in other work adjoining aluminum and glass door and frame Work, and other conditions detrimental to proper and timely completion of the Work. Do not proceed with erection until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Wherever possible, take field measurements, prior to completion of shop fabrication and finishing of aluminum and glass doors and frame. Do not delay job progress. Allow for erection tolerances corresponding with specified tolerances where final dimensions cannot be established before fabrication.

3.3 INSTALLATION

- A. Comply with manufacturers specifications and recommendations for the installation of aluminum and glass doors and frames components.
- B. Do not install component parts which are observed to be defective in any way, including warped, bowed, dented, abraided and broken members, and including glass with edge damage.
- C. Do not cut, or trim, component parts during erection, in a manner which would damage the finish, decrease the strength, or result in a visual imperfection or a failure in performance of the aluminum and glass doors and frames. Return component parts which require alteration to the shop for refabrication, if possible, or for replacement by new parts.
- D. Install component parts level, plumb, true to line and with uniform joints and reveals. Secure to structure with non-staining and non-corrosive shims, anchors, fasteners, spacers and fillers. Use erection equipment which will not mar or stain finished surfaces, and will not damage the component parts.
- E. Apply a bituminous coating of approximately 30-mil dry film thickness, or other suitable permanent separator, on concealed contact surfaces of dissimilar materials before installation, wherever there is the possibility of corrosive or electrolytic action.
- F. Anchor component parts securely in place as shown, by bolting, or other permanent mechanical attachment system, which will comply with performance requirements and permit movements which are intended or necessary. Install slip-joint linings to ensure movement as intended or necessary.
- G. Clean debris, dust and other substances from behind the aluminum window wall as it is erected, and provide temporary closures if necessary to prevent the accumulation of such substances in the void spaces behind the aluminum and glass doors and frames.
- H. Attach exterior pressure plate. Install snap covers over pressure plates.
- I. Install thermal barrier clips before installing covers.
- J. Install glass using dry glazing retainers which provide a firm but resilient clamping grip on the glass.

3.4 ADJUSTMENT AND CLEANING

- A. Maintain the aluminum and glass doors and frames in a clean condition throughout the construction period, so that they will be without any evidence of deterioration or damage, other than the effects of normal weathering, at the time of Final Acceptance. Select methods of cleaning which will promote the achievement of uniform appearance and stabilized colors and textures for materials that weather or age with exposure.
- B. Protect the aluminum and glass door and frame Work during the remainder of the construction period, including glass.
- C. Remove and replace with new material aluminum components which have been damaged, including finish, beyond successful repair, as directed by ENGINEER. Repair minor damage.
- D. Immediately before the time of Final Acceptance, clean the aluminum and glass doors and frames thoroughly, inside and out. Demonstrate proper cleaning methods to OWNER'S maintenance personnel during this final cleaning.
- E. At the completion of the Work, clean or replace adjacent work, marred by the Work of this Section.
- F. Remove all materials and debris and leave the site of the Work in clean condition.

+ + END OF SECTION + +

SECTION 08520
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all aluminum window Work.
2. The extent of the aluminum windows is shown and specified.
3. The types of aluminum window Work required includes, but is not necessarily limited to, the following:
 - a. Aluminum windows.
 - b. All accessories and fasteners.
 - c. Panning and miscellaneous materials.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed prior to the aluminum window Work.

C. Related Sections:

1. Section 08860, Glazing.

1.2 QUALITY AND ASSURANCE

A. Design Criteria: Except as otherwise shown or specified, the requirements for aluminum windows, and the terminology and standards of performance and fabrication workmanship, are those specified and recommended in AAMA 101, and the applicable general recommendations published by Architectural Aluminum Manufacturer's Association, National Association of Architectural Metal Manufacturers and Aluminum Association.

B. Source Quality Control: Provide aluminum window units produced by a single firm, capable of showing prior successful production of units similar to those required.

C. Requirements of Regulatory Agencies:

1. Performance and Testing: Except as otherwise specified, comply with the air infiltration tests, water resistance tests and applicable load tests specified in AAMA 101 for the type and classification of window unit required in each case.
2. Comply with Section 3 "Optional Performance Specifications" of AAMA 101. Provide uniform load structural test pressure of 52.5 pounds per square foot.
3. Design wind velocity at project site is 35 pounds per square foot.
 - a. Air Infiltration Test: ASTM E 283: Maximum infiltration 0.04 cubic feet per minute per linear foot of operating

- ventilator when tested at 6.24 pounds per square foot differential pressure.
- b. Water Penetration Test: ASTM E 331: No water penetration for 15 minutes when window is subjected to rate of flow of 5 gallons per hour per square foot with differential pressure across window unit of six pounds per square foot.
 - c. Wind load test: ASTM E 330: Minimum 35 pounds per square foot positive and negative load for 10 seconds. Maximum deformation of frame or sash member L/175 of span length.
 - d. Testing: Wherever manufacturer's standard window units comply with the requirements and have been tested in accordance with the specified tests, provide certification by the manufacturer of compliance with such tests; otherwise, perform the required tests through a recognized testing laboratory or agency and provide certified test results.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
1. Architectural Aluminum Manufacturer's Association (AAMA) 302.8, Specification for Aluminum Windows.
 2. AAMA 701.2, Woven Pile Weatherstrip.
 3. AAMA 101, Voluntary Specifications for Aluminum Prime Windows and Sliding Glass Doors.
 4. AAMA GS-001, Voluntary Guide Specifications for Aluminum Architectural Windows.
 5. ASTM B 221, Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.
 6. ASTM E 283, Rate of Air Leakage Through Windows.
 7. ASTM E 330, Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.
 8. ASTM E 331, Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Differential.
 9. National Association of Architectural Metal Manufacturers, Metal Finishes Manual.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of each required aluminum finish, on 12-inch long sections of extrusion shapes as required for the window units. Where color or texture of finish will vary slightly for the Work, include 2 or more sections in each sample, to show the limits of such variations. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Fabrication and installation of aluminum window units and associated components of the Work. Include wall elevations at 1/4 inch scale, typical unit elevations at 1 inch scale and full-size detail sections of every typical composite member. Show anchors, hardware and other components not included in manufacturer's standard data. Including glazing details.
 2. Copies of manufacturer's Specifications, recommendations and standard details for aluminum window units, including fabrication, finishing, hardware and other components of the Work.

Include certified test laboratory reports as necessary to show compliance with the requirements.

- C. Guarantee: Submit for approval copies of written guarantee signed by the manufacturer, installer and CONTRACTOR, agreeing to replace aluminum window units which fail in materials or workmanship within 3 years of the date of Final Acceptance. Failure of materials or workmanship shall include, but not be limited to, excessive leakage or air infiltration, excessive deflections, faulty operation of sash, deterioration of finish or metal in excess of normal weathering, and defects in hardware, weatherstripping and other components of the Work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Storage of Materials:
 - 1. Store windows in upright position off ground on dunnage.
 - 2. Protect from weather and damage.
 - 3. Store in designated areas as close as possible to point of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Extrusions: Alloy and temper, ASTM B 221, 6063-T5 and not less than 1/8-inch thickness at any location for main frame sash members and tube supports. Vertical mullions and support clips as recommended by the window manufacturer.
- B. Fasteners: Stainless steel, guaranteed by the manufacturer to be non-corrosive and compatible with the aluminum window members, trim, hardware, anchors and other components of the window units.
 - 1. Do not use exposed fasteners, except where unavoidable for the application of hardware. Match the finish of the metal surrounding the fastener, unless otherwise specified.
 - 2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise specified.
- C. Glazing Gaskets: Neoprene or EPDM.
- D. Glass and Glazing Materials: Refer to Section 08860, Glazing.
- E. Product and Manufacturer: Provide one of the following:
 - 1. TR-7100 Series F-HC55 Fixed by Traco A Three Rivers Aluminum Company.
 - 2. Or equal.

2.2 WINDOW CLASSIFICATION (GRADE)

- A. Windows: Provide window units complying with the requirements of AAMA 101, Section 3, Classification HC, Optimal Performance Class 35, and complying with the following:

1. Extruded aluminum glazing stops of 0.062-inch minimum wall thickness, except 0.050-inch minimum for snap-on type.
2. Hardware and anchors of non-magnetic stainless steel and white bronze.
3. Fabricate units with all main corners and intersections of frame and sash mitered. Provide double tubular frame with hydraulically crimped gusset corner construction. Mortise or cope secondary members to fit, and weld in place with hairline joints.
4. Provide metal thickness as required to withstand performance requirements, but not less than 0.078-inch for frame members.
5. Provide means of drainage for water and condensation which may accumulate in members of the window units.

2.4 FABRICATION AND ACCESSORIES

- A. General: Provide specified manufacturer's standard fabrication and accessories, except to the extent more specific or more stringent requirements are specified. Include complete system for assembly of components and anchorage of window units, and prepare sash for glazing.
- B. Coordination of Fabrication: Wherever possible check actual window openings in the construction Work by accurate field measurement before fabrication, and show recorded measurements before fabrication, and show recorded measurements on final Shop Drawings. However, coordinate fabrication schedule with construction progress as directed by CONTRACTOR to avoid delay of the Work. Where necessary, proceed with fabrication without field measurements, and coordinate installation tolerances to ensure proper fit of window units.
- C. Provide serrated sash for preshimmed glazing tape.
- D. Provide extruded aluminum surface applied muntins, and custom aluminum panning as shown.

2.5 ALUMINUM WINDOW FINISHES

- A. Exposed Aluminum Anodic Coating: Provide anodic coatings as specified which do not depend on dyes or impregnation processes to obtain color. Apply architectural Class I coatings using only the alloy and electrolyte to obtain specified colors. Comply with the following:
 1. Mechanically finish aluminum to provide Aluminum Association Designation - M21, buffed, bright smooth specular appearance.
 2. Chemically finish aluminum by etching to a medium matte finish, Aluminum Association Designation - C22.
 3. Desmut by bathing the aluminum in either nitric acid solution or as recommended by the coating applicator.
 4. Clean and rinse between steps as recommended by the aluminum manufacturer.
 5. Provide architectural Class I high density anodic coating, Aluminum Association Designation A42 for color coatings.
 6. Seal in deionized boiling water.

7. Anodization Tests: Prepare samples and perform tests on each rack load for ASTM B 136 and ASTM B 244, and each production shift for ASTM B 137, during the processing to show compliance with the requirements. Include suitable coupons in each rack load of production material; retain samples and carefully record the test data and area of building wall to receive the corresponding materials. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to ENGINEER:
 - a. Coating Thickness, ASTM B 244: Minimum of 0.7 mils thick.
 - b. Coating Weight: ASTM B 137: Minimum of 32 mg/sq. in.
 - c. Resistance to Staining, ASTM B 136: No stain after 5 minutes dye solution exposure.
 - d. Salt Spray, ASTM B 117: 30,000 hours exposure with no corrosion or shade change.
- B. Product and Manufacturer: Provide one of the following:
 1. Permanodic by Kaweer Architectural Products, Subsidiary of Alumax Aluminum Company, Incorporated.
 2. Duranodic by The Aluminum Company of America, Incorporated.
 3. Or equal.
- C. Provide the following colors:
 1. Aluminum Window Mullions, Muntins and Adaptors: Dark Bronze.
 2. Snap Covers and Closures: Dark Bronze.
 3. Exposed Fasteners: Color and finish to match substrate.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and conditions under which aluminum window Work is to be installed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for the installation of window units, hardware and other components of the Work.
- B. Set units plumb, level and true to line, without warp or rack of frames or sash. Anchor securely in place. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action at points of contact with other materials.
- C. Refer to Section 07920, Calking and Sealants for compounds, fillers and gaskets to be installed concurrently with window units.

3.3 ADJUSTMENT AND CLEANING

- A. Refer to Section 08860, Glazing for glass installation requirements.
- B. Clean aluminum surfaces promptly after installation of windows, exercising care to avoid damage of the finish. Remove excess glazing and sealant compounds, dirt and other substances.
- C. Advise CONTRACTOR of protective treatment and other precautions required through the remainder of the construction period, to ensure that window units will be without damage or deterioration, other than normal weathering, at the time of Final Acceptance.

+ + END OF SECTION + +

SECTION 08710
FINISH HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all finish hardware Work.
2. The extent of finish hardware Work is specified and in schedules. Finish hardware is defined to include all items known commercially as finish hardware, as required for swing doors, except special types of unique and non-matching hardware specified in the same Section as the door and door frame.
3. The types of finish hardware Work required includes, but is not necessarily limited to, the following:
 - a. Mortise hinges.
 - b. Pivot hinges.
 - c. Locksets.
 - d. Latchsets.
 - e. Panic exit devices.
 - f. Door closers.
 - g. Overhead holders and stops.
 - h. Stops.
 - i. Dust-proof strikes.
 - j. Flush bolts.
 - k. Astragals.
 - l. Silencers.
 - m. Stripping and seals.
 - n. Thresholds.
 - o. Coordinators.
 - p. Miscellaneous items.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the finish hardware Work.

C. Related Sections:

1. Section 08410, Aluminum and Glass Doors and Frames.

1.2 QUALITY ASSURANCE

- A. Supplier Qualifications: The finish hardware supplier shall have in his employ a member of the American Society of Architectural Hardware Consultants who shall be responsible for checking and supervising the complete finish hardware installation.

B. Design Criteria:

1. Where the finish, shape, size or function of a member receiving finish hardware is such as to prevent the use of, or make unsuitable the types specified, furnish similar types having as nearly as practicable the same operation.
2. If finish hardware for any location is not specified, provide finish hardware equal in design and quality to adjacent finish hardware for comparable openings.
3. Furnish finish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements, as necessary for proper installation and function.
4. Unless otherwise specified, comply with the National Builders Hardware Association, "Recommended Locations for Builders Hardware".
5. Provide statuary bronze finish hardware, or matching finish hardware as specified, for all doors and frames.

C. Requirements of Regulatory Agencies:

1. Provide finish hardware for fire-rated openings in compliance with NFPA No. 80. This requirement takes precedence over other requirements for such finish hardware.
2. Provide only finish hardware which has been tested, listed and labeled by UL for the types and sizes of doors required, and complies with the requirements of the door and door frame labels. Modify scheduled finish hardware, as required, to meet UL requirements.
3. Codes: Comply with the applicable requirements of governing authorities and codes for the types of finish hardware specified.

D. Source Quality Control: To the greatest extent possible, obtain each type of finish hardware from only one manufacturer.

E. Reference Standards: Comply with the applicable provisions and recommendations of the following except where otherwise shown or specified:

1. FS TT-S-001657, Sealing Compound - Single Component, Butyl Rubber Based, Solvent Release Type.
2. National Fire Protection Association, Standard for Fire Doors and Windows No. 80.
3. UL, Building Materials Directory.
4. UL, List of Inspected Fire Protection Equipment and Materials.
5. UL, Hardware, Automatic Flush or Surface Bolts.
6. National Builders Hardware Association, Recommended Locations for Builders Hardware.

1.3 SUBMITTALS

A. Samples: Submit for approval each item of finished hardware with specified finish.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's data for each item of finish hardware. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and

for maintenance of operating parts and exposed finishes. Wherever needed, furnish templates to fabricators of other work which is to receive finish hardware.

2. Copies of the finish hardware schedule. Include a separate key schedule, showing clearly how OWNER'S final instructions on keying of locks have been fulfilled. Finish hardware schedules are intended for coordination of the Work. Review and acceptance by ENGINEER does not relieve CONTRACTOR of his exclusive responsibility to fulfill the requirements as shown and specified.
3. Based on the finish hardware requirements specified, organize the final finish hardware schedule into "hardware sets," indicating complete designation of every item required for each door or opening. Furnish initial draft of schedule at the earliest possible date, in order to facilitate the fabrication of other work (such as aluminum frames) which may be critical in the Project construction schedule. Furnish final draft of schedule after samples, manufacturer's data sheets, coordination with Shop Drawings for other work, delivery schedules and similar information have been completed and accepted.
4. Maintenance Manual: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - a. Product names and numbers.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Complete repair, installation and parts manuals for all items.
 - d. Detailed procedures for routine maintenance and cleaning.
 - e. Detailed procedures for light repairs such as dents, scratches and staining.
5. Complete information on required maintenance tools to be furnished as recommended by the finish hardware manufacturer.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver finish hardware sufficiently in advance of its setting for proper inspection.
 2. Pack each piece of finish hardware separately, complete with screws, keying, instructions and templates, tagged to correspond with the approved finish hardware schedule.
- B. Storage of Materials:
 1. Provide secure lock-up for finish hardware stored at the site, but not yet installed.
 2. Store finish hardware in manufacturers' original packages.
- C. Handling of Materials: Control the handling and installation of finish hardware items which are not immediately replaceable, so that the completion of the Work will not be delayed by finish hardware losses, both before and after installation.

1.5 JOB CONDITIONS

- A. Scheduling: Deliver individually packaged finish hardware items at the proper time to the proper locations for installation.

1.6 SUBSTITUTIONS

- A. Do not make substitutions after ENGINEER'S approval of final finish hardware schedule.
- B. Clearly identify all proposed substitutions and provide complete comparative data with specified product at time of Shop Drawing submission.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General:
 - 1. Hand of Door: The Drawings show the swing or hand of each door leaf (left, right, reverse bevel, etc.). Furnish each item of finish hardware for proper installation and operation of the door swing as shown.
 - 2. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels.
 - 3. Base Metals: Produce finish hardware units of the basic metal and forming method specified, using the manufacturer's standard metal alloy, composition, temper and hardness. Do not substitute materials or forming methods for those specified.
 - 4. Fasteners: Manufacture finish hardware to conform to published templates, generally prepared for machine screw installation. Do not provide finish hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.
 - 5. Furnish screws for installation, with each finish hardware item. Provide Phillips flat-head screws except as otherwise specified. Finish exposed (exposed under any condition) screws to match the hardware finish or, if exposed in surfaces on other Work, to match the finish of such other Work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
 - 6. Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of finish hardware, base material or fastener.
 - 7. Provide concealed fasteners for finish hardware units which are not exposed when the door is closed, except to the extent no standard manufacturer units of the type specified are available with concealed fasteners. Do not use through bolts for installation where the bolt head or the nut on the opposite face is exposed in other Work under any condition, except where it is not possible to adequately reinforce the Work and use machine screws

or concealed fasteners of another standard type to satisfactorily avoid the use of through bolts.

8. Tools for Maintenance: Furnish a complete set of specialized tools as needed for OWNER'S continued adjustment, maintenance, removal and replacement of finish hardware.
- B. Mortise Hinges: Provide all doors with mortise hinges unless specifically scheduled as receiving pivot hinges:
1. Templates and Screws: Provide only template-produced units.
 2. Base Metal: Fabricate hinges from bronze and finish to match the latch and lock set.
 3. Number of Hinges: Except as otherwise specified, provide 2 hinges on each door leaf of less than 60-inches height; provide one additional hinge for next 30-inches of door height; provide two additional hinges for each 30-inches or fraction thereof for doors above 90-inches tall.
 4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Interior and Exterior Doors, maximum 36-inches wide: 4-1/2-inch heavy weight (0.180-inch).
 - b. Wide Exterior and Interior Doors:
 - 1) Maximum 47-inches Wide: 5-inch heavy weight (0.190-inch).
 - 2) 48-inches Wide and Over: 6-inch heavy weight (0.203-inch).
 5. Types of Hinges: Provide full-mortise type, ball-bearing hinges swaged for mortise applications, inner leaf beveled, square cornered, unless manufacturer's recommendations indicate that half-mortise, half-surface, full-surface or other type should be used for the frame and door type or condition.
 6. Hinge Pins: Except as otherwise specified, provide hinge pins as follows:
 - a. Pins: Bronze.
 - b. Exterior Doors: Non-removable pins.
 - c. Tips: Hospital tips and matching plug, finished to match leaves.
 7. Product and Manufacturer: Provide one of the following:
 - a. FBB 199H by The Stanley Works.
 - b. T4B3386H by McKinney Manufacturing Company.
 - c. Or equal.
 8. Comply with UL, List of Inspected Fire Protection Equipment and materials and NFPA No. 80 requirements.
- C. Pivot Hinges:
1. Templates and Screws: Provide only template-produced units.
 2. Base Metal: Fabricate hinges from forged bronze and finish to match the latch and lock set (US 10B).
 3. Number of Hinges: Except as otherwise specified, provide 2 hinges on each door leaf of less than 60-inches height; provide one additional hinge for next 30-inches of door height; provide two additional hinges for each 30-inches or fraction thereof for door above 90-inches tall.

4. Hinge Size: Except as otherwise specified or as required to comply with UL and NFPA, provide hinges of the following sizes:
 - a. Exterior Doors, maximum 48-inches wide: Top and bottom pivots; intermediate pivots based on number of hinges as specified.
 5. Types of Hinges: Provide offset hung, bottom, top and intermediate units with hardened steel pivot pins treated to prevent rising or binding permanently lubricated for the life of the door and capable of supporting a minimum door weight of 700 pounds recommended by the manufacturer for use on heavy-duty high traffic exterior doors subject to abuse. Provide single acting, surface-of-floor mounted units sized for a maximum door width of 4 foot-0 inches.
 6. Product and Manufacturer: Provide one of the following:
 - a. L0147 with L09AL intermediates by Dor-O-Matic Incorporated.
 - b. L147 with M19 intermediates by Rixon-Firemark Incorporated.
- D. Mortise Locks and Latch Sets:
1. Strikes: Provide manufacturer's standard wrought box strike, for each location and use shown. Provide bronze curved lip strikes, unless otherwise recommended by manufacturer, finished to match lock or latch set trim.
 2. Lock Throw: Provide minimum of 3/4-inch anti-friction latch bolt and 1-inch dead bolt throw wherever available on manufacturer's functions specified. Comply with UL requirements for throw of latchbolts and deadbolts on fire rated openings.
 3. Materials: Provide the following materials:
 - a. Latch Bolt: Stainless Steel.
 - b. Dead Bolt: Stainless Steel.
 - c. Case: Heavy gage steel with corrosion resistant finish.
 - d. Hub: Stainless steel.
 - e. Scalp: Bronze finished to match trim specified.
 - f. All components shall be of marine quality wherever possible.
 4. Backset: Provide minimum backset of 2-3/4-inches.
 5. Modify specified locks and latches to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
 6. Finish: US 10B (to match statuary bronze).
 7. Product and Manufacturer: Provide one of the following:
 - a. Heavy-Duty Mortise Lock 9700 Series 773L Design with LE2 Escutcheon (US 10B) by Corbin Division of Emhart Corporation.
 - b. Heavy-Duty Mortise Lock A7000 Series LusMo-LE (US 10B) by Russwin, Division of Emhart Corporation.
 - c. Or equal.
- E. Panic Exit Devices:
1. Strikes: Provide manufacturer's standard wrought bronze open back strikes for each location and use shown to allow independent opening and closing of each leaf of double doors with panic exit devices. Comply with UL list of Inspected Fire Protection Equipment and Materials and NFPA No. 80 requirements.
 2. Exit Doors: Where required by governing regulations or where shown or scheduled, provide panic exit devices, of the type required, including UL labels if required by governing regulations.

3. Fire Doors: Where shown or specified as a fire rated door, provide units listed and labeled by UL to comply with the rating and size of door shown.
4. Lock Throws: Provide minimum of 3/4-inch latch bolt throw.
5. Provide surface mounted vertical rod type exit device and mortise type exit devices as specified.
6. Provide the following materials:
 - a. Latch Bolt: Brass.
 - b. Case: Heavy gage chrome plated steel.
 - c. Cylinders: Bronze.
 - d. Front: Heavy gage steel.
 - e. Chassis: Brass.
 - f. Crossbar: Bronze, 0.062-inches minimum thickness, with steel reinforcing tube.
 - g. Surface Mounted Bolts: Minimum 1/2-inch diameter bronze.
7. Backset: Provide minimum backset of 2-3/4-inches.
8. Finish: US 10B Statuary Bronze, Oxidized and Fully Relieved Oil Rubbed.
9. Product and Manufacturer: Provide one of the following:
 - a. 3126½ for single doors and 3126½ x 3245U-73 for double doors 31MG Design (US 10B) by Corbin Division of Emhart Corporation.
 - b. 796½ for single doors and 796½ x U771-73 for double doors 7415 Modera (US 10B) by Russwin Division of Emhart Corporation.
 - c. Or equal.

F. Cylinders and Keying System:

1. Review the keying system with OWNER and provide the type required (master, grandmaster or greatgrandmaster). Provide a new keying system which integrates all locks at the Squaw Peak Water Treatment Plant under a single, uniform, high security, keying system.
2. Equip all locks with manufacturer's special 6-pin tumbler cylinder, with construction master key feature, which permits voiding of construction keys without cylinder removal.
3. Comply with the OWNER's instructions for masterkeying and, except as otherwise specified, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
4. Key Material: Provide keys of nickel silver only.
5. Key Quantity: Furnish 3 keys for each lock and 5 keys for each master and grandmaster system. Provide one extra key blank for each lock.
6. Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150 percent of the number of locks required for the project. Provide a hinged-panel type cabinet, for wall mounting.

G. Door Closers:

1. Provide all doors, both active and inactive, with door closers, unless otherwise specified.

2. Size of Units: Except as otherwise specified, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, and anticipated frequency of use.
3. Where parallel arms are specified, and for closers on exterior doors, provide closer unit one size larger than recommended for use with standard arms.
4. Use parallel arm arrangement for doors that would otherwise have the door closer appearing in finished corridors or entries.
5. Modify closers specified as required to comply with UL, Building Materials Directory, and List of Inspected Fire Protection Equipment and Materials, and NFPA NO. 80 for doors requiring door closures.
6. Provide hold open feature for all non-fire rated doors unless otherwise specified.
7. Select all arms to clear weatherstripping, and overhead door holders.
8. Provide long arm to allow door to swing 180 degrees where long arm will eliminate floor mounted stops and as shown.
9. Provide closers with spring power adjustment feature capable of increasing spring power 50 percent minimum in all closer sizes.
10. Provide closer with delayed closing action feature. Position valve at top of closer.
11. Provide individual regulating valves for closing and latching speeds, and separate adjustable backcheck valve.
12. Material: Provide the following materials:
 - a. Metallic Cover: Bronze US 10B.
 - b. Case: Cast iron.
 - c. Other Parts: Steel.
13. Finish: Color coordinate all arms and other accessories.
14. Product and Manufacturer: Provide one of the following:
 - a. 110 Series Door Closers by Corbin, Division of Emhart Corporation.
 - b. DA 2810 Series Door Closers by Russwin, Division of Emhart Corporation.
 - c. Or equal.

H. Holders and Stops:

1. Provide concealed overhead holders and stops on all exterior doors and as specified; with hold open feature. Comply with UL and NFPA requirements.
2. Material: Provide the following materials:
 - a. Shock Absorber Spring: Heavy tempered steel.
 - b. All other Parts: Extruded bronze.
3. Coordinate placement of overhead holder and stop with arm and bracket selection for door closers, for non-interference.
4. Two types of holders and stops are required as follows:
 - a. For all door leaves with maximum width of 3 foot-0 inches provide the following:
 - 1) Product and Manufacturer: Provide one of the following:
 - a) GJ100A Series Heavy Duty Concealed Overhead Door Holder by Glynn Johnson Corporation.
 - b) Or equal.

- b. For all door leaves wider than 3 foot-0 inches provide the following:
 - 1) Design extra heavy-duty surface mounted door holders and connections where they are fastened to other materials, to resist a superimposed load of 30 pounds per square foot acting on the plane of the doors.
 - 2) Provide extra heavy-duty units at head of each leaf which shall engage and release door automatically by roller cam action with a provision at the end of the arm to regulate the hold-open tension or place it in a neutral position.
 - 3) Provide 3/4-inch diameter steel arm, all other parts shall be cast bronze.
 - 4) Provide all manufacturer recommended door reinforcements and coordinate the furnishing of hardware templates required for the installation of the units.
 - 5) Finish: US 10B (to match statuary bronze).
 - 6) Product and Manufacturer: Provide one of the following:
 - a) GJ79HD by Glynn Johnson Corporation.
 - b) Or equal.

I. Stops:

1. All doors shall have stops. Provide wall stops for all interior doors wherever possible. Provide long arms on closers where possible in order to avoid use of floor stops.
2. Materials: Chassis with grey rubber tip.
3. Finish: US 10B (to match statuary bronze).
4. Provide concealed stainless steel fasteners as required by the substrate.
5. Product and Manufacturer: Provide one of the following:
 - a. WB60MX wall mounted concave series type series by Glynn Johnson Corporation.
 - b. Or equal.

J. Stripping and Seals:

1. Provide perimeter weather stripping at all exterior doors and as specified.
2. Continuity of Stripping: Except as otherwise specified, it is required that the stripping at each opening be continuous and without unnecessary interruptions at door corners and hardware.
3. Replaceable Seal Strips: It is required that the resilient or flexible seal strip of every unit be easily replaceable and readily available from stocks maintained by the manufacturer.
4. Provide bumper type weather stripping at jambs and head, including a resilient insert and metal retainer strip, surface-applied, of the following metal, finish and resilient bumper material:
 - a. Housing: Extruded aluminum with dark bronze anodized finish; 0.062-inch minimum thickness of main walls and flanges.
 - b. Seals: Closed cell extruded sponge neoprene.
5. Product and Manufacturer: Provide one of the following:
 - a. No. 293AV by Pemko Manufacturing Company.
 - b. No. 129VDUR by Reese Enterprises, Incorporated.
 - c. Or equal.

6. Provide automatic drop-seal sound-stripping door-bottom unit of manufacturer's standard design, with operating seal bar of the following material, retained in an extruded metal bar, and capable of operating to close a 3/4-inch gap (from door bottom to floor or threshold). House mechanism and operating bar in the following metal housing, for mounting on doors as follows:
 - a. Housing: Extruded aluminum, 0.062-inch thick, with dark bronze anodized finish on exposed surfaces.
 - b. Seal: Closed-cell sponge neoprene.
 - c. Mounting: Surface-mounted, except as otherwise indicated. Mount on stop-face of doors, except mount on hinge-face of swing-in exterior doors.
 7. Product and Manufacturer: Provide one of the following:
 - a. No. 430AS by Pemko Manufacturing Company.
 - b. No. 330 by Reese Enterprises, Incorporated.
 - c. Or equal.
- K. Astragals:
1. Provide metal astragal bar, not less than 1/8-inch by 2-inches, for exposed flat head screw mounting on active leaf of all exterior pairs of doors.
 2. Provide astragal of extruded aluminum with dark bronze anodized finish.
 3. Product and Manufacturer: Provide one of the following:
 - a. No. 357 series by Pemko Manufacturing Company.
 - b. No. 183 series by Reese Enterprises, Incorporated.
 - c. Or equal.
- L. Dust-Proof Strikes:
1. Provide dust-proof strikes which incorporate a slotted plunger raised to flush position by spring tension for all flush bolts and rod-type panic exit devices.
 2. Provide 5/8-inch inside diameter dust-proof strikes; threshold mounting.
 3. Product and Manufacturer: Provide one of the following:
 - a. DP-2 by Glynn Johnson Corporation.
 - b. Or equal.
- M. Flush Bolts:
1. Provide flush bolts on the inactive leaf of all pairs of doors, unless otherwise specified.
 2. Provide flush bolts at the top and bottom of door.
 3. Materials: Provide the following materials:
 - a. Flush Bolt Levers: Forged Brass.
 - b. Flush Bolt Plate: Forged Brass.
 - c. Flush Bolt Guide and Strike: Wrought brass.
 - d. Flush Bolt Rods: 1/2-inch round rods, bronze, 12-inches minimum length.
 - e. Bolt Head: Brass.
 4. Provide extension flush bolts with 3/4-inch throws and with top bolt not over 6-foot 0-inches above finished floor. Provide bottom flush bolt 12-inches long.

5. Product and Manufacturer: Provide one of the following:
 - a. GJFB6 Extension Flush Bolts by Glynn Johnson Corporation.
 - b. Or equal.
 6. Where required by governing authorities provide automatic flush bolts bearing and UL label.
 7. Product and Manufacturer: Provide one of the following:
 - a. GJFB7 Automatic Flush Bolts by Glynn Johnson Corporation.
 - b. Or equal.
- N. Thresholds and Cover Plates:
1. Provide thresholds on all exterior doors. Interior doors shall be provided with thresholds as scheduled.
 2. Metal: Extruded bronze.
 3. Surface Pattern: Grooved tread, manufacturer's standard.
 4. Provide countersunk bronze screws and expansion shields.
 5. Width: 5-inches wide and full width of opening.
 6. Construction:
 - a. Single-piece, complying with manufacturer's recommendations.
 - b. Double-piece, threshold to accommodate raised floor finishes.
 7. Profile: Provide manufacturer's standard unit which conforms with the minimum size and profile requirements specified.
 - a. For doors equipped with panic hardware, including floor bolts, provide profile with stop bar of proper size and shape to function as the strike plate for the floor bolts.
 8. Thickness: 1/4-inch minimum.
 9. Product and Manufacturer: Provide one of the following:
 - a. 171 and 227 with 196 by Pemko Manufacturing Company.
 - b. Or equal.
- O. Silencers:
1. Provide silencers for all non-fire rated door frames.
 2. Product and Manufacturer: Provide one of the following:
 - a. No. 3446 by Sargent and Company.
 - b. No. 33 by Russwin, Division of Emhart Corporation.
 - c. Or equal.
- P. Sealants: Provide butyl rubber sealant complying with FS TT-S-001657 for use with thresholds.
- Q. Coordinators:
1. Provide coordinator device on all pairs of doors required or specified to have automatic flush bolts, or panic exit devices. Comply with UL, List of Inspected Fire Protection Equipment and Material, and NFPA No. 80 requirements.
 2. Provide manufacturer's standard carry bar and strike on all pairs of doors equipped with coordinator. Provide manufacturer's recommended reinforcements and mounting brackets.
 3. Materials: Forged brass.
 4. Finish: US 10B (to match statuary bronze).
 5. Product and Manufacturers: Provide one of the following:
 - a. COR-65 by Glynn Johnson Corporation.
 - b. Or equal.

2.2 HARDWARE FINISHES

- A. Provide matching finishes for finish hardware units at each door or opening, to the greatest extent possible. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of finish hardware exposed at the same door or opening. In general, match all items to the manufacturer's standard finish for the latch and lock set for color and texture.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate to receive finish hardware, and ascertain the conditions under which the Work will be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the finish hardware Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Templates: Furnish finish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of finish hardware. Upon request, check the Shop Drawings of such other work, to confirm that adequate provisions are made for the proper installation of the finish hardware.

3.3 INSTALLATION

- A. Mount finish hardware units at heights recommended in, "Recommended Locations for Builders' Hardware," by National Builders Hardware Association, except as otherwise specified or required to comply with governing regulations.
- B. Install each finish hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install finish hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- D. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

- E. Cut and fit threshold and floor covers to profile of door frames, with metered corners and hair-line joints. Join units with concealed welds or concealed mechanical joints. Cut smooth openings for spindles, bolts and similar items, if any.
- F. Screw thresholds to substrate with No. 10 or larger bronze screws, of the proper type for permanent anchorage.
- G. Set thresholds in a bead of butyl rubber sealant to completely fill concealed voids and exclude moisture from every source. Do not plug drainage holes or block weeps. Remove excess sealant.

3.4 ADJUSTMENT AND CLEANING

- A. Adjust and check each operating item of finish hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with the type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application.
- B. Final Adjustment: Where finish hardware installation is made more than one month prior to Final Acceptance or occupancy of a space or area, return to the Work during the week prior to Final Acceptance or occupancy, and make a final check and adjustment of all finish hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of finish hardware and doors. Adjust door control devices to compensate for final operating of heating and ventilating equipment.
- C. Instruct OWNER'S personnel in proper adjustment and maintenance of finish hardware during the final adjustment of finish hardware.
- D. Finish hardware which is blemished or defective will be rejected even though it was set in place before defects were discovered. Remove and replace with new finish hardware. Repair all resultant damage to other work.
- E. Continued Maintenance Service: Approximately 6 months after the acceptance of finish hardware in each area, the installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and finish hardware. Consult with and instruct OWNER'S personnel in recommended additions to the maintenance procedures. Clean and lubricate operational items wherever required. Replace finish hardware items which have deteriorated or failed due to faulty design, materials or installation of finish hardware units. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the finish hardware.

3.5 SCHEDULES

- A. Scheduled items for each door are specified above. Specific lock functions and some other items requiring specific location are specified in Hardware Schedule. The listing of hardware types provided is only a general guideline for the final finish hardware schedule. CONTRACTOR shall submit a finish hardware schedule acceptable to all codes and testing agencies and complete with all required accessories and components for each door listed by door numbers shown.
- B. Hardware Schedule: In addition to specified requirements provide the following:

ADMINISTRATION BUILDING

Doors: 101-1, 108-1, 108-2, 125-1, 203-1, 303-1

7056	Ruswin
9751	Corbin

Doors: 118-1

Hardware as specified in Section 08410, Aluminum and Glass Doors and Frames.

Doors: 111-1, 112-2, 113-1, 117-1, 121-2, 121-3, 122-1, 123-1, 124-1, 124-2, 126-1, 127-1, 128-1

Panic Exit Hardware

Doors: 103-1, 104-1, 104-2, 106-1, 108-3, 109-1, 110-1, 112-1, 119-1, 120-1, 121-1, 201-1, 205-1, 208-1, 201.5-1, 202.5-1, 202.5-2, 304-1, 305-1, 307-1, 401-1, 402-1, 501-1

7045	Ruswin
9755	Corbin

Doors: 102-1, 105-1

7067	Ruswin
9749	Corbin

Doors: 114-1, 116-1, 207-1, 210-1, 308-1

7024	Ruswin
9723	Corbin

Doors: 107-1, 202-1, 206-1, 302-1, 306-1

7025	Ruswin
9710	Corbin

ADMINISTRATION BUILDING (Cont'd)

Interior Door Requiring Full Perimeter Weatherstripping and
Thresholds: 107-1, 112-1, 112-2, 121-1, 122-1, 123-1, 124-2,
126-1

CHEMICAL BUILDING

Doors: 101-1, 102-1, 102-2, 103-1, 103-2, 103-3, 103-4, 104-1,
104-2, 104-3, 104-4, 105-1, 105-2, 106-1, 106-2, 107-1, 107-2,
107-3, 107-4, 107-5

Panic Exit Hardware

Doors: 101-2

7045	Ruswin
9755	Corbin

Interior Doors Requiring Full Perimeter Weatherstripping and
Thresholds: 101-2, 103-3, 103-4, 105-2, 106-1

MAINTENANCE BUILDING

Doors: 101-1, 103-1, 104-1, 104-3, 106-1, 110-1, 115-3, 115-4

7067	Ruswin
9749	Corbin

Doors: 102-1, 105-1, 113-1

7024	Ruswin
9723	Corbin

Doors: 107-1, 108-1, 109-1

7056	Ruswin
9751	Corbin

Doors: 101-2, 103-2, 104-2, 111-1, 112-1, 115-1, 115-2, 116-1

7045	Ruswin
9755	Corbin

Doors: 110-2, 114-1

7025	Ruswin
9710	Corbin

Interior Doors Requiring Full Perimeter Weatherstripping and
Thresholds: 101-2, 103-2, 104-2, 115-1, 115-2, 116-1

+ + END OF SECTION + +

SECTION 08800

GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all glass and glazing Work.
2. The extent of glass and glazing is shown.
3. The types of glass and glazing Work required includes, but is not necessarily limited to, the following:
 - a. Clear wire glass.
 - b. Bronze tinted tempered reflective insulating glass.
 - c. Glazing sealants and tapes.
 - d. Miscellaneous glazing materials.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the glazing Work.
2. Review products specified under other Sections and coordinate the selection of those items to match the Work of this Section.

C. Related Sections:

1. Section 07920, Calking and Sealants.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: The installer of the glass and glazing materials shall be a firm with documented experience in the application of the types of glass and glazing required.

B. Manufacturer Qualifications:

1. The manufacturer of the glass and glazing materials shall be a firm with documented experience in manufacturing the types of glass specified.
2. Obtain glazing materials from manufacturers who will, if required, send a qualified technical representative to project site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.

C. Design Criteria: For glass size, type and thickness comply with the following:

1. Uniform Building Code.
2. Consumer Product Safety Commission, Part 1201, Safety Standards for Architectural Glazing Materials.
3. Glass manufacturer's recommended load tables.

- D. Requirements of Regulatory Agencies:
1. Wherever a fire-resistance classification is shown or scheduled for doors or interior stick systems, provide glass complying with the requirements established by UL and other governing authorities.
 2. Safety Glass: Comply with ANSI Z97.1, with label on each piece of glass as required.
- E. Allowable Tolerances: Provide tongless temper glass by manufacturer's special process which will insure the strictest possible tolerance; glass shall not exceed the following flatness tolerances (either face, any direction, any location except for 2-inch wide border area) based on 1/4-inch glass thickness with inversely proportionate tolerances of other thicknesses:
1. For 3-foot run: 1/8-inch bow.
 2. For 7-foot run: 1/4-inch bow.
 3. For 10-foot run: 3/8-inch bow.
- F. Source Quality Control:
1. To the greatest extent possible, provide all glass and glazing materials from one manufacturer.
 2. Manufacturers of "or equal" products shall provide the same selection of bronze tinted tempered reflective glass colors, light reflectances, shading coefficients and aesthetic effects and other features as provided by manufacturer specified.
- G. Job Mock-Up: Aesthetic effect of specified vision glass has been selected based on coating type, location, content and tint. Manufacturers of "or equal" products shall provide, for ENGINEER'S approval, full size side by side mock-ups, mounted in aluminum window system, of specified manufacturer's products as well as the "or equal" manufacturer's products in order that the exact match in aesthetic effect of the "or equal" product and the specified product may be determined by ENGINEER.
- H. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ANSI Z97.1, Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 2. ASTM D 1667, Sponge Made from Closed-Cell Polyvinylchloride, or Copolymers Thereof.
 3. Consumer Product Safety Commission, Part 1201, Safety Standard For Architectural Glazing Materials.
 4. FS-DD-G-451D, Glass, Float or Plate Sheet, Figured (Flat, For Glazing Mirrors and Other Uses).
 5. FS-DD-G-1403C, Glass, Float, Sheet, Figured, Coated (Heat Strengthened and Tempered).
 6. FS-TT-S-00227E(3), Sealing Compound, Elastomeric Type, Multi-Component (For Caulking, Sealing, and Glazing in Buildings and Other Types of Construction).
 7. Flat Glass Marketing Association (FGMA), Glazing Manual.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. 12-inch square samples of each type of glass specified. Label each sample with manufacturer's product data and intended aesthetic effect. ENGINEER'S review of samples will be for color, texture and aesthetic effect only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
 2. Insulating glass samples need not be hermetically sealed, but edge construction must be included.
 3. 12-inch long samples of each color for each type of glazing sealant or gasket exposed to view. Install sample between two strips of material similar to or representative of channel surfaces where sealant or gasket will be used, held apart to represent typical joint widths. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's specifications, and installation instructions for each type of glass, glazing sealant or compound, gasket and associated miscellaneous material required.
 2. Manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.
 3. Plan showing location of each type of glass specified and details of glazing system. Include manufacturer's recommendations for glazing.
- C. Certificates: Submit certification that all glazing materials subject to the applicable standards of the Consumer Product Safety Council, Safety Standard for Architectural Glazing Material are in compliance. The certification must be issued in conformance to procedures stated in the standard.

1.4 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Delivery of Materials: Deliver glass with manufacturer's labels intact. Do not remove labels until glass has been installed. Keep glass free from contamination by materials capable of staining glass. Deliver glazing compounds and sealants in manufacturer's unopened, labeled containers.
- B. Handling of Materials: Protect glass from edge damage at all times during handling, installation and operation of the building.

1.5 JOB CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of liquid glazing sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with glazing only when forecasted weather conditions are favorable to proper cure and development of high early bond strength. Wherever channel action is affected by ambient

temperature variations, install glazing sealants only when temperatures are in the middle third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation or compression, and bond stress will not be excessive at extremely low or high temperatures. Coordinate time schedule to avoid delay of project.

1.6 WARRANTY

- A. Reflective Coating: Submit copies of written guarantee agreeing to repair or replace glass which fails to perform as specified, including peeling and damage due to normal weather conditions or which appears to deteriorate in any other manner not clearly identified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated, for a period of ten years. Provide guarantee signed by the installer and CONTRACTOR.
- B. Insulating Glass: Submit copies of written guarantee agreeing to repair or replace glass which fails to perform as specified, including failure of the hermetic seal due to faulty manufacturing of the unit, for a period of ten years.

PART 2 - PRODUCTS

2.1 GLASS

- A. Clear Wired Glass: Provide one of the following:
 - 1. FS DD-G-451D, Type III, Class 1, Kind A (flat), Form 1, wired and polished both faces, Mesh m2, welded square mesh; 1/4-inch thick except as otherwise shown or specified.
 - 2. Product and Manufacturer: Provide the following:
 - a. Polished Plate Wire Glass by PPG Industries, Incorporated.
 - b. Or equal.
- B. Bronze Tinted Tempered Reflective Insulating Glass: Provide the following:
 - 1. Manufacturer's standard units of two sheets of 1/4-inch thick tempered plate glass, ANSI Z97.1, FS DD-G-1403C, Grade B. The outer sheet of Style III, Type 1, quality q3, Class 3 bronze tempered reflective glass and the inner sheet of Style I, Type I, quality q3, Class 1 clear tempered glass; heat-strengthened by manufacturer's standard process to achieve a flexural strength of 4-1/2 times normal glass strength. The outer and inner sheet shall be permanently and hermetically sealed together at edges with spacers and sealant, to provide a dehydrated air space 1/2-inch thick with -60 F dew point; fabricated to the sizes and shapes shown. Provide the following physical properties:
 - a. Daylight Transmittance: 13 percent.
 - b. Reflectance: Out - 17 percent, In - 48 percent.
 - c. U Factor: 0.30 Btu/Hr/sf/°F maximum.
 - d. Shading Coefficient: 0.16.
 - 2. Aesthetic Effect: Rose Cinnabar.

3. Product and Manufacturer: Provide one of the following:
 - a. Tempered Solarban 575-20(2) Bronze Twindow by PPG Industries, Incorporated.
 - b. Or equal.

2.2 GLAZING SEALANTS AND TAPES

A. General:

1. Colors: Provide black or other natural color wherever no other color is available. Wherever material is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for the application shown. Provide manufacturer's standard colors as shown or, if not shown, provide color selected by ENGINEER from manufacturer's standard colors to either blend or contrast with adjoining surfaces.
2. Hardness shown and specified is intended to indicate the general range necessary for overall performance. Consult the manufacturer's technical representative to determine the actual hardness recommended for the conditions of installation and use. Except as shown or specified, provide glazing materials within the following ranges of hardness (Shore A, fully cured, at 75 F):
 - a. 15 to 35 for elastomeric compounds and tapes used with rigid stops and frames for large glass sizes (in excess of 100 united inches). Provide material sufficiently hard to withstand exposure to abrasion and vandalism.
 - b. 25 to 50 for rubber-like curing compounds used with rigid stops and frames for medium and small glass sizes (less than 100 united inches). Provide materials sufficiently hard to withstand impact of moving sash and doors.
 - c. 35 to 60 for molded gaskets used with rigid stops and frames, depending upon strength needed for application or insertion of units.
3. Compatibility: Before purchase of the specified glazing materials, investigate compatibility with the channel surfaces, joint fillers and other materials in the glazing channel. Provide only materials and manufacturer's recommended variation of the specified materials which are known to be fully compatible with the actual installation condition, as shown by manufacturer's published data or certification.

B. Exterior One-Part Silicone Rubber Sealant:

1. Silicone rubber-based, one-part elastomeric sealant, complying with the following:
 - a. FS TT-S-001543, Type 2 (non-sag) Class A.
 - b. Provide acid-type wherever both joint faces are metal, glass, plastic or other non-porous material.
 - c. Dynamic Movement Capability, FS TTS-001543: ± 25 percent.
2. Product and Manufacturer: Provide one of the following:
 - a. Silglaze with primer by General Electric Company.
 - b. Proglaze with primer by Tremco Incorporated.
 - c. Or equal.

- C. Preformed Butyl Rubber Glazing Sealant:
 - 1. Preformed tape of polymerized butyl or mixture of butyl and polyisobutylene with inert fillers with built-in spacer of synthetic rubber, solvent-based with minimum 95 percent solids, non-sag consistency, tack-free time of 24 hours or less, paintable, non-staining, AAMA 804.1.
 - 2. Products and Manufacturers: Provide one of the following:
 - a. Polyshim Tape by Tremco Manufacturing Company.
 - b. PTI 303 Spacer Rod Tape by Protective Treatments, Incorporated.
 - c. Or equal.

2.3 MISCELLANEOUS GLAZING MATERIALS

- A. Setting Blocks: Neoprene, 70-90 durometer hardness, with proven compatibility with sealants used as recommended by the glass manufacturer.
- B. Spacers: Neoprene, 40-50 durometer hardness, with proven compatibility with sealants used as recommended by the glass manufacturer.
- C. Compressible Filler Rod: Closed-cell or waterproof-jacketed rod stock of synthetic rubber or plastic foam, proven to be compatible with sealants used, flexible and resilient, with 5-10 pounds per square inch compression strength for 25 percent deflection.
- D. Cleaners, Primers and Sealers: Type recommended by sealant, gasket and glass manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the framing and glazing channel surfaces, backing, removable stop design, and the conditions under which the glazing is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the glazing until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PERFORMANCE

- A. Watertight and airtight installation of each piece of glass is required. Each installation must withstand normal temperature changes, wind loading, impact loading (for operating sash and doors) without failure of any kind including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in the Work.
- B. Glass manufacturer's recommended glazing channel dimensions are intended to provide for necessary minimum bite on the glass, minimum edge clearance and adequate sealant thicknesses, with reasonable tolerances. CONTRACTOR is responsible for correct glass size for

each opening, within the tolerances and necessary dimensions established.

3.3 INSTALLATION

A. General:

1. Comply with combined recommendations of glass, aluminum window and frame and sealant manufacturer and other materials used in glazing, except where more stringent requirements are shown or specified, and except where manufacturer's technical representatives direct otherwise.
2. Comply with Flat Glass Marketing Association, Glazing Manual, except as shown and specified otherwise, and except as specifically recommended otherwise by the manufacturers of the glass and glazing materials.
3. Inspect each piece of glass immediately before installation, and eliminate any which have observable edge damage or face imperfections.
4. Unify appearance of each series of lights by setting each piece to match others with their predominant bow in the same direction convex to the exterior. Inspect each piece and set with pattern, draw and bow oriented in the same direction as other pieces.
5. Cut and install tinted and reflective glass as recommended in manufacturer's technical bulletin.
6. Do not attempt to cut, seam, nip or abrade glass on site which is tempered, heat strengthened, or coated.

3.4 PREPARATION FOR GLAZING

- A. Clean the glazing channel, or other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to the substrate. Remove lacquer from metal surfaces wherever elastomeric sealants are used.
- B. Apply primer or sealer to joint surfaces wherever recommended by sealant and glass manufacturer.

3.5 GLAZING

A. Tape and Sealant Glazing:

1. Cut glazing tape to length and set against permanent stops. Install horizontal strips first, extending over width of opening, before applying vertical strips. Place setting blocks at quarter points. Remove paper backing from tape. Position glass on setting blocks and press against tape for full contact.
2. Place glazing tape on free perimeter of glass. Seal butt joints of tape with joint sealant.
3. Install removable stop, avoiding displacement of tape, and exert pressure on tape for full continuous contact. Calk space above glazing tape to top of glazing stop. Tool exposed surfaces of calking compounds to provide a substantial "wash" away from the glass.
4. Clean and trim excess glazing materials from the installation, and eliminate stains and discolorations.

5. Where wedge-shaped gaskets are driven into one side of the channel to pressurize the sealant or gasket on the opposite side, provide adequate anchorage to ensure that gasket will not "walk" out when subjected to dynamic movement. Anchor gasket to stop with matching ribs, or by proven adhesives, including embedment of gasket tail in cured heel bead.
- B. Gasket Glazing: Install glass in gaskets as recommended by the glass and window manufacturer.

3.6 FIELD QUALITY CONTROL

- A. Test for water leaks. Flood the joint exposure with water directed from a 3/4-inch hose held perpendicular to wall face, 2 feet-0 inch from joint, connected to a water system with 30 pounds per square inch minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.
- B. Test approximately 5 percent of total glazing system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct tests in the presence of ENGINEER, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.
- C. Repair glazing installation at leaks or, if leakage is excessive, replace glazing sealants as directed.
- D. Wherever nature of observed leakage indicates the possibility of inadequate glazing joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints have been fully cured, followed by natural exposure through both extreme temperatures, and returned to the range of temperature in which it is feasible to conduct testing. Repair or replace Work as required and directed.

3.7 ADJUSTMENT AND CLEANING

- A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.
- B. The installer shall advise CONTRACTOR of procedures required for the protection of glass and glazing sealants and compounds during the construction period, so that they will be without deterioration or damage, other than normal weathering, at the time of OWNER'S Final Acceptance.
 1. Furnish specific instructions on the precautions and provisions required to prevent glass damage resulting from the alkaline wash from concrete surfaces and similar sources of possible damage.
- C. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass. Do not apply markers of any type to surfaces of glass.

- D. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during the construction period, including natural causes, accidents and vandalism.
- E. Maintain glass in a reasonably clean condition during construction, so that it will not be damaged by corrosive action and will not contribute (by wash-off) to the deterioration of glazing materials and other work.
- F. Wash and polish glass on both faces not more than 4 days prior to OWNER'S Final Acceptance of the Work in each area. Comply with glass manufacturer's recommendations.

+ + END OF SECTION + +

FINISHES
Division 9

SECTION 09201
FURRING AND LATHING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all furring and lathing Work. The Work also includes:
 - a. Providing openings in furring and lathing to accommodate the Work under this and other Sections and building into the furring and lathing all items such as sleeves, anchor bolts, inserts and all other items to be embedded in furring and lathing for which placement is not specifically provided under other Sections.
2. This Section specifies the furring and lathing Work for cement plaster work specified in Sections 09221, Cement Plaster.
3. The extent of furring and lathing, hereby defined to include bases for thick-coat plastering and mortar beds, and metal support systems to receive lathing and other applied sheet materials, is shown and scheduled.
4. The types of furring and lathing Work required includes, but is not necessarily limited to, the following:
 - a. Runner channel ceiling suspension systems.
 - b. Metal furring.
 - c. Metal lathing.
 - d. Accessories for thick-coat plastering.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or demolished prior to the furring and lathing Work.

C. Related Sections:

1. Section 06100, Rough Carpentry.
2. Section 09221, Cement Plaster.
3. Section 09250, Gypsum Wallboard.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide products as manufactured by one of the following:
1. United States Gypsum Company.
 2. Gold Bond Building Products, Division of National Gypsum Company.
 3. Or equal.
- B. Design Criteria: Ceiling and wall support system shall limit deflection of finished ceilings and walls to less than L/360 of span.

- C. Allowable Tolerances: For flat surfaces: do not exceed 1/4 inch in 10 feet-0 inches for bow, warp, plumb and level.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 - 1. ANSI A42.3, Lathing and Furring for Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior.
 - 2. ASTM A 90, Tests for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
 - 3. ASTM A 123, Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strip.
 - 4. ASTM A 525, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
 - 5. ASTM A 659, Specification for Steel, Carbon (0.16 maximum to 0.25 maximum, percent) Hot-Rolled Sheet and Strip, Commercial Quality.
 - 6. Metal Lath Association, Metal Lath Reinforcement for Plaster Bases Other Than Metal Lath.
 - 7. Metal Lath Association, Specifications for Metal Lathing and Furring.
 - 8. FS QQ-L-101C, Lath, Metal (And Other Metal Plaster Bases).

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's product specifications and installation instructions for each item and each system required in the Work. Include reports and other data as may be required to show compliance with these specifications.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
- B. Storage of Materials: Store metallic materials and accessories indoors, off floor.
 - 1. Remove items delivered in broken, damaged, rusted, or unlabeled condition from project site immediately.
- C. Protection of Materials: Protect metal lath, metal suspension materials, metal studs and metal accessories from dampness or wetting.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General:
 - 1. Manufacturer's Recommendations: Except where otherwise shown or specified, including the requirements of governing regulations and applicable standards, provide the type, weight, grade and finish of materials, and include for each system the clips,

- fasteners, ties, reinforcing, stiffeners, shoes, tracks, hangers, brackets, anchors, accessories and trim as recommended by the manufacturer for the application shown or specified.
2. Metal and Finishes: Provide manufacturer's standard galvanized finish on steel products as follows:
 - a. Hot-dip Galvanized Finish: ASTM A 525, G 90, for 18 gage and lighter formed metal products, ASTM A 123, galvanized after fabrication, for 16 gage and heavier products.
 - b. Exposed Plastering Accessories: Provide solid zinc alloy accessories except where fully concealed in plaster.
 3. Wire Ties: Galvanized soft steel wire, 16 gage minimum.
- B. Ceiling Suspension/Furring Materials:
1. Runner Channels: 1-1/2-inches, 0.475-pounds per foot cold-rolled or 1.12 pounds per foot hot-rolled.
 2. Cross Furring: 3/4-inch by 0.3-pounds per foot cold-rolled channel.
 3. Hangers: Wire or rod type of size to comply with ANSI A42.4.
 4. Hanger Supports: Sized for pull-out resistance of 5 times calculated hanger loading.
- C. Metal Lathing Materials:
1. General: Where not otherwise specified, comply with Metal Lath Association, Specifications for Metal Lathing and Furring, and Technical Bulletin 101, for selection of metal lath for each application specified.
 2. Product Standards: Comply with FS QQ-L-101C.
 3. Exterior Diamond Mesh Lath: 3.4-pounds per square yard; self-furring type. Manufacturer's recommended base for cement plaster stucco finish and contour plastering. Galvanized as specified.
- D. Plastering Accessories and Trim: Provide 26 gage units, G90 galvanized steel for interior use and solid zinc for exterior use of the pattern/profile as shown, or manufacturer's standard profiles where not otherwise shown, and coordinate depths with depths of plaster as specified. Include corner beads, exterior corner reinforcement wire, casing beads, joints, caps, screeds, moldings control and expansion joints and similar units as indicated, or required.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine areas to receive furring and lathing Work, including grounds and other accessories which act as grounds, or screeds, and shall notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Ceiling Anchorages: Coordinate Work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.

3.3 INSTALLATION

- A. General: Comply with manufacturer's installation instructions and recommendations. If a discrepancy exists with the Specifications, consult ENGINEER for clarification.
 - 1. Comply with Metal Lath Association, Specification for Metal Lathing and Furring, except where otherwise shown or specified.
- B. Isolation: Where lathing and metal support system abuts building structure horizontally, isolate the Work from structural movement sufficiently to prevent transfer of loading into the Work from the building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.
 - 1. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.
- C. Fixture Support Framing: Install supplementary framing, blocking and bracing where Work is shown or required to support fixtures, equipment, services, casework, heavy trim and furnishings and similar work requiring attachment and support.
- D. Wire Tying: Except as otherwise specified, tie interior furring with 16 gage wire.
- E. Splicing Members: Lap furring members 8 inches and runner channels 12 inches, and wire-tie near each end of lap. Splice plastering accessories by use of concealed splines, anchored to prevent offsets.
- F. Installation of Ceiling Suspension:
 - 1. Space runner channels 4 feet-0 inches on centers; and space hangers along channels 4 feet-0 inches on centers.
 - 2. Secure hangers to channels and to building structure only, by looping and wire tying wherever possible.
 - 3. Level runner channels to a tolerance of 1/8 inch in 12 feet-0 inches.
- G. Installation of Metal Furring:
 - 1. Space furring members 16 inches on centers, except as otherwise indicated.
- H. Installation of Metal Lathing:
 - 1. Install metal lath by wire tying, to supports or substrate in the manner shown and in accordance with industry standards.
 - 2. Install with long dimension of lath accross the supports.
 - 3. Lap sides of wire mesh not less than 1/2 inch. Lap ends not less than 1 inch. Stagger end laps, wire ties, side laps at intervals not to exceed 9 inches, lace end laps.

4. At external corners, cut and butt lath and provide continuous corner reinforcing.
 5. Provide corner reinforcing at all openings, at all edges of arch at all other exposed corners.
- I. Installation of Plastering Accessories:
1. Anchor each flange of accessories to plaster base 8 inches on centers.
 2. Miter or cope accessory corners, and install with tight joints accurately aligned.
 3. Set accessories plumb, level and true to line, with a tolerance of 1/8 inch in 10 feet-0 inches.
 4. Install casing beads at terminations of plaster work, except where plaster is shown to pass through other Work and be concealed by lapping Work, and except where special screeds, bases or frames act as casing beads including interior metal door frames. Set casing beads 1/4 inch from abutting frames and other work, for application of sealant.
 5. Install prefabricated control joints of one-piece design where shown as control joint.

3.4 CUTTING AND REPAIRING

- A. Cut, repair and align furring and lathing Work as required and as necessary to accommodate other work. Repair bent and dented surfaces. Repair or replace the Work as necessary to comply with specified tolerances.

3.5 CLEANING

- A. Remove temporary covering and whatever other provisions were made to minimize debris on other work. Repair surfaces which have been stained, marred or otherwise damaged during the furring and lathing Work. When Work is completed, remove unused materials, containers, and equipment and debris.
- B. Take adequate precautions for the protection of furring and lathing from deterioration and damage during remainder of construction period.

+ + END OF SECTION + +

SECTION 09221
CEMENT PLASTER

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all cement plaster Work. The Work also includes:
 - a. Providing openings in cement plaster to accommodate the Work under this and other Sections and building into the cement plaster all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.
2. The extent of cement plaster is shown and is specified in Section 09RFS, Room Finish Schedule.
3. The types of cement plaster Work required includes, but is not necessarily limited to, the following:
 - a. Base coat.
 - b. Scratch coat.
 - c. Finish Coat.
 - d. Miscellaneous materials.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the cement plaster Work.

C. Related Sections:

1. Section 09201, Furring and Lathing.

1.2 QUALITY ASSURANCE

- A. Design Criteria: Comply with the recommendations of the Plasterer's Manual, by the Portland Cement Association and the Uniform Building Code, except where more stringent requirements are shown or specified.
- B. Allowable Tolerances: For flat or curved surfaces, shall not exceed 1/8-inch in 8 feet for bow or warp of surface, and for plumb or level.
- C. Do not use air entraining agents, air entrained lime, or air entrained portland cement.
- D. Reference Standards: Comply with applicable provisions and the recommendations of the following, except where otherwise shown or specified.
 1. American Concrete Institute, ACI 306, Recommended Practice for Cold Weather Concreting.

2. ANSI A42.2, Portland Cement and Portland Cement-Lime Plastering, Exterior (Stucco) and Interior.
3. ASTM C 150, Portland Cement.

1.3 SUBMITTALS

- A. Shop Drawings: Submit copies of manufacturer's product specifications and installation instructions for each product, including data showing compliance with the requirements.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Except for stone aggregate, sand and water, deliver materials to the site in sealed containers or bags fully identified with manufacturer's name, brand, type, and grade.
- B. Storage of Materials: Store materials in a dry, well ventilated space, under cover and off the ground.

1.5 JOB CONDITIONS

- A. Environmental Requirements:
 1. Cold Weather Requirements: Maintain not less than 40 F temperature in areas to be plastered for a period of not less than 72 hours prior to application, during application, and thereafter.
 2. Warm Weather Requirements: Protect cement plaster work against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial. Apply and cure cement plaster as required by climatic and job conditions to prevent dryout during cure period. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.
 3. Ventilation Requirements: Provide natural or mechanical means of ventilation to properly dry interior spaces after portland cement plaster has been cured.

PART 2 - PRODUCTS

2.1 PLASTERING MATERIALS

- A. General: Except as otherwise specified, provide standard products recommended by the manufacturer for the application shown or specified, complying with ANSI A42.2, and provide either neat or ready mixed.
- B. Base Coat Cement: Provide one of the following cements, or mixtures thereof where recommended by cement manufacturer.
 1. Portland Cement: ASTM C 150, Type I.
- C. Base-Coat Lime: ASTM C 206, Type S finishing hydrated lime.
- D. Base Coat Aggregate: Sand, ANSI A42.2.

- E. Bonding Agent: Provide a special formulation of acrylic polymers and modifiers designed for use as an additive for portland cement mixes to improve adhesion and mechanical properties. Provide bonding agent for all cement plaster Work.
- F. Job Mixed Finish Coat Materials: Products recommended by the manufacturer of job mixing to produce the finish coats specified on portland cement plaster base coats.
 - 1. Cement: Waterproof white Portland cement, ASTM C 150, Type I.
 - 2. Aggregate: Natural white sand or ground white stone, graded in accordance with ANSI A42.2 except 100 percent passing the No. 8 sieve.
 - 3. Lime: ASTM C 206, Type S, special finishing hydrated lime.

2.2 PORTLAND CEMENT PLASTER MIXES

- A. General: Except as otherwise specified, comply with ANSI A42.2 for the proportioning of materials and manner of mixing the cement plaster for each required application.
- B. Scratch Coat: One sack Portland cement, 2 sacks lime, 7-1/2 cubic feet sand, 2 pounds fiber. Include hair or fiber in mix for the scratch coat on metal lath or reinforcement.
- C. Brown Coat: One sack portland cement, 2 sacks lime, 9 cubic feet sand. Include hair or fiber in mix for the brown coat on metal lath or reinforcement.
- D. Job Mixed Finish Coat: One part Portland cement, one part lime, 3 parts sand.
- E. Mix bonding agent with scratch coat, brown coat and finish coats in strict accordance with manufacturer's written instructions for all mixing and batching.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine surfaces to receive cement plaster Work, including grounds and other accessories which act as grounds or screeds, and shall notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the cement plaster Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Clean plaster bases, and substrates for direct application of portland cement plaster, removing loose material and substances which might impair the Work.

3.3 INSTALLATION OF PORTLAND CEMENT PLASTER AND STUCCO

A. General:

1. Standards: Except as otherwise shown or specified, comply with ANSI A42.2 and with the recommendations of the "Plasterer's Manual" by Portland Cement Association.
2. Do not use materials which are frozen, caked or lumpy or which are dirty or contaminated by foreign materials. Use only potable water, free from impurities which might impair the cement plaster Work; do not use water which has been used to clean tools.
3. Do not use excessive water in the mixing and application of plaster materials.
4. Sequence plastering applications with other Work and as follows:
 - a. In general, complete interior plastering prior to installation of adjoining tile work, acoustical materials and similar finishes.
5. Plaster flush with metal casing beads and other built-in metal items or accessories which act as a plaster ground, unless otherwise shown.
6. Use mechanical mixing equipment, except small applications requiring less than one bag of plastering material may be hand mixed.

B. Plaster Applications:

1. Apply 2-coat plaster over metal lath and metal reinforced substrates (scratch, brown and finish coats).
2. Plaster Thicknesses: Apply total plaster thicknesses as shown or specified. If not shown, comply with ANSI A42.2.
 - a. Apply finish coat plaster not less than 1/8-inch thick, and increase thickness as required to achieve required texture, pattern, embedment of exposed aggregate, or other finish requirements as specified.

C. Finish Coat Texture/Pattern:

1. Sand Float Plaster Finish: Float finish coat application to a uniform sand float texture. Match sample or mock-up or, if none, provide normal sand float texture as directed by ENGINEER.

D. Curing Portland Cement Plaster: Protect each coat of portland cement plaster Work from dry out for a period of 20 to 24 hours after placement or until curing operation will not damage surface, and moisture cure not less than 48 hours after time of placement. Moisture cure by maintaining in a moist condition, by frequent fog-spraying with water and by protecting from fast dry out with covering of polyethylene film or similar enclosure. Dry each coat to a uniform moisture content before installing succeeding coat, and do not install finish coat until base coat has been dried at least 5 days.

3.4 CUTTING AND PATCHING

- A. Cut, patch, repair and point-up portland cement plaster as required and as necessary to accommodate and provide acceptable substrate for other work. Repair cracks and indented surfaces. Point-up finish cement plaster surfaces around items which are built into or penetrate cement plaster surfaces. Repair or replace the Work to elimi-

nate blisters, buckles, check cracking, dry outs, efflorescence, excessive pinholes, and similar imperfections. Repair or replace the Work as necessary to comply with specified tolerances and required visual effects.

3.5 CLEANING AND PROTECTION

- A. Remove temporary covering and whatever other provisions were made to minimize spattering of cement plaster on other work. Promptly remove cement plaster from door frames, windows and other surfaces which are not to be plastered. Repair surfaces which have been stained, marred or otherwise damaged during the cement plastering Work. When cement plastering Work is completed, remove unused materials, containers, and equipment and cement plaster Work debris.
- B. Protect portland cement plaster from deterioration and damage during remainder of construction period.

+ + END OF SECTION + +

SECTION 09222

ACRYLIC STUCCO

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all acrylic stucco Work.
2. The types of acrylic stucco Work required includes, but is not necessarily limited to, the following:
 - a. A ready-mixed acrylic-based textured interior wall coating system including all additives, components, primers and ground coats and reinforcing meshes as recommended by the manufacturer for application over properly prepared gypsum wallboard, concrete unit masonry, and cement plaster.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the acrylic stucco Work.
2. Review installation procedures under other Sections and coordinate the Work to produce substrate surfaces free from contaminants incompatible with the acrylic stucco Work, and substrates acceptable to the acrylic stucco installer for completely acceptable product performance.

C. Related Sections:

1. Section 07222, Exterior Wall Insulation and Finish System.
2. Section 09RFS, Room Finish Schedule.

1.2 QUALITY ASSURANCE

- ###### A. Installer Qualifications:
- Engage a single installer regularly engaged in acrylic stucco Work, and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Engage an installer approved by the manufacturer.

B. Design Criteria:

1. Comply with the recommendations of the Plasterer's Manual, by the Portland Cement Association and the applicable Building Code, except where more stringent requirements are shown or specified.
2. In order to insure complete product compatibility and bondability of the completed acrylic stucco finish system Work, CONTRACTOR may, with the approval of ENGINEER, submit manufacturer sub-components of the acrylic stucco finish system Work which the manufacturer certifies in writing to ENGINEER, to be more appropriate to the substrate or job conditions encountered. All such approved substitutions shall be at no additional cost to OWNER.

Reinforcing mesh shall be provided without substitution as specified herein.

3. Final selection of products shall be made from manufacturer's complete selection of highest quality products at no additional expense to OWNER.
4. It is required that all interior concrete unit masonry mortar joints scheduled to receive acrylic stucco finish system shall be visually eliminated in the finished Work.

C. Allowable Tolerances:

1. Flat Surfaces: Do exceed 1/8-inch in 8 feet for bow or warp of surface, and for plumb or level.
2. Color Breaks: Do not exceed 1/8-inch in 8 feet out-of-alignment from color break lines shown on the Drawings.

D. Source Quality Control: Obtain all materials from the same manufacturer. Obtain materials only from manufacturers who will:

1. Provide the services of a qualified manufacturer's representative at the project site at the commencement of Work and during the time when the mock-up Work is being done to advise on materials, installation and finishing techniques.
2. Certify long term compatibility of all coatings with the substrates.
3. Do not use air entraining agents, air entrained lime, or air entrained portland cement.

E. Job Mock-Ups:

1. Prior to the installation of the acrylic stucco Work, but after ENGINEER'S approval of the samples of material, build a free-standing 4 foot by 6 foot sample panel of each type of complete acrylic stucco system over each substrate encountered in the Work, to show a representative installation of the complete interior acrylic stucco Work including final texture and colors. Obtain ENGINEER'S acceptance of visual qualities of the mock-ups before start of acrylic stucco Work. Retain and protect mock-ups during installation as a standard for judging completed acrylic stucco Work. Do not alter approved mock-ups. Build as many sample panels as required to obtain ENGINEER'S acceptance of the Work.
2. Acrylic stucco Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material, as required by ENGINEER.

F. Reference Standards: Comply with applicable provisions and recommendations, except as otherwise shown or specified.

1. ASTM E 84, Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Samples: Submit for approval the following:

1. Complete selection of manufacturer's standard colors and textures for selections by ENGINEER.
2. 12-inch by 12-inch samples of each color and texture selected by ENGINEER on substrate simulating each actual project substrate.
3. Each component material to be used in the Work.

4. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Manufacturer's specifications and installation instructions for each component of the acrylic stucco system.
 2. Manufacturer's complete selection of standard and custom colors and textured finish coats.
- C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.
- D. Certification: Certify that all coatings are compatible with substrates as specified.
- E. Maintenance Manual: Submit copies of bound maintenance manual for the acrylic stucco Work. Include instructions for cleaning, repair and general maintenance Work. Include manufacturer's data on all components of the acrylic stucco Work and name, address and telephone number of manufacturer, installer and local product distributor.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver materials in acrylic stucco manufacturer's original unopened packages.
 2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Formula or specification number, lot number, color and date of manufacture.
 - c. Mixing instructions, shelf life and curing time when applicable.
 3. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by ENGINEER, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to OWNER.
- B. Storage of Materials:
 1. Store materials so as to preclude the inclusion of foreign materials.
 2. Store in accordance with manufacturer's recommendations in a clean, dry, well-ventilated area.
 3. Store materials out of direct sunlight and at a temperature of not less than 40 F.
- C. Handling:
 1. Handle materials carefully to prevent inclusion of foreign materials.
 2. Do not open containers or mix components until necessary preparatory Work has been completed and installation will start immediately.
 3. Do not expose combustible or sensitive material to excessive heat or open flame.

1.5 JOB CONDITIONS

- A. Environmental Conditions:
1. Proceed with the acrylic stucco Work only when conditions will permit unrestricted use of materials and quality control of the Work being installed, complying with the Specification requirements and with the recommendations of the acrylic stucco materials manufacturer.
 2. Do not proceed with the installation of acrylic stucco until temperature and humidity conditions within the building are being, and will continue to be, maintained within final occupancy range.
 3. Proceed only when CONTRACTOR and his installer are willing to guarantee the Work as required and without additional reservations and restrictions.
- B. Scheduling: Proceed with and complete the Work only when materials, equipment and tradesmen required for the installation of the acrylic stucco system Work are at the site and have sufficient materials and resources to complete the Work in a manner which shall reveal no inconsistencies of texture, color or allowable tolerance in the finished Work greater than that which has been approved on the sample panels by ENGINEER.
- C. Protection:
1. Do not allow finish system Work to overflow or spill onto adjoining surfaces or to migrate into the voids of adjoining materials.
 2. Draw all color break lines accurately and to the tolerances specified.
 3. Protect materials against damage by construction traffic.

1.6 GUARANTEE

- A. CONTRACTOR shall execute his own written guarantee direct to OWNER warranting all acrylic stucco system Work color fast, and non-crazing, cracking or delaminating for a period of three years after the date of conditional acceptance thereof by OWNER. Imperfections, by reason of defective materials, workmanship or arrangement of the various parts shall be made good to the satisfaction of OWNER at CONTRACTOR'S expense.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Unit Masonry:
1. Concrete Unit Masonry Primer: Provide a solvent based acrylic polymer substrate hardener and sealer capable of consolidating and preventing saponification.
 2. Ground Coats: For primed concrete unit masonry provide a water based co-polymer emulsion containing quartz sands and other special fillers and requiring the addition of 20 percent by weight of portland cement, as recommended by the acrylic stucco manufacturer.

3. Ground Coat Primer: Provide manufacturer's recommended acrylic co-polymer emulsion primer with titanium dioxide, extenders and calcium carbonate and quartz fillers, as an adhesion and water-resistance-enhancing intermediary coat over the ground coat. Provide primer tinted to match finish coat.
 4. Reinforcing Mesh: Provide the following:
 - a. Alkali-resistant glass fiber symmetrically interlaced, made from twisted multi-end strands.
 - b. Glass fibers coated with a minimum of 20 grams of styrene butadine per square yard.
 - c. Product and Manufacturer: Provide the following:
 - 1) Reinforcing Mesh by STO Energy Conservation Incorporated.
- B. Gypsum Wallboard Finish System:
1. Gypsum Wallboard Primer: Provide manufacturer's recommended acrylic co-polymer emulsion primer with titanium dioxide, extenders and calcium carbonate and quartz fillers, as an adhesion and water-resistance-enhancing intermediary coat over the ground coat. Provide primer tinted to match finish coat.
- C. Textured Wall Finish: Provide a ready-mixed water-based co-polymer acrylic wall coating capable of achieving a uniform smooth stucco effect, containing marble aggregate, fine pigments and fillers. Comply with the following:
1. Particle Size: 1.0 millimeter.
 2. Color:
 - a. Complete selection of manufacturer's standard and custom colors. ENGINEER will select a maximum of 20 different colors or tones.
 - b. A maximum of two colors may be required on any walls designated in the Room Finish Schedule as receiving interior textured wall finish.
 3. Texture: Smooth stucco effect. Final exact texture to be selected by ENGINEER from manufacturer's complete selection of available smooth and uniformly straited finishes. ENGINEER will select a maximum of three textures to be used in the Work.
 4. Weather Resistance: Extremely resistant.
 5. Hardness: Very resistant to mechanical stress. Scratch and impact resistant.
 6. Flexibility: Very flexible; capable of bridging normal shrinkage cracks.
 7. Surface Burning Characteristics, ASTM E 84:
 - a. Flame Spread Rating: 20 maximum.
 - b. Fuel contributed: 0.
 - c. Smoke Development: 20 maximum.
 8. Manufacturer's of "or equal" products and systems shall provide exactly the same complete selection of standard and custom colors and textures as the manufacturer specified.
 9. Product and Manufacturer: Provide the following:
 - a. STOLIT K-1 by STO Energy Conservation Incorporated.
- D. Miscellaneous Materials:
1. Water: Free from injurious amounts of impurities and potable.
 2. Portland Cement: ASTM C 150, Type I.

2.2 MIXES

- A. Stir co-polymer based adhesive, ground coat and leveler following manufacturer's written instructions, prior to the addition of Type I portland cement.
- B. Anti-freeze, acclerators and rapid binders shall not be approved.
- C. Primer: Mix thoroughly with 10 percent by weight of clean water.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates to receive acrylic stucco system Work, and the conditions under which the Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the acrylic stucco Work. Do not proceed with the acrylic stucco Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Prime all gypsum wallboard and concrete unit masonry with primer specified and coordinate finishing of gypsum wallboard as required by acrylic stucco system manufacturer.
- B. Tint primer to match finish color of wall following manufacturer's written instructions.

3.3 INSTALLATION

- A. Gypsum Wallboard:
 - 1. Using a clean rust free high speed mixer, thoroughly stir finish to a uniform consistency (small amounts of clean water may be added to aid workability).
 - 2. After primer has dried apply acrylic stucco by either spraying, rolling or troweling, or a combination of the above, as required to achieve the approved color and texture.
 - a. Apply finish in a continuous application always working to a wet edge.
 - 3. Finish may be applied over calk joints, but not over expansion joints.
 - 4. Apply finish coats following manufacturer's printed instructions.
- B. Primed Concrete Unit Masonry:
 - 1. Level specified ground coat and embed standard reinforcing mesh into the wet ground coat.
 - 2. Overlap mesh seams a minimum of 2-1/2-inches and smooth surface with a large stainless steel trowel. Allow to dry 24 hours.
 - 3. Apply ground coat primer, tinted to match the finish coat, over the entire surface receiving the finish coat at the rate of approximately 0.05-0.06 pounds per square foot or more as

required to visually eliminate all concrete unit masonry mortar joints. Let dry thoroughly before applying finish coat.

4. Apply finish coat to provide colors and textures approved by ENGINEER using a clean plastic trowel following manufacturer's written instructions and as specified in 3.3.A. above.

3.4 ADJUSTMENT, CUTTING AND PATCHING

- A. Cut, patch, and repair acrylic stucco finish coat Work as required and as necessary to accommodate and provide acceptable substrate for other work. Repair cracks and indented surfaces. Point-up finish surfaces around items which are built into or penetrate the gypsum wallboard system Work.
- B. Repair or replace the Work to eliminate blisters, buckles, check cracking, dry outs, excessive pinholes, and similar imperfections. Repair or replace the Work as necessary to comply with specified tolerances and required visual effects.
- C. Protect acrylic stucco system Work so as to be clean and undamaged at the time of Final Acceptance.
- D. ENGINEER may require additional finish coats if, in the opinion of ENGINEER, the finish is inconsistent in color, texture, or has holidays, areas of unusual porosity or other imperfections.
- E. Only the installer shall repair or replace deteriorated or defective Work.
- F. Clean the acrylic stucco finish system Work as recommended by the manufacturer.

3.5 CLEANING AND PROTECTION

- A. Remove temporary covering and whatever other provisions were made to minimize spattering of ground, primer and finish coats on other work. Promptly remove primer and finish coats from surfaces which are not to be finished as part of the Work of this Section. Repair surfaces which have been stained, marred or otherwise damaged during the acrylic stucco finish system Work. When acrylic stucco finish system Work is completed, remove unused materials, containers, and equipment and other debris caused by the Work of this Section.
- B. Protect acrylic stucco system Work from deterioration and damage during remainder of construction period.

+ + END OF SECTION + +

SECTION 09250
GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all gypsum wallboard Work. The Work also includes:
 - a. Providing openings in gypsum wallboard to accommodate the Work under this and other Sections and building into the gypsum wallboard all items such as sleeves, anchor bolts, inserts and all other items to be embedded in gypsum wallboard for which placement is not specifically provided under other Sections.
2. The extent of the gypsum wallboard systems is shown and is hereby defined to include walls, columns and ceilings finished with gypsum wallboard manufactured for direct application of decorative finishes, including a joint treatment system known as drywall finishing and other drywall trim systems.
3. The types of gypsum wallboard Work required includes, but is not necessarily limited to, the following:
 - a. Ceiling suspension systems for gypsum wallboard.
 - b. Metal stud systems for interior Work only.
 - c. Metal furring for gypsum wallboard Work.
 - d. Drywall system face-type gypsum wallboard Work.
 - e. Gypsum backing boards for gypsum wallboard facing or other finish.
 - f. Trim and accessories which are installed prior to or concurrent with gypsum wallboard.
 - g. Vapor barrier and accessory materials.
 - h. Joint reinforcement and finish treatment with compounds.
 - i. Partial treatment for the restriction of air or smoke passage through joints.

B. Coordination:

1. Review installation and demolition procedures under other Sections and coordinate the installation and demolition of items that must be installed or demolished with or prior to the gypsum wallboard Work.

C. Related Sections:

1. Section 07210, Building Insulation.
2. Section 09291, Glass Fiber Cement Wallboard.
3. Section 09310, Ceramic Tile.
4. Section 09513, Suspended Metal Ceilings.
5. Section 09951, Vinyl Wallcovering.
6. Section 09900, Painting.

1.2 QUALITY ASSURANCE

- A. Manufacturer: Provide products as manufactured by one of the following:
1. United States Gypsum Company.
 2. Gold Bond Building Products, Division of National Gypsum Company.
 3. Or equal.
- B. Requirements of Regulatory Agencies: Wherever a fire-resistance classification is shown or scheduled which includes gypsum wallboard (3-hour, 2-hour, 15-minute and similar designations), provide components complying with the applicable requirements of materials and installation established by UL, and other governing authorities.
- C. Source Quality Control: Obtain all gypsum wallboard materials and system components from a single manufacturer.
- D. Allowable Tolerances and Design Criteria:
1. 1/8 inch offsets between planes of board faces, and 1/4 inch in 12 feet for plumb, level, warp and bow.
 2. Deflection:
 - a. Suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles and gypsum wallboard: maximum deflection L/360 of the span.
 - b. Deflection Test: ASTM C 635.
 3. Limiting heights for each individual wall assembly shall not permit an allowable deflection in excess of L/240 when subjected to a 5 pound per square foot uniform load perpendicular to partition or furring. Provide mid-height bracing for all walls exceeding 12 foot-0 inches.
 4. Provide gypsum wallboard partitions full height to underside of structural decks unless specifically shown, or scheduled as discontinuing before reaching underside of structural decks.
 5. Provide sound transmission coefficient of 55 for all gypsum wallboard Work.
 6. Gypsum wallboard partition systems are shown and scheduled to establish design intention only. Where a fire resistance rating is shown or scheduled for gypsum wallboard systems provide such systems according to UL Test Reports, and manufacturer's recommended minimum assemblies to meet loading, deflection and sound transmittance criteria specified.
 7. Fire resistance ratings shown or scheduled shall be considered as minimum requirements. Where UL Test Reports list greater fire resistance ratings for the assembly specified, provide specified assembly.
- E. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ANSI A42.4, Interior Lathing and Furring.
 2. ASTM C 36, Gypsum Wallboard.
 3. ASTM C 171, Sheet Materials for Curing Concrete.
 4. ASTM C 635, Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 5. ASTM C 475, Joint Treatment for Gypsum Wallboard Construction.
 6. ASTM C 630, Water-Resistant Gypsum Backing Board.

7. ASTM C 645, Non-Load (Axial) Bearing Steel Studs, Runners (Track, and Rigid Furring Channels for Screw Application of Gypsum Board.
8. Gypsum Association, GA-203, Installation of Furring Members.
9. Gypsum Association, GA-216, Application and Finishing of Gypsum Board.
10. UL, Fire Resistance Directory.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's product specifications and installation instructions for each gypsum drywall system required. Other data as may be required to show compliance with these specifications.
 2. Show location and extent of each product system. Indicate construction of each gypsum wallboard partition, soffit and ceiling.
 3. Certification that all materials meet specified tests and standards.
 4. Where fire resistance ratings are shown or scheduled provide UL test data and Design Numbers of systems for each area and condition encountered in the Work.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver materials to the project site with manufacturer's labels intact and legible.
 2. Deliver fire-rated materials bearing testing agency label and required fire classification numbers.
- B. Storage of Materials:
1. Store materials inside under cover, stack flat, off floor.
 2. Stack wallboard so that long lengths are not over short lengths.
 3. Avoid overloading floor system.
 4. Store adhesives in dry area and provide protection against freezing at all times.

1.5 JOB CONDITIONS

- A. Environmental Requirements:
1. Temperature: During cold weather, in areas receiving wallboard installation, maintain temperature range between 55 F to 70 F for 24 hours before, during and after gypsum wallboard and joint treatment application.
 2. Ventilation:
 - a. Provide ventilation during and following adhesives and joint treatment applications.
 - b. Use temporary air circulators in enclosed areas lacking natural ventilation.
 - c. Under slow drying conditions, allow additional drying time between coats of joint treatment.
 - d. Protect installed materials from drafts during hot, dry weather.
- B. Protection: Protect adjacent surfaces against damage and stains.

PART 2 - PRODUCTS

2.1 METAL SUPPORT MATERIALS

- A. Wall/Partition/Soffit/Ceiling Support Materials:
1. Studs: Lightgauge screw-type C-shaped studs complying with ASTM C 645 of the depth indicated, 20 gage studs, zinc-coated 40 kips per square inch steel complying with ASTM C 525.
 - a. Depth of Section: 4-inches deep and 6-inches deep with 1-3/4-inch flanges, except as otherwise shown, specified, or required to comply with UL Test Reports.
 - b. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of gypsum wallboard Work at other work.
 - c. Stiffeners: 3/4-inch cold-rolled steel channels at 0.3 pounds per foot. Provide rust-inhibitive paint finish.
 - d. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system.
 - e. In fire-rated assemblies provide components in accordance with applicable UL Test Reports. Submit UL approved test data to ENGINEER for approval.
 2. Furring Members: Screw-type hat-shaped furring channels, of 25 gage zinc-coated steel; comply with ASTM C 645. Where furring is applied vertically, provide special-shaped units at external corners.
 - a. Fasteners: Type and size recommended by furring manufacturer for the substrate and application specified.
- B. Ceiling Support Materials:
1. Main Runners: 1-1/2-inch steel channels, either cold-rolled at 0.457-pounds per foot or hot-rolled at 1.12-pounds per foot. Provide rust-inhibitive paint finish.
 2. Furring Members: Screw-type hat-shaped furring channels of 25 gage zinc-coated steel; comply with ASTM C 645.
 3. Hanger Wire: Galvanized, soft-temper steel wire complying with ASTM A 641, Class 1 coating, prestretched; sized in accordance with ANSI A42.4 unless otherwise specified.
 4. Hanger Anchorages: Comply with ANSI A42.4 for precast concrete and wood inserts, clips, bolts, screws and other devices applicable to the indicated method of structural anchorage for ceiling hangers. Size devices for 3 times calculated load supported.
 5. Furring Anchorages: 16 gage galvanized wire ties, manufacturer's standard wire-type clips, bolts, nails or screws as recommended by furring manufacturer and complying with ANSI A42.4.

2.2 GYPSUM BOARD PRODUCTS

- A. Exposed Gypsum Wallboard: Comply with ASTM C 36 for exposed gypsum wallboard, hereby defined to include Work indicated for painted finish and similar forms of decoration as well as unfinished work.
1. Fire Rated Type: Provide where indicated and where required to achieve specified fire-resistance ratings.

2. Thickness:
 - a. 2 layers of 1/2-inch gypsum wallboard per side, for all types of gypsum wallboard at all locations, unless otherwise specified, scheduled or required to comply with UL Test Reports.
3. Sheet Size: 4-feet wide by maximum length available which will minimize the number of end joints in the Work.
4. Long-Edge Profile: Round edge taper.
5. Water-Resistant Type: Comply with ASTM C 630.
 - a. Tapered-Edge Profile: Where water-resistant type is shown to extend beyond the application of wall tile and receive a painted finish, provide standard taper long-edge profile.
6. Fire-Resistant and Water-Resistant Type: Comply with ASTM C 630 and FF SS-L-30D.

2.3 JOINT TREATMENT MATERIALS

- A. Joint Tapes: Perforated complying with ASTM C 475.
- B. Joint compound: ASTM C 475 ready-mixed type adhesive ready for application, type as indicated.
 1. Provide vinyl-based ready-mixed liquid compound.
 2. Provide single multiple-use compound, designed to be used for both bedding and topping.
 3. Joint compound shall be approved by, and acceptable to, the manufacturer of the gypsum wallboard.

2.4 TRIM ACCESSORIES

- A. General: Provide manufacturer's standard trim accessories of types shown or specified for gypsum wallboard Work, formed of galvanized steel unless otherwise specified, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads and L-type edge trim-beads.

2.5 MISCELLANEOUS MATERIALS

- A. Laminating Adhesive: The type and grade of adhesive or compound recommended by the gypsum wallboard manufacturer, for laminating gypsum boards together in applications as specified.
- B. Gypsum Wallboard Fasteners: Comply with GA-216, and with gypsum wallboard manufacturer's recommendations; choice is installer's option where more than one type is recommended for application specified.
 1. Screws, self-drilling, self-tapping, bugle head, for use with power driven tool.
 2. Type S-12 for sheet metal to sheet metal.
 3. Type S for single-layer wallboard to sheet metal.
- C. Acoustical Sealant: Non-shrinking, non-migrating, non-staining sealant of either non-drying or permanently-elastic type, as recommended by the gypsum wallboard manufacturer.

1. Where exposed to view, provide paintable type acoustical sealant either latex or acrylic based type, or acrylic-latex type.
- D. Sound Attenuation and Sound Attenuation Fire Blankets: See Section 07210, Building Insulation.
- E. Vapor Barrier: Provide polyethylene sheeting, 4-mils thick, complying with ASTM C 171.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates and the spaces to receive gypsum wallboard Work, and the conditions under which gypsum wallboard Work is to be installed; and shall notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Check framing for accurate spacing and alignment.
- C. Verify that spacing of installed framing does not exceed maximum allowable for thickness of gypsum wallboard to be used.
- D. Verify that frames are set for thickness of gypsum wallboard to be used.
- E. Protrusions of framing, twisted framing members, or unaligned members shall be repaired before installation of wallboard is started.

3.2 INSTALLATION OF METAL SUPPORT SYSTEMS

- A. General: Comply with ANSI A42.4 as applicable to the type of substrate and gypsum wallboard support system specified; and comply with the Gypsum Association GA-203 for installation of furring members.
 1. Do not bridge building expansion joints with support system. Frame both sides of joints with furring and other support as shown.
- B. Wall/Partition/Soffit Support Systems:
 1. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum wallboard alone. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
 2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading. Comply with details shown.
 3. Anchor ends of horizontal stiffeners where system abuts structural columns or walls.

4. Install runner tracks at floors, ceilings and structural walls and columns where gypsum wallboard stud system abuts other Work, except as otherwise shown.
5. Extend partition stud system through ceilings to the structural support or substrate above the ceiling.
6. Space studs 16 inches on centers, except as otherwise specified.
7. Fasten studs at ends of floor and ceiling runner tracks by installing a screw into both flanges at each end.
8. Secure 20 gage jamb studs to frames of openings with screws, wire-ties or welds, either directly to frames or to special frame-support brackets; and install runner track sections, for jack studs above and below openings, secured to jamb studs.
 - a. Space jamb studs same as partition studs, and screw to runner tracks above and below.
 - b. Install two 20 gage studs at each jamb of each opening over 24 inches wide, except as otherwise specified.
 - c. Install horizontal stiffeners 6 inches above and 6 inches below each opening more than 3 feet-0 inches wide, and extend 2 regular stud spaces beyond each jamb.
9. Space furring members 16 inches on centers, except as otherwise specified.
10. Install extra furring members and angle runners at terminations of gypsum wallboard Work, and at openings and where required for support of other work occurring with the gypsum wallboard Work such as wood base, wainscot and cornice moldings. Wood studs shall be permitted for attaching wood base, wainscot and cornice moldings.

C. Ceiling Support Suspension Systems:

1. Furnish and install inserts and similar devices in coordination with other Work. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
2. Secure hanger wires to structural support by wire-tying directly to structure where possible; otherwise tie to inserts, clips or other anchorage devices or fasteners as specified. Wire-tie hanger wires to main runners.
3. Space main runners 4 feet-0 inches on centers and space hangers 4 feet-0 inches along runners, except as otherwise shown.
4. Level main runners to a tolerance of 1/4 inch in 12 feet, measured both lengthwise on each runner and transversely between parallel runners.
5. Wire-tie or clip furring members to main runners and to other structural supports.
6. Space furring member 16 inches on center.
7. Install auxiliary framing at termination of gypsum wallboard Work, and at openings for air supply and lighting fixtures and similar work, as required for support of both the gypsum wallboard construction and other work indicated for support thereon. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
8. For gypsum wallboard ceilings use 4-inch lightgage screw-type C-shaped metal studs as specified, spaced 16 inches on centers capable of clear spanning between structural supports.
9. Secure gypsum wallboard 6 inches on centers to furring using galvanized Type S screws.

3.3 INSTALLATION OF GYPSUM WALLBOARD

- A. Preparations and Coordination:
1. Pre-Installation Coordination: Prior to the start of installation of gypsum wallboard, coordinate work requiring openings, chases, frames, access panels, support and similar integrated requirements, including heating and ventilating and electrical work. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
 - a. Do not proceed with gypsum wallboard installation until blocking, framing, bracing and other supports for subsequently applied work have been installed.
 - b. Do not install gypsum wallboard until thermal insulation to be concealed by board has been installed.
 - c. Do not install gypsum wallboard until vapor barrier has been installed on the warm side of all exterior perimeter wall partitions and all gypsum wallboard ceilings.
 - d. Install sound attenuation or sound attenuation fire blankets in all gypsum wallboard partitions.
- B. General Installation Requirements:
1. Standards: Comply with GA-216 unless otherwise shown or specified. Comply with requirements for indicated fire-resistance ratings.
 2. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 12 inches in alternate courses of board.
 3. Install exposed gypsum wallboard with face side out. Do not install imperfect damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.
 4. Locate either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that both tapered edge joints abut, and mill-cut or field-cut end joints abut. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.
 5. Attach gypsum wallboard to framing and blocking as required for additional support at openings and cutouts.
 6. Install gypsum wallboard on both faces of steel stud partition framing above ceilings and in similar concealed spaces, except in chase walls which are properly braced internally.
 7. Provide perimeter isolation where non-load-bearing partitions abut structural decks or ceilings, or vertical structural elements. Allow not less than 1/4 inch, nor more than 1/2 inch gap between gypsum wallboard and structure. Finish edges of face layer with J-type (semi-finishing) casing bead. Seal space between casing bead and structure with continuous acoustical sealant bead. Attach gypsum wallboard to studs not less than 1/2 inch below bottom edge of ceiling track flanges and to first stud adjacent to vertical tracks. Do not attach wallboard directly to tracks.

C. Methods of Gypsum Drywall Installation:

1. General: In addition to compliance with the standards, comply with the specific requirements indicated for each type or arrangement of gypsum wallboard system shown.
2. Multi-Layer Walls and Partitions: Install base layer of exposed type gypsum wallboard, and face layers of exposed gypsum wallboard. Apply base layers vertically, with joints of base layer over supports. Apply face layers at right angles to base layer. Provide sheet lengths which will minimize end joints in face layer.
3. Multi-Layer Ceilings: Install base layer of gypsum backing board or exposed type gypsum wallboard, at installer's option, and then face layer of exposed gypsum wallboard. Apply base layer before applications on walls and partitions, to the greatest extent possible, and apply at right-angles to support with end joints staggered over supports.
4. For both multi-layer partition and ceiling construction comply with the following:
 - a. Fasten base layer with screws.
 - b. Laminate face layers to base layer with laminating adhesive. Apply in direction which results in minimum end joints, and offset joints (both directions) with base layer joints at least 10 inches.
 - c. Brace or temporarily fasten face layer until adhesive has dried.
 - d. Supplement adhesive with permanent screw fastening of face layer, through base layer and into supports.
 - e. Comply with applicable UL Standards where fire-rated construction is shown or scheduled.

3.4 INSTALLATION OF DRYWALL TRIM ACCESSORIES

- A. General: Coordinate, and integrate where possible, the installation of trim accessories with the installation of gypsum wallboard. Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum wallboard to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions.
- B. Install 1-1/4-inch by 1-1/4-inch metal corner beads at external corners of gypsum wallboard Work.
- C. Install metal edge trim wherever edge of gypsum wallboard would otherwise be exposed or semi-exposed.
 1. Install U-type trim-beads, for joint compound, where edge is not tightly fitted to abutting Work, exposed, revealed with a sealant pocket, gasketed, or with other separation, except as otherwise indicated.
- D. Install plastic edge trim at juncture of walls and partitions with ceilings, and elsewhere as shown. Install after completion of joint treatment.

3.5 FINISHING

- A. General: Comply with manufacturer's instructions for the mixing, handling and application of materials. Machine or hand application is installer's option. Apply treatment at joints both directions, flanges of trim accessories, but not semi-finishing types, penetrations of the gypsum wallboard, electrical boxes, piping and similar work, fastener heads, surface defects and elsewhere as shown or specified. Apply in the manner which will result in each of these being concealed when applied decoration has been completed.
1. Where open joints of more than 1/16 inch occur, including edges of boards with rounded or beveled corners, prefill joint with special chemical-hardening-type bedding compound, prior to bedding of joint tape.
 2. Apply joint tape at joints between gypsum wallboards, except where a trim accessory is shown.
 3. Apply joint compound in 3 coats, not including prefill or openings in base, and sand between last 2 coats and after last coat.
- B. Base for Tile: Where gypsum wallboard is shown or scheduled as a base for thin-set ceramic tile finish, and similar rigid applied finishes, install drywall finishing in the area to receive the applied finish in accordance with the recommendations of both the manufacturer of the applied finish and the gypsum wallboard manufacturer.
- C. Base for Flexible Wall Coverings: Where gypsum wallboard is shown or scheduled as a base for the adhesive-application of flexible wall coverings, comply with manufacturer's instructions for applying joint compound and joint tape in minimum thicknesses over end-joints and cut-joints, so as to avoid a build-up of tape and compound which would telegraph through. Select topping coat for maximum strength and bond with gypsum wallboard. Refer to Section 09951, Vinyl Wallcovering.
- D. Partial Finishing: Omit gypsum wallboard finishing only where specifically shown as unfinished. Omit third topping coat of compound and omit sanding where shown for partial finish and where Work is concealed, including partition/wall/ceiling surfaces above suspended ceilings where Work is shown or specified for fire-resistance, smoke barrier, sound attenuation, air plenum or similar purposes.

3.6 ADJUSTING AND CLEANING

- A. Ridging:
1. Do not repair ridging until condition has fully developed: approximately six months after installation or one heating season.
 2. Sand ridges to reinforcing tape without cutting through tape.
 3. Fill concave areas on both sides of ridge with topping compound.
 4. After fill is dry, blend in topping compound over repaired area. Fill cracks with compound and finish smooth and flush.

5. Installer shall advise CONTRACTOR and ENGINEER of required procedures for the protection of completed gypsum wallboard finishing from damage and deterioration during the remainder of the construction period. CONTRACTOR shall provide required protection.

+ + END OF SECTION + +

SECTION 09291

GLASS FIBER CEMENT WALLBOARD

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all glass fiber cement wallboard Work. The Work also includes:
 - a. Providing openings in glass fiber cement wallboard to accommodate the Work under this and other Sections and building into the glass fiber cement wallboard all items such as sleeves, anchor bolts, inserts and all other items to be embedded in glass fiber cement wallboard for which placement is not specifically provided under other Sections.
2. The extent of the glass fiber cement wallboard systems is shown and is hereby defined to include walls finished with glass fiber cement wallboard manufactured for direct application of decorative finishes, including a joint treatment system using open mesh polymer coated glass fiber tape and thin-set mortar.
3. The types of glass fiber cement wallboard Work required includes, but is not necessarily limited to, the following:
 - a. Exterior grade glass fiber cement wallboard.
 - b. Metal stud systems for exterior perimeter wall Work.
 - c. Joint reinforcement and finish treatment with compounds.
 - d. Vapor barriers.
 - e. Miscellaneous materials, fasteners, adhesives, reinforcing meshes and accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the gypsum wallboard Work.

C. Related Sections:

1. Section 07210, Building Insulation.
2. Section 07222, Exterior Wall Insulation and Finish System.
3. Section 09250, Gypsum Wallboard.

1.2 QUALITY ASSURANCE

A. Source Quality Control:

1. Obtain all glass fiber cement wallboard materials and system components from a single manufacturer.
2. Provide each type of material obtain from only one source to minimize variations in appearance and quality.

B. Installer Qualifications: Engage a single installer regularly engaged in performing glass fiber cement wallboard Work and with experience in the installation of the types of materials required;

and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualification to ENGINEER.

- C. Allowable Tolerances and Design Criteria:
1. 1/8 inch offsets between planes of board faces, and 1/4 inch in 12 feet for plumb, level, warp and bow.
 2. Limiting heights for each individual wall assembly shall not permit an allowable deflection in excess of L/240 when subjected to a 5 pound per square foot uniform load perpendicular to partition or furring. Provide mid-height bracing for all walls exceeding 12 foot-0 inches.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM A 525, Specification for General Requirement for Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 2. ASTM C 473, Methods for Physical Testing of Gypsum Board Products and Gypsum Lath.
 3. ASTM C 645, Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
 4. ASTM C 666, Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
 5. ASTM C 947, Test Method for Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete.
 6. ASTM C 948, Test Method for Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's product specifications and installation instructions for each glass fiber cement system required. Other data as may be required to show compliance with these specifications.
 2. Show location and extent of each product system. Indicate construction of each glass fiber cement wallboard partition.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's directions.
- B. Storage of Materials:
1. Store materials inside under cover, stack flat, off floor.
 2. Stack wallboard so that long lengths are not over short lengths.
 3. Avoid overloading floor system.
 4. Store materials in dry area and provide protection against freezing at all times.

1.5 JOB CONDITIONS

A. Environmental Requirements:

1. Temperature: During cold weather, in areas receiving wallboard installation, maintain temperature range between 55 F to 70 F for 24 hours before, during and after glass fiber cement wallboard and joint treatment application.
2. Ventilation:
 - a. Provide ventilation during and following adhesives and joint treatment applications.
 - b. Use temporary air circulators in enclosed areas lacking natural ventilation.
 - c. Protect installed materials from drafts during hot, dry weather.

B. Protection: Protect adjacent surfaces against damage and stains.

PART 2 - PRODUCTS

2.1 METAL SUPPORT MATERIALS

A. Wall/Partition Materials:

1. Studs: Heavy gage screw-type C-shaped studs complying with ASTM C 645 of the depth indicated, 14 gage studs, zinc-coated as per ASTM A 525, 40 kips per square inch steel complying with ASTM C 525.
 - a. Depth of Section: 4-inches deep with 1-3/4-inch flanges.
 - b. Runners: 18 gage zinc-coated studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of glass fiber cement wallboard Work at other work.
 - c. Stiffeners: 3/4-inch cold-rolled steel channels at 0.3 pounds per foot. Provide rust-inhibitive paint finish.
2. Stud System Accessories: Provide stud manufacturer's standard clips, shoes, ties, reinforcements, fasteners and other accessories as needed for a complete stud system. Provide web stiffeners as may be required to meet field conditions.
3. Product and Manufacturer: Provide one of the following:
 - a. 40SJ14 and complimentary accessories by United States Gypsum Company/USG Industries, Incorporated.
 - b. Or equal.

2.2 GLASS FIBER CEMENT BOARD PRODUCTS

- #### A. Provide aggregated portland cement board with polymer-coated, woven glass-fiber mesh on back and front surfaces. Provide the following physical properties.
1. Flexural Strength, ASTM C 947; 1000 (pounds per square inch).
 2. Water Absorption, ASTM C 948: 10 percent by weight over 24 hour period.
 3. Nail Pull Resistance, ASTM C 473: 125 pounds using 0.4-inch head diameter.
 4. Weight, ASTM C 473: 3 pounds per square foot.

5. Freeze/Thaw Resistance, ASTM C 666: 100 cycles with no deterioration using procedure "A".
 6. Surface Burning Characteristics, ASTM E 84: 5.0.
- B. Size: 1/2-inch by 4 foot-0 inch wide by 8 foot-0 inch long.
- C. Provide edges square cut, formed smooth and reinforced as standard with the manufacturer specified.
- D. Product and Manufacturer: Provide one of the following:
1. DUROCK Exterior Cement Board by United States Gypsum Company/USG Industries, Incorporated.
 2. Or equal.

2.3 JOINT TREATMENT MATERIALS

- A. Joint Reinforcement: 2-inch wide open weave exterior tape with pressure-sensitive adhesive on one side as recommended by the exterior cement board system manufacturer.
- B. Grout: Provide a ready-to-mix grout containing dry latex polymers and recommended by the exterior cement board system manufacturer.

2.4 TRIM ACCESSORIES

- A. Accessories: Control joints and other accessories to be imbedded in exterior cement board system shall be zinc alloy as recommended by the exterior cement board system manufacturer.

2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: 1-1/4-inch Type S-12, wafer head screws with corrosion resistant finish as recommended by the exterior cement board system manufacturer.
- B. Staples: 1/2-inch crown, 3/8-inch leg as recommended by exterior cement board system manufacturer for attaching water and air infiltration barrier to back of cement board.
- C. Water and Air Infiltration Barrier:
1. Provide a vapor permeable membrane recommended by the exterior cement board system manufacturer for installation on the outside face of metal studs behind exterior cement board.
 2. Product and Manufacturer: Provide one of the following:
 - a. Tyvek Housewrap by DuPont Company Textile Fibers Department.
- D. Vapor Barrier: Provide polyethylene sheeting, 6-mils thick, complying with ASTM C 171.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates and the spaces to receive glass fiber cement wallboard Work, and the conditions under which glass fiber cement wallboard Work is to be installed; and shall notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Check framing for accurate spacing and alignment.
- C. Verify that spacing of installed framing does not exceed maximum allowable for thickness of wallboard to be used.
- D. Verify that frames are set for thickness of wallboard to be used.
- E. Protrusions of framing, twisted framing members, or unaligned members shall be repaired before installation of wallboard is started.

3.2 PREPARATION

- A. Provide structurally sound, dry substrates free of ridges and depressions finished in compliance with the installation method specified.

3.3 INSTALLATION OF METAL SUPPORT SYSTEMS

- A. Wall/Partition Support Systems:
 - 1. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar Work which cannot be adequately supported on glass fiber cement wallboard alone. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
 - 2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
 - 3. Align runners accurately according to exterior wall layout and secure to cast-in-place concrete with 5/32-inch diameter low-velocity power-driven fasteners with 1-1/2-inch minimum penetration spaced 24-inches on centers.
 - 4. Position studs vertically in runners and space no greater than 16 inches on center. Securely anchor each stud to runner with four 1/2-inch Type S-12 pan head or 5/8-inch Type S-12 low-profile head screws, two at top and two at bottom, with one screw in each flange.
 - 5. Anchor ends of horizontal stiffeners where system abuts structural columns or walls.
 - 6. Install runner tracks at floors, ceilings and structural walls and columns where glass fiber cement wallboard stud system abuts other Work.

7. Space studs 16 inches on centers, except as otherwise specified.
8. Fasten studs at ends of floor and ceiling runner tracks by installing a screw into both flanges at each end.
9. Secure 14 gage jamb studs to frames of openings with screws, wire-ties or welds, either directly to frames or to special frame-support brackets; and install runner track sections, for jack studs above and below openings, secured to jamb studs.
 - a. Space jamb studs same as partition studs, and screw to runner tracks above and below.
 - b. Install two 14 gage studs at each jamb of each opening over 24 inches wide, except as otherwise specified.
 - c. Install horizontal stiffeners 6 inches above and 6 inches below each opening more than 3 feet-0 inches wide, and extend 2 regular stud spaces beyond each jamb.
10. Install building insulation between studs as specified in Section 07210, Building Insulation.
11. Install vapor barrier full height and length of wall.

3.4 INSTALLATION OF GLASS FIBER CEMENT WALLBOARD

A. Preparations and Coordination:

1. Pre-Installation Coordination: Prior to the start of installation of glass fiber cement wallboard, coordinate work requiring openings, chases, frames, access panels, support and similar integrated requirements, including heating and ventilating and electrical work. Refer to Paragraph 1.1.B. herein for the requirements of coordination with others.
 - a. Do not proceed with glass fiber cement wallboard installation until blocking, framing, bracing and other supports for subsequently applied work have been installed.
 - b. Do not install glass fiber cement wallboard until thermal insulation to be concealed by board has been installed.
 - c. Do not install glass fiber cement wallboard until vapor barrier has been installed on the warm side of all exterior perimeter wall partitions and until water and air infiltration barrier is installed on the cold side of metal wall studs.

B. General Installation Requirements:

1. Apply cement board panels with rough side towards exterior and with ends over supports. Fit ends and edges closely, but not forced together. Stagger end joints in successive courses.
2. Fasten cement board panels to framing with specified fasteners. Drive fasteners in field of panels first, working towards ends and edges. Hold panel in firm contact with framing while driving fasteners. Space fasteners 8 inches on center maximum along framing with perimeter fasteners at least 3/8 inch from ends and edges. Drive screws so heads are flush with surface of panels, to provide firm panel contact with framing. Apply exterior tape centered over all joints and corners but not overlapped.
3. Provide perimeter isolation where non-load-bearing partitions abut structural decks or ceilings, or vertical structural elements. Allow not less than 1/4 inch, nor more than 1/2 inch gap between glass fiber cement wallboard systems and structure.

Seal space between wallboard and structure with continuous backer rod and sealant bead.

3.5 FINISHING

- A. General: Comply with manufacturer's instructions for the mixing, handling and application of materials. Machine or hand application is installer's option. Apply treatment at joints both directions, flanges of trim accessories, but not semi-finishing types, penetrations of the glass fiber cement wallboard, electrical boxes, piping and similar work, fastener heads, surface defects and elsewhere as shown or specified.

+ + END OF SECTION + +

SECTION 09310

CERAMIC TILE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all ceramic tile Work.
2. The extent of ceramic tile is shown.
3. The types of ceramic tile Work required includes, but is not necessarily limited to, the following:
 - a. Ceramic mosaic floor tile.
 - b. Ceramic stone porcelain polished wall tile.
 - c. Ceramic stone porcelain unpolished and textured stone surface floor tile.
 - d. Pregrouted glazed ceramic wall tiles.
 - e. Bond coats.
 - f. Grouts.
 - g. Marble thresholds.
 - h. Miscellaneous materials and accessories.

B. Coordination:

1. Review installation and demolition procedures and products under other Sections and coordinate the installation and demolition of items that must be installed or demolished before the ceramic tile Work.
2. Coordinate and schedule sandblasting, grinding and cementitious underlayments of substrates in order to provide substrates within the tolerances specified.
3. Coordinate required thickness of cementitious underlayments with doors, thresholds and adjacent materials in order to provide smoothly aligned transitions acceptable to ENGINEER and in compliance with governing codes.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 04100, Mortar.

1.2 QUALITY ASSURANCE

A. Design Criteria:

1. Furnish tile conforming with the Standard Grade Requirements of Tile Council of America A137.1.
2. Specified Manufacturer's written recommendations concerning layout, workmanship and installation shall be considered part of this specification.

B. Source Quality Control:

1. Provide materials obtained from only one source for each type of ceramic tile and color to minimize variations in appearance and quality.
2. Obtain all material from manufacturer's who are licensees of the Tile Council of America, Incorporated, and who agree to supply licensed products, where applicable.
3. Where manufacturer's of specific products require, provide manufacturer's recommended primers, adhesive, sealants and edging strips.
4. Manufacturer's of "or equal" material shall provide exactly the same physical properties, colors, sizes, back mounting, pregrouting and accessories as manufacturers specified.

C. Installer Qualifications:

1. Engage a single installer regularly engaged in performing ceramic tile Work and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work.
2. Submit name and qualification to ENGINEER.
3. Engage an installer who agrees to use only the highest quality installation techniques in order to provide a minimum of 95 percent average contact areas on all ceramic tile Work.

D. Installation Tolerances:

1. Limit out-of-plane variation of all ceramic tile Work to 1/4-inch in 20 feet, but provide uniform slopes to drain as shown for floor tile.
2. Limit height offsets between individual ceramic tile to 1/32-inch.
3. Limit joint width variation to 1/16-inch plus or minus in 20 feet.
4. Provide minimum average contact area of 95 percent for all Work.

E. Job Mock-Ups:

1. Prior to the installation of ceramic tile and accessories, but after ENGINEER'S approval of samples and Shop Drawings, install 4-foot square sample of each type of ceramic tile system, in areas selected by ENGINEER to show a representative installation of the Work. Obtain ENGINEER'S acceptance of visual qualities of the mock-up before start of the ceramic tile Work. Retain and protect mock-up during construction as a standard for judging completed ceramic tile Work. Do not alter mock-up.
2. Ceramic tile Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material, as required by ENGINEER.
3. Indicate to ENGINEER back buttering techniques and "laying down" techniques to be used in the Work.

F. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. Tile Council of America, Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Full size unit of each type and color of tile required but not less than 12-inch by 12-inch sample for tile of smaller size. Review will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
 2. Manufacturer's full selection of standard and custom color grout samples.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's technical information and installation instructions for all materials required.
 2. Include certifications and other data as may be required to show compliance with these Specifications.
 3. Complete dimensioned plans and elevations at 1/4 scale showing all accent stripe locations, tile fields and control joint locations and details. Show location and details of all special shapes and trim. Show modular planning to minimize ceramic tile cutting.
 4. Proposed installation specifications and details for each area of the Work based on TCA, Handbook details for Ceramic Tile Installation. Submit TCA standards indicating standards to be used for the Work.
 5. Provide a schedule of substrate materials and conditions in each area to receive the Work of this Section. Provide proposed methods of substrate preparation and underlayment requirements as required to provide permanent adhesion and cohesion of underlayments to existing substrates and to provide underlayments which meet specified requirements.
- C. Certificate:
1. Furnish Master Grade Certificate for each type of ceramic tile, signed by manufacturer and installer.
- D. Maintenance Stock:
1. At time of completing the installation, deliver stock of maintenance material to OWNER. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.
 2. Furnish an amount equal to 5.0 percent of the amount installed.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver packaged materials and store in original containers with seals unbroken and labels intact until time of use, in accordance with manufacturer's directions.
 2. Ceramic floor tile materials shall bear the Tile Council triangular hallmark.
 3. Provide identification and formula numbers on containers of setting and grouting materials produced under TCA license.

- B. Storage of Materials:
 - 1. Store only acceptable materials on project site.
 - 2. Store materials so as to preclude the possibility of contamination by foreign matter.

- C. Handling of Materials:
 - 1. Handle materials carefully to prevent inclusion of foreign materials.
 - 2. Do not open containers or mix components until necessary preparatory Work has been completed and installation will start immediately.

1.5 JOB CONDITIONS

- A. Environmental Conditions: Maintain a temperature of not less than 50 degrees F during ceramic tile installation and for 7 days after completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ceramic Mosaic Floor Tile: Provide the following:
 - 1. "Standard Grade" units, complying with ANSI A137.1, 2-inch by 2-inch square, 1/4-inch thick.
 - 2. Type: Porcelain units, with water absorption not exceeding 0.5 percent.
 - 3. Provide all-purpose edge units and factory-mount floor tile onto sheets with mesh, dot, net or other backing method.
 - 4. Special Shapes: Rounded external and round internal corners. Coved base and caps at shower curbs and locker curbs.
 - 5. Color: Two colors required for toilet, locker rooms and similar spaces as shown.
 - a. American Olean Tile Company: Jade; Panama Blue.
 - 6. Product and Manufacturer: Provide one of the following:
 - a. Master-Set Ceramic Mosaics by American Olean Tile Company.
 - b. Or equal.

- B. Ceramic Stone Porcelain Tile: Provide the following:
 - 1. Polished, unpolished and stone textured fully vitrified stone porcelain ceramic tile fired at 2300 F. with flat patterned backs and with bullnose edges and corner shapes.
 - 2. Physical Properties: Provide the following:
 - a. Water Absorption, ASTM C 373: 0.1 percent maximum.
 - b. Abrasive Wear, ASTM C 501: 155 minimum.
 - c. Breaking Strength, ASTM C 648: 420 pounds minimum.
 - d. Bond Strength, ASTM C 482: 315 pounds per square inch minimum.
 - e. Co-efficient of Friction (unpolished), ASTM C 21: .6-.7 minimum.
 - f. Facial Dimension (Range), ASTM C 499: 0.5 percent maximum.
 - g. Range of Thickness, ASTM C 499: ± 6.25 percent maximum.
 - h. Diagonal Warpage, ASTM C 485: ± 0.5 percent maximum.
 - i. Wedging, ASTM C 502: 0.66 percent maximum.

3. Size:
 - a. Floor Tile:
 - 1) Tile Field: 11-11/16-inches by 11-11/16-inches by 5/16-inch.
 - b. Wall Tile:
 - 1) Tile Field: 11-11/16-inches by 11-11/16-inches by 5/16-inch.
 - 2) Bullnose Trim: 3-3/4-inches by 7-3/4-inches by 5/16-inch.
 4. Color and Finish:
 - a. Floor Tile:
 - 1) Interior Tile Fields: C 620 Cinnamon; C633 Brickstone.
 - 2) Exterior Tile Field: C 620 Textured Stone Surface Cinnamon.
 - b. Wall Tile:
 - 1) Tile Field: C 620 Polished Cinnamon.
 - 2) Accent Band: C 790 Polished Burgundy Smoke.
 5. Product and Manufacturer: Provide the following:
 - a. Genesis by Crossville Ceramic Incorporated.
- C. Glazed Ceramic Wall Tile: Provide the following:
1. "Standard Grade" units, complying with ANSI A137.1, 4-1/4-inches by 4-1/4-inches square, 1/4-inch thick. Provide cushion edge units with bright gloss and smooth-matted finishes.
 2. Provide pregrouted sheets of 4-1/4-inches ceramic wall tiles factory assembled and grouted with manufacturer's standard silicone elastomeric material.
 3. Trim and Special Shapes: Rounded external corners, and trim shapes at head, jamb and sills of openings, of same material and finish as field tile, and as follows:
 - a. Base: Sanitary cove units.
 - b. External Corners: Bullnose shapes, with a radius of not less than 3/4 inch, unless otherwise shown.
 - c. Internal Corners: Field-buttet square, except use square corner, combination angle and stretches type cap.
 4. Colors: Two colors are required for the wall tile Work as shown.
 - a. Wall Colors:
 - 1) American Olean Tile Company: 03 Blue Mist; 14 Spring Green.
 5. Product and Manufacturer: Provide one of the following:
 - a. Redi-Set 100 Bright and Matte Series with 594 Style Soap Holder by American Olean Tile Company.
 - b. Or equal.
- D. Mortar: Provide the following:
1. Floor Tile:
 - a. Bond Coat: Latex-portland cement mortar on a cured bed.
 - b. Latex-Portland Cement Mortar: Provide a presanded portland cement mortar with latex additives complying with ANSI A118.4.
 - c. Product and Manufacturer: Provide one of the following:
 - 1) Tile-Mate 710/713 Thin-Set Mortar with Hydroment Multi-Purpose Acrylic Latex Mortar Admixture by Bostik Construction Products.
 - 2) Or equal.

2. Wall Tile:
 - a. Organic adhesive complying with ANSI A136.1, Type I, non-discoloring to silicone grout.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) AO 1700 Type 1 by American Olean Tile Company.
 - 2) Or equal.
- E. Grouts: Provide the following:
 1. For PregROUTED Ceramic Tile:
 - a. Grout: Tile manufacturer's recommended silicone adhesive waterproof and mildew resistant grout, for all job-site required joints.
 2. For All Ceramic Tile:
 - a. Provide a two component epoxy resin and hardener with mineral filler complying with ANSI A118.3.
 - b. Product and Manufacturer: Provide one of the following:
 - 1) U-Poxy/AAR-II by Bostik Construction Products.
 - 2) Or equal.
 3. Color: To be selected by ENGINEER from manufacturer's standard and custom colors. ENGINEER will select a maximum of four grout colors.
- F. Miscellaneous Materials and Accessories: Provide the following:
 1. Portland Cement: Comply with ASTM C 150, Type 1.
 2. Aggregate: Provide sand complying with ASTM C 144. Provide clean, graded sand passing a 16-mesh screen.
 3. Thresholds:
 - a. Provide sound Group "A" marble with an abrasive hardness of not less than 10.0 when tested in accordance with ASTM C 241.
 - b. Provide white marble for thresholds, where shown on the Drawings, and as scheduled.
 4. Water: Potable.
 5. Expansion Joints: Provide expansion joint materials in accordance with TCA "Handbook for Ceramic Tile Installation" Method EJ 171, and applicable ANSI installation standards. Provide terrazzo type expansion joint strips at locations where expansion joints are required.

2.2 MORTAR MIXES

- A. Follow recommendations of TCA "Handbook for Ceramic Tile Installation" specification numbers specified herein.
 1. Machine mix in approved mixer in which the quantity of water is accurately and uniformly controlled.
 2. Add only enough water to produce a workable mix allowing for maximum compaction during tamping of the mortar bed.
- B. Comply with manufacturer's instructions and specified ANSI standard for the mixing of setting mortars, grouts and other materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrate and the conditions under which mortar bed and ceramic tile Work is to be installed and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Inspect substrates to assure compliance with the applicable substrate tolerances contained in specified ANSI standards.
- C. Follow all recommendations for condition and inspection of surfaces including tolerances contained in the "General Conditions" of ANSI "Specifications for the Installation of Ceramic Tile".
- D. Installation surface shall be smooth, level and at required elevation, without more than 1/8 inch in 10 feet-0 inch variation from level and without high spots and local changes in height.

3.2 PREPARATION

- A. Prepare all substrates in accordance with ANSI A108.1.
- B. Clean substrate of all waxy or oily films and curing compounds.
- C. Provide a structurally sound, dry substrate free of ridges and depressions finished in compliance with the installation method specified.
- D. Neutralize and seal substrates in accordance with bond coat manufacturer's instructions, where required.

3.3 INSTALLATION

- A. Comply with all requirements of the Tile Council of America standard installation specifications as follows:
 - 1. F113 for all interior ceramic floor tile. In laboratory areas, installation shall include flush joint between face of tile and grout. Concave grout joints are not acceptable and shall be filled to provide joint flush with plane of ceramic tile.
 - 2. W223 and W242 for all ceramic wall tile on gypsum wallboard.
- B. Prior to setting, all ceramic stone porcelain tile shall be back buttered. All notched trowel-applied adhesives shall be laid down by lightly troweling the back buttered tile to assure a minimum average contact area of ceramic stone porcelain tile with substrate of 95 percent.
- C. Take extra care in setting the ceramic stone porcelain tile. Use glazier suction cups to press and slide each tile into place.

- D. Use of vibration to achieve maximum contact area will be permitted by ENGINEER.
- E. Handle, store, mix and apply proprietary setting and grouting materials in compliance with the manufacturer's instructions.
- F. Extend ceramic tile Work into recesses and under and behind equipment, fixtures and lockers, to form a complete covering without interruptions. Terminate Work neatly at obstructions, edges and corners without disruption of pattern or joint alignment.
- G. Accurately form intersections and returns. Perform cutting and drilling of ceramic tile without marring visible surfaces.
- H. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Cut and ground edges shall be uniform and straight without marring ceramic tile faces. Fit tile closely to electrical outlets, piping, and fixtures so that plates, collars, or covers overlap tile.
- I. Setting Beds: Provide the following:
 - 1. Latex-Portland Cement Mortar: ANSI A108.5.
 - 2. Organic Adhesive Mortar: ANSI A108.4.
 - 3. Set marble thresholds in the same type mortar as ceramic floor tile.
- J. Jointing Pattern: Provide the following:
 - 1. Lay ceramic tile in grid pattern at 90 degrees to walls and floors in color pattern shown and specified. Layout ceramic tile Work and center tile fields both directions in each space or on each wall area. Adjust to minimize tile cutting. Begin patterns where shown, provide alignments shown. Provide uniform joint widths, unless otherwise shown.
- K. Expansion and Control Joints:
 - 1. Install expansion joint in locations and in the manner recommended by the Method EJ171 of Tile Council of America, Incorporated, and as shown. Whether or not shown on the Drawings the maximum distance between exterior expansion joints shall be 12 foot-0 inches.
 - 2. Locate openings for expansion joints directly over structural joints in horizontal surfaces, where backing materials change and where ceramic tile Work abuts restraining surfaces such as perimeter walls, curbs, columns and pipes.
 - 3. Width of openings for expansion joints over structural joints shall be at least as wide as the structural joint.
 - 4. Provide expansion joints 1/4-inch wide.
- L. Grout all non-pregROUTED ceramic tile with latex-portland cement grout. Grout all field joints in pregROUTED sheets using silicone grout as recommended by specified manufacturer.
- M. Cure ceramic tile Work using materials and techniques recommended by the mortar and grout manufacturer.

- N. Do not use chipped, cracked or defaced ceramic tile.
- O. Remove grout and mortar from ceramic tile faces before it hardens on face of ceramic tile or adjoining work.
- P. Install removable divider and accent strips to the same depth as the finished ceramic floor tile system.

3.4 ADJUSTMENT AND CLEANING

- A. Cleaning:
 - 1. Clean grout and setting materials from face of ceramic tile while materials are workable. Leave ceramic tile face clean and free of all foreign matter.
 - 2. Unglazed tile may be cleaned with acid solutions only when permitted by the ceramic tile and grout manufacturer's printed instructions, but not sooner than 14 days after installation. Protect metal surfaces, cast iron and vitreous plumbing fixtures from effects of acid cleaning. Flush the surface with clean water before and after cleaning.
- B. Finished Ceramic Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbounded, or otherwise defective ceramic tile Work. Remove cracked, broken, unbounded or damaged ceramic tile Work and replace with new at no further cost to OWNER.
- C. Protection:
 - 1. When recommended by ceramic tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors.
 - 2. Protect installed ceramic tile Work with Kraft paper or other heavy covering during the construction period to prevent damage and wear. Lay board walkways on floors that are to be tracked over. Provide continuous runways of required width installed over building paper.
 - 3. Prohibit all foot and wheel traffic from using ceramic tiled floors for at least 7 days.
 - 4. Before final inspection, remove protective coverings, rinse neutral cleaner from all ceramic tile surfaces and wash all floors and walls clean.

+ + END OF SECTION + +

SECTION 09330

QUARRY TILE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all quarry tile Work.
2. The extent of quarry tile is shown. Quarry tile is defined to include unglazed, wire cut iron spot rough textured and iron spot smooth-matt textured extruded, high-fired, low water absorptive, frostproof quarry floor tile units, approved by the manufacturer for exterior above grade use for the locations shown and complying with the requirements specified herein.
3. The types of quarry tile Work required includes, but is not necessarily limited to, the following:
 - a. Exterior non-skid wire cut rough surfaced iron spot blend frostproof quarry tile.
 - b. Interior iron spot blend smooth-matt textured quarry tile.
 - c. Miscellaneous accessories and materials.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed before the quarry tile.
2. Comply with ANSI suggestions for related trade coordination presented in the foreword of ANSI, "Specifications for the Installation of Ceramic Tile".
3. Coordinate substrate finishing techniques and slope to drain requirements for the type of quarry tile installation specified and shown on the Drawings.
4. Coordinate substrate finishing with other Sections and coordinate the installation requirements of these Sections with the Work of this Section.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 03600, Grout.
3. Section 04100, Mortar.
4. Section 09310, Ceramic Tile.

1.2 QUALITY ASSURANCE

- ###### A. Installer Qualifications:
- Engage a single installer regularly engaged in performing quarry tile Work and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualification to ENGINEER.

B. Design Criteria:

1. Standards: Comply with applicable standards and recommendations of the Tile Council of America, Incorporated, except to the extent more stringent requirements are specified.
2. Provide quarry tile Work and associated materials that comply with the following minimum performance characteristics, as proven by appropriate and recognized laboratory test methods acceptable to ENGINEER for heavy commercial use.
 - a. Percentage of Water Absorption, ASTM C 373: 5 percent maximum.
 - b. Frost Resistance, ASTM C 424: Resistant.
 - c. Breaking Strength, ASTM C 648: 1,400 pounds per square inch minimum.
 - d. Compressive Strength, ANSI A137.1: 14,460 pounds per square inch minimum.
 - e. Coefficient of Thermal Expansion, ANSI A137.1: 1.72×10^{-6} per inch per degree F.
 - f. Modulus of Rupture, ANSI A137.1: 3,000 pounds per square inch minimum.
 - g. Hardness, 6 MOHS minimum.
3. Provide single-fired quarry tile fired at 2000 F.
4. Provide coefficient of friction of .75 minimum on wet leather.
5. Provide cement mortars and grouts of the type specified herein but of a brand approved or recommended by the quarry tile manufacturer, at no additional cost to OWNER.

C. Installation Tolerances:

1. Limit out-of-plane variation of the quarry tile floor to 1/4-inch in 20 feet, but provide uniform slopes to drain as shown on the Drawings.
2. Limit height offsets between individual quarry tile to 1/32-inch.
3. Limit joint width variation to 1/16-inch plus or minus in 20 feet.

D. Requirements of Regulatory Agencies: Comply with all applicable building codes and ordinances related to the installation of quarry tile Work.

E. Job Mock-Ups:

1. Prior to the installation of quarry tile and accessories, but after ENGINEER'S approval of samples and Shop Drawings, install 4-foot square sample of each type of quarry tile floor system, in areas selected by ENGINEER to show a representative installation of the Work. Obtain ENGINEER'S acceptance of visual qualities of the mock-up before start of the quarry tile Work. Retain and protect mock-up during construction as a standard for judging completed quarry tile Work. Do not alter mock-up.
2. Quarry tile Work that does not meet the standard approved on the sample areas shall be removed and replaced with new material, as required by ENGINEER.

F. Source Quality Control:

1. Provide material from only one manufacturer of quarry tile to minimize variations in appearance and quality.

2. Obtain all materials from manufacturers who are licensees of the Tile Council of America Incorporated, and who agree to supply licensed products, where applicable.
 3. Manufacturer Qualifications: Manufacturers of "or equal" material shall provide exactly the same colors, finishes, dimensions, and textures as the manufacturer specified in addition to meeting all other criteria specified herein.
- G. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ANSI A108.1, Glazed Wall Tile, Ceramic Mosaic Tile, Quarry Tile and Paver Tile Installed with Portland Cement Mortar.
 2. ANSI A108.5, Ceramic Tile Installed with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.
 3. ANSI A108.6, Ceramic Tile Installed with Chemical-Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
 4. ASTM A 82, Cold-Drawn Steel Wire for Concrete Reinforcement.
 5. ASTM A 185, Welded Steel Wire Fabric for Concrete Reinforcement.
 6. ANSI A118.3, Chemical-Resistant, Water-Cleanable Tile-Setting and Grouting-Epoxy.
 7. ANSI A118.4, Latex-Portland Cement Mortar.
 8. ASTM C 144, Aggregate for Masonry Mortar.
 9. ASTM C 150, Portland Cement.
 10. ASTM C 171, Sheet Materials for Curing Concrete.
 11. ASTM C 206, Special Finishing Hydrated Lime.
 12. ASTM C 207, Hydrated Lime for Masonry Purposes.
 13. ASTM C 648, Breaking Strength of Ceramic Tile.
 14. Tile Council of America, Incorporated, TCA 137.1, Recommended Standard Specifications for Ceramic Tile.
 15. Tile Council of America, Incorporated, Handbook for Ceramic Tile Installation.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Each specified type of quarry tile mounted on 16-inch by 16-inch hardwood boards showing color, type and class of each quarry tile required. Sample will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
 2. Manufacturer's full selection of standard and custom colored grout.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's specifications and installation instructions for all required materials. Include manufacturer's published data, indicating that each material complies with the requirements and is intended for the application shown.
 2. Copies of installers Shop Drawings showing completely dimensioned and detailed plans for quarry tile Work. Show quarry tile pattern and recommended location of all control joints, and expansion joints in substrate. Designate all special quarry tile required in the Work. Show all quarry tiles including location

of each type, color and pattern. Indicate existing work adjacent to quarry tile Work which may affect quarry tile pattern.

- C. Test Reports: Submit for approval certified laboratory test reports indicating conformance with the requirements specified.
- D. Certificates: Submit for approval the following:
 - 1. Master Grade Certificate for each type of quarry tile specified.
 - 2. Certificate stating that products licensed by the Tile Council of America, Incorporated have been supplied where applicable.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver materials in original, unopened containers bearing the manufacturer's name with standard grade labels complying with TCA 137.
 - 2. All materials shall bear the Tile Councils triangular hall mark.
 - 3. Tile shall be accompanied by a certificate and a shipping receipt from the manufacturer stating the grade of tile, the number and kinds of containers and shipping identification.
 - 4. Provide identification and formula numbers on containers of setting and grouting materials produced under TCA license.
 - 5. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by ENGINEER, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to OWNER.
- B. Storage of Materials:
 - 1. Store materials so as to preclude the possibility of contamination by foreign matter.
 - 2. Protect from freezing and water damage.
 - 3. Do not allow quarry tile to lay upon wet materials or surfaces.
- C. Handling:
 - 1. Handle materials carefully to prevent contamination.
 - 2. Do not open containers or mix components until necessary preparatory work and priming has been completed.

1.5 JOB CONDITIONS

- A. Scheduling:
 - 1. Do not set quarry tile on surfaces where other work is required to be embedded in the quarry tile Work until such other work has been installed and approved.
- B. Environmental Conditions:
 - 1. Quarry tile shall not be applied to surfaces that contain frost. Install tile only when substrate is 50 F minimum and rising. Maintain minimum temperature for curing period recommended under the appropriate ANSI standard for the substrate and setting bed specified.

2. Do not install quarry tile when temperature of the substrate is 100 F or is expected to rise above 100 F during curing period.

C. Protection:

1. Protect adjoining work from the Work of this Section.
2. In cases where acid solutions are required to clean the surface of finished Work, all exposed adjoining work shall first be covered to protect adjoining work from possible effect of the acid or its fumes.
3. Clean adjoining surfaces soiled by the quarry tile Work.
4. Replace, at no further cost to OWNER, adjoining work damaged beyond repair, in the opinion of ENGINEER, by the Work of this Section.

1.6 CERTIFICATE

- A. Provide Master Grade Certificate signed by CONTRACTOR and his installer, for each type of quarry tile, in the form adopted by the Tile Manufacturers Association.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Quarry Tile:

1. Provide quarry tile manufactured from shale and fire clays.
2. Comply with TCA 137.1, Standard Grade, Seconds are not acceptable.

B. Portland Cement: Comply with ASTM C 150, Type 1. Select color for compatibility with grout color selection made by ENGINEER.

C. Aggregate: Provide sand complying with ASTM C 144. Provide clean, graded sand passing a 16-mesh screen.

D. Waterproofing Admixture:

1. Proportion: In strict accordance with manufacturer's instructions.
2. Product and Manufacturer: Provide one of the following:
 - a. Omicron by Master Builders Company.
 - b. Hydrocide Powder by Sonneborn Building Products.

E. Latex-Portland Cement Mortar:

1. Provide a pre-sanded portland cement mortar with latex additives complying with ANSI A118.4.
2. Product and Manufacturer: Provide one of the following:
 - a. Tile-Mate/Sanded/911/963 with Tile-Mate Latex Additive by the Upco Company's Division of the Emhart Chemical Group.
 - b. Polycrete Latex Mortar by L&M-Surco Manufacturing Company.

F. Grout:

1. Provide a compound of portland cement and additives, factory-blended to decrease shrinkage and increase moisture resistance.
2. Colors: To be selected by ENGINEER to match quarry tile colors.

3. Product and Manufacturer: Provide one of the following:
 - a. Hydroment Joint Filler with Latex Additive by Upco Company, Division of the Emhart Chemical Group.
 - b. Latex Modified Floor Grout by L&M-Surco Manufacturing Company.
- G. Miscellaneous Materials:
 1. Water: Potable.
 2. Metal Lath: Galvanized expanded metal lath 3.4 pounds per square yard.
 3. Reinforcing Wire Fabric: 2-inch by 2-inch mesh, 16/16 wire complying with ASTM A 28 and ASTM A 185.
 4. Cleavage Membrane: Provide polyethylene sheeting, 4-mils thick, complying with ASTM C 171.
 5. Burlap or Cheese Cloth: As provided by installer to keep drainage layer free of mortar from mortar bed installation Work.
 6. Expansion Joints: Provide expansion joint materials in accordance with TCA, "Handbook for Ceramic Tile Installation" and applicable ANSI installation standards. Provide joints with neoprene filler between metal flanges.
 7. Metal Edge Strip: Provide bronze metal edge strip with integral provisions for anchorage to substrate for transition between quarry tile and other floor materials.
 8. Sealants: See Section 07920, Calking and Sealants.

2.2 FABRICATION

- A. Quarry Tile:
 1. Grind quarry tile on all four sides after firing.
 2. Quarry tile shall be precisely formed with uniform, straight edges and facial surfaces.
 3. Provide quarry tile with patterned backs. Do not provide dove-tail backs.
 4. Quarry Tile Color Schedule:
 - a. Exterior: 92 Salem Iron Spot Wire Cut 8-inches by 8-inches by 1/2-inch.
 - b. Interior: 92 Salem Iron Spot Smooth-Matt 8-inches by 8-inches by 1/2-inch.
 5. Product and Manufacturer: Provide the following:
 - a. Olde Towne Quarry Tiles by Summitville Tiles Incorporated.
- B. Complete selection of all special radiused, bullnosed, cove base, stair tread and riser shapes, as may be required by ENGINEER for a complete installation.

2.3 MIXES

- A. Cement Mortar:
 1. Provide one part portland cement to six parts sand.
 2. Machine mix in approved mixer in which the quantity of water is accurately and uniformly controlled.
 3. Add only enough water to produce a workable mix allowing for maximum compaction during tamping of the mortar bed.

- B. Stearate Additive: Add to mix in amount equal to not more than 3 percent of the weight of cement.
- C. Comply with manufacturer's instructions and specified ANSI standard for the mixing of setting mortars, grouts and other materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates to receive mortar bed and quarry tile and conditions under which the quarry tile Work is to be performed and notify ENGINEER in writing of unsatisfactory tolerances which exceed specified limits in other work adjoining the quarry tile Work, and other conditions detrimental to the proper and timely completion of the Work. Do not proceed with the installation of quarry tile Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Inspect substrates to assure compliance with the applicable substrate tolerances contained in specified ANSI standards.
- C. Follow all recommendations for condition and inspection of surfaces including tolerances contained in the "General Conditions" of ANSI "Specifications for the Installation of Ceramic Tile".

3.2 PREPARATION

- A. Prepare all substrates in accordance with ANSI A108.1.
- B. Clean substrate of all waxy or oily films and curing compounds.
- C. Install mortar bed and cleavage membrane in accordance with ANSI A108.1.
- D. Provide a structurally sound, dry substrate free of ridges and depressions finished in compliance with the installation method specified.
- E. Neutralize and seal substrates in accordance with bond coat manufacturer's instructions, where required.

3.3 INSTALLATION

- A. Install quarry tile complying with TCA, "Handbook for Ceramic Tile Installation" handbook method F103 for exterior quarry tile, and F111 for interior quarry tile, and in accordance with ANSI A108.5, except as otherwise specified.
- B. Extend quarry tile Work into recesses and under equipment and fixtures, to form a complete covering without interruptions except as otherwise shown. Terminate Work, neatly at obstructions, edges and corners without disruption of pattern or joint alignment.

- C. Accurately form intersections and returns. Perform cutting and drilling of quarry tile without marring visible surfaces.
- D. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight, aligned joints. Cut and ground edges shall be uniform and straight without marring tile faces. Extend quarry tile half-way under door thresholds unless otherwise shown on the Drawings. Fit quarry tile closely to electrical outlets, piping and fixtures so that plates, collars or covers overlap quarry tile.
- E. Jointing Pattern: As shown on the Drawings. Align joints when adjoining quarry tile on floor, base, and trim are the same size. Layout quarry tile Work and center tile fields both directions in each space. Adjust to minimize tile cutting. Provide uniform 3/8-inch joint.
- F. Expansion Joints:
 - 1. Install expansion joint in locations and in the manner recommended by the Tile Council of America, Incorporated, and as shown on the Drawings.
 - 2. Locate openings for expansion joints directly over structural joints in horizontal surfaces, where backing materials change and where quarry tile Work abuts restraining surfaces such as perimeter walls, curbs, columns and pipes.
 - 3. Width of openings for expansion joints over structural joints shall be at least as wide as the structural joint.
 - 4. Provide expansion joints same width as grout joints.
- G. Grout all joints with latex grout.
- H. Cure quarry tile Work using materials and techniques recommended by the mortar and grout manufacturer.
- I. Do not use chipped, cracked or defaced quarry tile.
- J. Remove grout and mortar from quarry tile faces before it hardens on face of quarry tile or adjoining work.

3.4 ADJUSTMENT AND CLEANING

- A. Prohibit all traffic from using quarry tile floors for a period of seven days after grouting is completed.
- B. Before traffic is permitted over finish quarry tile floors cover with heavy building paper.
- C. Lay board walkways on floors that are to be trucked over. Provide continuous runways of required width installed over building paper.
- D. Do not acid clean quarry tile until 10 days after installation. Soak quarry tile with water before cleaning with a saturated solution of sulfamic acid in room-temperature water.

- E. Protect all metal and enamel surfaces with petroleum jelly. Thoroughly flush quarry tile with water after acid cleaning.
- F. Remove cracked, broken, unbonded or damaged quarry tile and replace with new at no further cost to OWNER.
- G. Before final inspection, remove protective coverings and wash floors clean.

+ + END OF SECTION + +

SECTION 09410
PLASTIC MATRIX TERRAZZO

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all plastic matrix terrazzo Work.
2. The extent of plastic matrix terrazzo is specified in Schedules.
3. The types of plastic matrix terrazzo Work required includes, but is not necessarily limited to, the following:
 - a. Thin-set acrylic modified portland cement terrazzo system of colored marble aggregates, polymer binder and color pigments.
 - b. Divider, stop, control, expansion joint and similar strips.
 - c. Anchoring devices, cleaners, sealers and other miscellaneous materials and accessories for an installation complying with all National Terrazzo and Mosaic Association requirements.
 - d. Substrate grinding, sandblasting, testing, leveling and other required substrate preparation.

B. Coordination:

1. Review installation and demolition procedures and products under other sections and coordinate the installation and demolition of items that must be installed or demolished before the plastic matrix terrazzo Work.
2. Coordinate and schedule sandblasting, grinding and cementitious underlayments of substrates in order to provide substrates within the tolerances specified.
3. Coordinate required thickness of cementitious underlayments with doors, thresholds and adjacent materials in order to provide smoothly aligned transitions acceptable to ENGINEER and in compliance with governing codes.
4. Remove all chemicals, compounds and other materials from substrate which could preclude bonding of plastic matrix terrazzo.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.
2. Section 09740, Concrete Toppings.

1.2 QUALITY ASSURANCE

A. Design Criteria:

1. Plastic Matrix Terrazzo Selection: Provide plastic matrix terrazzo to match NTMA Plate No. S-183.
2. Thickness: Provide finished plastic terrazzo thickness of 3/8-inch.
3. Minimum Allowance for Thickness of Plastic Matrix Terrazzo at Localized High Points in Substrate: 1/4-inch.

- B. Codes and Standards:
 - 1. Comply with applicable specifications and recommendations of National Terrazzo and Mosaic Association, Incorporated (NTMA), as specified.
 - 2. Materials shall comply with NTMA requirements. Submit these requirements along with verification of compliance.
- C. Manufacturer's Instructions: In addition to specified requirements, comply with resin manufacturer's instructions and recommendations, including preparation of substrate, storing, mixing and applying materials, finishing, and curing of plastic matrix terrazzo Work.
- D. Installer Qualifications:
 - 1. Installer shall be a member of NTMA and be certified to perform all Work in accordance with NTMA standards.
 - 2. Engage a single installer regularly engaged in performing plastic matrix terrazzo Work and with experience in the installation of the types of materials required; and who agrees to employ only tradesmen with specific skill and experience in this type of Work.
 - 3. Submit name and qualifications to ENGINEER and a list of completed projects of the same magnitude and complexity.
- E. Allowable Tolerances:
 - 1. Prepared substrates shall be level with maximum variation not to exceed 1/4 inch in 10 feet-0 inches and shall have a finely textured surface achieved by sandblasting.
 - 2. Finished Floor Flatness: 1/4 inch in 10 feet-0 inch.
 - 3. Minimum Marble Density: 70 percent.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. Samples of each pattern and color of terrazzo required with all types of divides and similar type strips specified included on a plastic matrix sample panel, not less than 12-inches square.
 - 2. 6-inches long samples of all accessories.
 - 3. Samples will be reviewed for color, pattern, texture and workmanship only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 - 1. Copies of manufacturer's technical information and installation instructions for all materials required.
 - 2. Complete dimensioned plans at 1/4 scale showing all divider and expansion strip locations and plastic matrix terrazzo patterns.
- C. Certification: Submit copies of manufacturer's written certification that plastic matrix terrazzo materials meet or exceed specified NTMA properties.
- D. Maintenance Instructions: Submit copies of written instructions for recommended periodic maintenance of plastic matrix terrazzo.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver materials in a manner to prevent damage to containers and bags.
- B. Storage of Materials:
 - 1. Store materials in a clean, dry location as recommended by the approved installer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acrylic Modified Portland Cement Matrix: Composite resinous matrix, complying with NTMA "Guide Specifications for Polyacrylate Terrazzo" and as required to match NTMA specified plate number. Provide manufacturer's certification of compliance with NTMA materials requirements and compliance with MIL-D-3134F.
- B. White Portland Cement:
 - 1. ASTM C 150, Type I.
 - 2. Provide nonstaining white portland cement.
- C. Aggregates: Natural, sound, crushed marble chips, colors selected and graded to match specified NTMA plate number and selected to avoid off-color or contaminated material, crushed by a process that will largely eliminate flat or slivery chips and accurately sized to yield marble chips for terrazzo, but with maximum size within limits of workability for the terrazzo thickness specified. Abrasion resistance of marble chips shall be Ha10 minimum in compliance with ASTM C 241.
- D. Substrate Primer: Two-component resin or other compound, recommended by matrix manufacturer, to penetrate and seal substrate and provide maximum bond of terrazzo to substrate.
- E. Finishing Grout: Resin or other compound with filler and pigments, as recommended by matrix manufacturer.
- F. Terrazzo Cleaner: Provide an alkaline solution free from crystalizing salts and water soluble alkalne salts and which is biodegradable and phosphate free.
- G. Finish Sealer: A modified acrylic compound recommended by matrix manufacturer which is self-polishing and slip-resistant.

2.2 TERRAZZO ACCESSORIES

- A. Divider Strips: Provide two-piece T strips; heavy top strip of solid brass; bottom member of solid brass. Provide 1/4-inch wide top; depth of strips sized for a finished plastic matrix terrazzo depth of 3/8-inch.

- B. Angle Type Strip: Solid brass with 1/4-inch exposed thickness; depth as required for a finished plastic matrix terrazzo depth of 3/8-inch.
- C. Expansion Strips: T-type black neoprene filled expansion strips with brass vertical legs; neoprene exposed thickness of 1/4-inch; depth as required for a finished plastic matrix terrazzo depth of 3/8-inches.
- D. Product and Manufacturer: Provide a complete selection of plastic matrix terrazzo accessories as manufactured by one of the following:
 - 1. Manhattan American Terrazzo Strip Company.
 - 2. Or equal.

2.3 POLYACRYLATE TERRAZZO

- A. Provide the following physical properties in the finished Work:
 - 1. Odor: Matrix shall be free from objectionable odors under ordinary service conditions.
 - 2. Weight: 4.5 pounds per square foot in a thickness of 3/8-inches.
 - 3. Resistance to Impact: No visible signs of chipping, cracking, or detachment when tested in accordance with MIL-D-3134F, Section 3.8.
 - 4. Indentation: No signs of cracking or detachment. Initial indentation shall be less than 7 percent and more than 1 percent when tested in accordance with MIL-D-3134F, Section 3.9.
 - 5. Resistance to Elevated Temperature: No flow or slip in any part more than 1/16 inch or softening when tested in accordance with MIL-D-3134F, Section 3.10.
 - 6. Non-Slip Properties: Not less than those specified in MIL-D-3134F, Table 1, Factors of Friction, when tested in accordance with MIL-D-3134F, Section 3.11.
 - 7. Resistance to Moisture and Temperature Changes: No signs of cracking, separation or corrosion when tested in accordance with MIL-D-3134F, Section 3.12.
 - 8. Moisture Absorption: Not more than 5 percent moisture based on its weight at normal atmospheric conditions when tested in accordance with MIL-D-3134F, Section 3.13.
 - 9. Resistance to Corrosion: No softening or detachment from the substrate when tested in accordance with MIL-D-3134F, Section 3.14.
 - 10. Resistance to Wear: Not to exceed 0.150-inch when tested in accordance with MIL-D-3134F, Section 3.15.
 - 11. Fire Resistance: The polyacrylate terrazzo shall be rated at least fire retardant when tested in accordance with MIL-D-3134F, Section 3.16.
 - 12. Resistance to Oil: Minimum weight change of 3 percent and a maximum volume change of 2 percent when tested in accordance with MIL-D-3134F, Section 3.17.
 - 13. Shock Resistance: No signs of chipping, cracking or detachment when tested in accordance with MIL-D-3134F, Section 3.18.
 - 14. Adhesive Strength: Initial adhesive strength of not less than 65 pounds per square inch. After aging and exposure the adhesive strength shall be no less than 95 pounds of the initial adhesive strength when tested in accordance with MIL-D-3134F, Section 3.19.1 and Section 3.19.2.

15. Resistance to Accelerated Light and Weather Aging: No appreciable change in color, signs of checking, cracking or other deterioration when tested in accordance with MIL-D-3134F, Section 3.21.
16. Serviceability: No breaks, loss of adhesion or other deficiency which would limit its serviceability when tested in accordance with MIL-D-3134F, Section 3.22.
17. Tensile Strength: 700 pounds per square inch minimum after aging 28 days (Test Method C-170). Tensile strength shall not change more than 20 percent between -10 F and +180 F in compliance with ASTM C 190.
18. Bond Strength: To wet, cured concrete, after aging 28 days, shall be at least 300 pounds per square inch (Test Method ASTM C 321).
19. Flexural Deflection: After aging 7 days reinforced prisms shall have a flexural deflection on 6 inch centers greater than 0.06 inches. Flexural specimens prepared under ambient conditions and when immersed in either water or lubricating oil at 180 F shall have a minimum flexural strength of 2000 pounds per square inch in compliance with ASTM C 293.
20. Thermal Coefficient of Expansion: Matrix material shall develop a coefficient of thermal expansion not greater than 10×10^{-6} in compliance with ASTM D 696.
21. Linear Shrinkage: Developed in one year shall not exceed 0.05% in compliance with ASTM C 157.
22. Flammability: Matrix material shall not support combustion (Test Method 15 minute suspension of sample at top of flame from Fisher Burner).
23. Toxicity: Materials shall be non-toxic and non-allergenic and shall emit no toxic or noxious fumes or odors during mixing and placing procedures.

- B. Product and Manufacturer: Provide one of the following:
1. Thinset Polyacrylate No. 800 Terrazzo by General Polymers Corporation.
 2. Monile Roman Polyacrylate Terrazzo - Heavy Duty by Mameco International.
 3. Or equal.

2.4 PROPORTIONS

- A. Polyacrylate Terrazzo Topping: In accordance with polyacrylate suppliers recommendation.

2.5 MIXING

- A. Terrazzo Topping: Charge and mix marble chips and polyacrylate in accordance with suppliers instructions.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrates and conditions under which plastic matrix terrazzo Work is to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Subfloors: Prior to start of applying plastic matrix terrazzo, broom clean or vacuum surfaces to be covered and inspect the subfloor. Start of application operations will indicate acceptance of subfloor conditions and full responsibility for the completed Work.
- B. Sandblasting: All areas to receive the Work of this Section shall be given a medium sandblast finish to insure maximum plastic matrix terrazzo adhesion.
- C. Primer: Apply primer as recommended by flooring manufacturer, prior to application of the plastic matrix terrazzo. Apply in accordance with manufacturer's directions.
- D. Fill or grind concrete substrate as may be required to achieve a uniformly textured level finished appearance on finished work in compliance with allowable tolerances specified.

3.3 INSTALLATION, GENERAL

- A. Comply with NTMA for proportioning mixes, installation of strips, and for placing, curing, grinding, grouting and finishing.
- B. Place and finish terrazzo around obstructions and beneath all fixed furniture to achieve continuous color, pattern and finish.
- C. Install divider and accessory strips in a 3 foot-0 inches square maximum grid pattern with a 12-inch wide border along the base of all walls and as shown. Install in an adhesive setting bed, in accordance with manufacturer's instructions and without voids below strips. Provide mechanical anchorage for additional attachment of strips to substrate.
- D. Provide control joints where shown or required by installing angle-type divider strips back-to-back with neoprene rubber filler cemented between strips, flush with floor.
- E. Provide for expansion joints, where shown or required, by installing T-type divider strips back-to-back, with removable filler of the width shown, but not less than 1/4-inch wide between strips.

3.4 POLYESTER TERRAZZO

- A. Place matrix and aggregates in accordance with matrix manufacturer's instructions. Comply with time limitations and instructions for rolling, troweling, sprinkling additional aggregates and curing installed work. Match approved sample and provide total material thickness shown of 1/2-inch.
- B. Rough grind, grout and finish grind in compliance with matrix manufacturer's instructions. Use final grit size as required to match texture of approved sample. Exercise extreme care to ensure that fluids from grinding operation do not react with divider or control strips to produce a stain on aggregate.

3.5 ADJUSTMENT AND CLEANING

- A. Thoroughly wash all surfaces with a neutral cleaner after fine grinding.
- B. Rinse with clean water and allow surface to dry thoroughly.
- C. Seal surface of plastic matrix terrazzo with finish sealer in accordance with matrix manufacturer's instructions, after thoroughly curing and cleaning finished surface. Provide a two coat application in strict compliance with sealer manufacturer's written requirements for a high gloss finish.
- D. Protection: Provide protection for finished plastic matrix terrazzo work until Final Acceptance.
- E. Final Cleaning: Clean plastic matrix terrazzo and machine buff as required when building is ready for occupancy.

+ + END OF SECTION + +

SECTION 09500
ACOUSTICAL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all acoustical panel Work in the Blower Room of the RAS/WAS Blower Building and the compressor room in the Dewatering Building. The Work also includes:
 - a. Providing openings and framed cutouts in acoustical panels to accommodate the Work under this and other Sections and building into the acoustical panels all items such as wall and ceiling mounted equipment and their supports and all other items to be embedded in acoustical panels for which placement is not specifically provided under other Sections.
2. The extent of acoustical panels is shown on the Drawings.
3. The types of acoustical panel Work required includes, but is not necessarily limited to, the following:
 - a. Perforated metal acoustical ceiling panels in pattern specified.
 - b. Perforated acoustical wall panels in pattern specified.
 - c. Miscellaneous supports, fasteners and brackets.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items in a sequence which permits the installation of the Work of this Section.
2. Coordinate and schedule the installation of ceiling and wall mounted equipment and ductwork so that clearances between equipment and ductwork and wall and ceiling surfaces are acceptable to the installer of acoustical wall and ceiling panel Work. Provide continuous, unbroken surfaces of acoustical wall and ceiling panel Work wherever possible.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: The installer of the acoustical panel Work shall be an installation firm regularly engaged in the installation of acoustic materials, acceptable to the manufacturer of the materials specified herein and who agrees to employ only workmen skilled in the specialty involved.
- B. Design Criteria: Standards for Terminology and Performance: Applicable publications by the Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials."

C. Requirements of Regulatory Agencies:

1. FM Compliance: Class I.
2. UL Fire Hazard Classification: Acoustical Panels shall comply with fire hazard classification for flame spread, including fuel contribution and smoke development classifications. Provide acoustical panel Work which has been tested, rated and labeled by UL for the indicated ratings as listed in the "Classified Building Materials Index" by UL.
 - a. Classification: Maximums of 10 for flame spread, 25 for fuel contributed, and 5 for smoke developed (Class A).
3. Noise Reduction Coefficient (NRC): Provide the following:

FREQ (Hz)	SOUND ABSORPTION EXPRESSED AS SABINS PER PANEL				
	Size (30-inch wide x length)				
	4'	5'	6'	8'	10'
125	3.0	3.8	4.5	6.9	6.2
250	8.5	10.6	12.7	17.8	20.5
500	14.9	18.7	22.4	28.4	35.2
1000	14.5	18.2	21.8	27.3	34.5
2000	13.2	16.5	19.8	25.5	31.5
4000	13.8	17.3	20.7	27.9	33.1
NRC	12.8	16.0	19.2	24.8	30.4

D. Allowable Tolerances:

1. Surfaces to receive acoustical treatment: Free from irregularities and level to within 1/4 inch in 12 feet.
2. Allowable tolerance of finished acoustical panel system: Level within 1/8 inch in 12 feet.

E. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.

1. Acoustical and Insulating Materials Associations Performance Data, Architectural Acoustical Materials.
2. ASTM C 423, Methods of Test for Sound Absorption of Acoustical Materials in Reverberation Rooms.
3. UL Building Materials List, Guide No. 40 U18.1, Acoustical Materials.
4. UL Guide No. 40 U8.1, Fire Hazard Classification.

1.3 SUBMITTALS

- A. Samples: Submit for approval 24-inch square samples. Samples shall show the full range of exposed color and texture to be expected in the completed Work. ENGINEER'S review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Copies of manufacturer's product specifications and installation instructions for acoustical panel material required, and for suspension system. Include certified laboratory test reports and other data as required to show compliance with these Specifications.

- a. Include manufacturer's recommendations for cleaning and refinishing acoustical panels, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.
 2. Details, wall elevations, reflected ceiling plans showing acoustical panel systems specified in this Section.
 3. Provide completely coordinated Shop Drawings showing and locating all items of Work specified and shown under this Contract which will be placed on and near walls and ceilings receiving the Work of this Section. Coordinate the location of all such Work so that there is a minimum of cutouts and penetrations required in the acoustical wall panel Work.
- C. Maintenance Stock:
1. At time of completing the installation, deliver stock of maintenance material to OWNER. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.
 - a. Acoustical Panels: Furnish an amount equal to 1.0 percent of the amount installed.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.
- B. Storage of Materials:
1. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
 2. Store cartons open at each end to stabilize moisture content and temperature.
 3. Do not begin installation until sufficient materials to complete a room are received.

1.5 JOB CONDITIONS

- A. Environmental Requirements:
1. Do not begin installation of acoustical wall and ceiling panels until wet-work and other Work which may damage the acoustical panels has been completed and is dry.
 2. Maintain a uniform temperature 60 - 80° F prior to and during installation of materials.
 3. Do not install acoustical panel Work until space has been enclosed and is weather-tight and ambient conditions of temperature and humidity are continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 PERFORATED METAL ACOUSTICAL PANELS

- A. Acoustical panels shall be formed from 0.032-inch thick stucco embossed aluminum sheets, 5005-H134 alloy, with factory applied polyurethane enamel finish. Panels shall have 3/32-inch diameter holes on 5/32-inch staggered centers for a total open area of 14 percent and "V" ridged on 6-inch centers to a depth of 3/4 inches. Panels shall be formed to create integral sides and ends. Framing member shall be 10 gauge aluminum. Panels shall be one piece construction. One vertical seam is allowed in corrugated panels.
- B. Panels shall be backed with 2-inches of fiberglass insulation. Ceiling panels shall have reinforcing with the same finish at each end to give the insulation a bed in which to lie. Under no condition shall the insulation be visible.
- C. Size:
 - 1. Width: 30-inches.
 - 2. Length: A complete selection of manufacturer's standard and custom lengths in order to provide continuous acoustical wall and ceiling units. Provide 2 framing members on panels up to 8 foot - 0 inches in length and 3 framing members on panels over 8 foot - 0 inches in length.
- D. Brackets, Inserts, Fasteners: Type 316 stainless steel. Provide 11 gage Type 316 stainless steel brackets. Provide inserts 3/4-inches long and capable of resisting 220 pounds in tension.
- E. Colors: Complete selection of manufacturer's standard and custom colors for selection by OWNER. One color will be selected for the Work.
- F. Acoustical Insulation: 2-inch fiberglass, 1.5 pounds per cubic foot density complying with FS HH 558, Form B, Type 1, Class 7. All acoustical insulation shall be wrapped in flame-resistant 2 mil thick polyethylene.
- G. Product and Manufacturer: Provide one of the following:
 - 1. Eckoustic Functional Panels by Eckel Industries, Incorporated.
 - 2. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the conditions under which the acoustical panel Work is to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Verify and coordinate the location of all items which may affect the installation of the acoustical panel Work including, but not limited to, the locations of equipment, lights, ducts and other ceiling penetrations. Adjust acoustical panel layout if required and submit changes for approval before erection.

3.3 INSTALLATION, ACOUSTICAL PANELS

- A. General: Install materials in accordance with manufacturer's instructions.
- B. Arrange acoustical wall and ceiling acoustical panels with a uniform spacing of 2 foot - 0 inches maximum clearance between continuous panel runs.
- C. For acoustical panel Work on walls and ceilings begin installation of continuous runs of acoustical panels at a point 6 foot - 0 inches above the finished floor. Located bottom edge of wall panels at 6 foot - 0 inches above finished floor and install acoustical panels in a vertical pattern in continuous, unbroken lengths. On two opposite sides of room continue acoustical panels to top of wall, across ceiling and down adjacent wall. In addition, on adjacent walls continue pattern to top of walls only. See Drawings for panel layout.

3.4 TESTING ACOUSTICAL PANELS

- A. The finished installation shall be tested by CONTRACTOR at his expense. The sound level of the completed installation shall not exceed 90 decibels as tested in conformance with 1910.95(a) of the Occupational Safety and Health Act of 1970.
- B. If calculations indicate that the specified pattern along with other acoustical material present in the space (as specified in other Sections) provide a decibel level less than the maximum allowable, provide pattern specified.
- C. If calculations show that the pattern specified will not reduce the noise level to less than 90 decibels, acoustical panel pattern shall be adjusted and/or additional acoustical panels added until the required decibel level is achieved.

3.5 ADJUSTMENT AND CLEANING

- A. Clean exposed surfaces of acoustical panels, including trim, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace Work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

- B. Advise CONTRACTOR and ENGINEER of required protection for the acoustical panels, including temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by OWNER. CONTRACTOR shall provide required protection.

+ + END OF SECTION + +

SECTION 09510
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all acoustical ceilings Work. The Work also includes:
 - a. Providing openings in acoustical ceilings to accommodate the Work under this and other Sections and building into the acoustical ceilings all items such as sleeves, anchor bolts, inserts and all other items to be embedded in acoustical ceilings for which placement is not specifically provided under other Sections.
2. The extent of acoustical ceilings are shown.
3. The types of acoustical ceiling Work required includes, but is not necessarily limited to, the following:
 - a. Acoustical panel ceilings, exposed suspension.
 - b. Miscellaneous fasteners, clips, hangers, wire and other accessories.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the acoustical ceilings.

C. Related Sections:

1. Section 15779, Ductwork and Accessories.
2. Division 16, Electrical (Lighting and Devices).

1.2 QUALITY ASSURANCE

- A. Erector Qualifications: The erector of the acoustical ceilings shall be an installation firm regularly engaged in the erection of ceilings for at least 5 years.
- B. Design Criteria:
 1. Standards for Terminology and Performance: Applicable publications by the Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials".
- C. Requirements of Regulatory Agencies:
 1. Light Reflectance Ratings: Except as otherwise shown or specified, provide factory-finished acoustical tile which has been tested by a recognized testing laboratory, in accordance with the procedures of ASTM C 523, to show a light reflectance rating of not less than the required rating indicated.
 - a. Light Reflectance: Not less than 75 percent (AIMA value "a").

2. Noise Reduction Coefficient (NRC): The average of sound absorption coefficients (tested in accordance with ASTM C 423) reported by AIMA method for a specification range of 10 points, for middle frequencies of 250, 500, 1000, and 2000 Hertz. Provide not less than the required NRC rating specified.
 - a. NRC Rating: Range of 0.60 - 0.70, except as otherwise specified.
 3. Sound Transmission: Provide tile which has been sound transmission loss through the acoustical tile ceiling, determined in accordance with ASTM E 90 and ASTM E 413, and reported as a 5 Db range. Provide not less than the required STC class specified.
 - a. STC Class: Range of 35-39, for mounting No. 7 except as otherwise specified.
- D. Allowable Tolerances:
1. Surfaces to receive acoustical treatment: free from irregularities and level to within 1/4 inch in 12 feet.
 2. Deflection:
 - a. Suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles, and acoustical units: maximum deflection 1/360 of the span.
 - b. Deflection test: ASTM C 635.
 3. Allowable tolerance of finished acoustical ceiling system: level within 1/8 inch in 12 feet.
- E. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
1. Acoustical and Insulating Materials Associations Performance Data, Architectural Acoustical Materials.
 2. ASTM A 641, Zinc Coated (Galvanized) Carbon Steel Wire.
 3. ASTM C 423, Methods of Test for Sound Absorption of Acoustical Materials in Reverberation Rooms.
 4. ASTM C 523, Methods of Test for Light Reflectance of Acoustical Materials by the Intergrating Sphere Reflectometer.
 5. ASTM C 635, Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 6. ASTM E 413, Sound Transmission Class, Classification for Determination of.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. 12-inch square samples for each acoustical unit required. Samples shall show the full range of exposed color and texture to be expected in the completed Work. ENGINEER'S review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
 2. 12-inch long samples of each exposed runner and molding. ENGINEER'S review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.

- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system. Include certified laboratory test reports and other data as required to show compliance with these Specifications.
 - a. Include manufacturer's recommendations for cleaning and refinishing acoustical units, including precautions against materials and methods which may be detrimental to finishes and acoustical performances.
 2. Details and reflected ceiling plans of suspension systems specified. Show location of ceiling units and other items of Work which are to be coordinated with the ceiling, and show framing and support details for Work supported by the suspension system. Certify compliance with ASTM C 635 and other specified requirements, and indicate structural classification of each type of suspension system.
- C. Maintenance Stock:
1. At time of completing the installation, deliver stock of maintenance material to OWNER. Furnish full size units matching the units installed, packaged with protective covering for storage, and identified with appropriate labels.
 - a. Acoustical Units: Furnish an amount equal to 5.0 percent of the amount installed.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size and thickness as applicable, legible and intact.
- B. Storage of Materials:
1. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
 2. Store cartons open at each end to stabilize moisture content and temperature.
 3. Do not begin installation until sufficient materials to complete room are received.

1.5 JOB CONDITIONS

- A. Environmental Requirements:
1. Complete installation of dampening materials before beginning work.
 2. Maintain humidity of 65 to 75 percent in area where acoustical materials are to be installed 25 hours before, during, and 25 hours after installation.
 3. Maintain a uniform temperature in the range of 55 F prior to and during installation of materials.
 4. Do not install interior acoustical ceilings until space has been enclosed and is weather-tight, and until wet-Work in the space has been completed and is nominally dry, and until Work above ceilings has been completed, and ambient conditions of tempera-

ture and humidity are continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 CEILING UNITS

A. Acoustical Panels:

1. General: Unless otherwise specified, provide standard lay-in panels of the type recommended by the manufacturer for the application shown or specified. Provide 24-inch by 24-inch grid-size panels.
2. Mineral Fiber Acoustical Panels: Provide units not less than 3/4-inch thick and of density not less than 10 pounds per cubic foot, medium-coarse non-directional texture, NRC 0.60 to 0.70, STC 35-39, light reflectance over 65 percent.
3. Provide washable plastic coating finish. Color to be selected by ENGINEER from manufacturer's complete selection of standard colors.
4. Product and Manufacturer: Provide one of the following:
 - a. Sanserra 573A Travertone by Armstrong Cork Company.
 - b. Or equal.

2.2 CEILING SUSPENSION MATERIALS

- A. General: Comply with ASTM C 635, as applicable to the type of suspension system required for the type of ceiling units specified. Coordinate with other Work supported by or penetrating through the ceilings, including light fixtures and HVAC equipment. Refer to paragraph 1.2.B. for other requirements of coordination.
 1. Structural Class: Intermediate-duty system.
- B. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.
 1. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 12 gage.
- C. Edge Moldings: Manufacturer's standard white baked enamel molding for penetrations of ceiling, with a single flange of molding exposed; "W" molding at edges.
- D. Exposed Suspension System: Manufacturer's standard exposed runners, cross-runners and accessories, of the types and profiles recommended by the manufacturer to be compatible with acoustical panels specified and with exposed cross runners coped to lay flush with main runners.
 1. Finish of Exposed Members: Provide uniform factory-applied finish on exposed surfaces of ceiling suspension system including moldings, trim and accessories.
 - a. Finish: Manufacturer's standard baked enamel finish. Color to be selected from the manufacturer's standard colors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and conditions under which the acoustical ceiling Work is to be performed and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General: Install materials in accordance with manufacturer's instructions.
- B. Install tile with pattern running in one direction.
- C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers near each end and spaced 4 feet along each carrying channel or direct-hung runners, unless otherwise shown.
 - 1. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws or other devices approved by ENGINEER.
- D. Install edge moldings of the type specified at edges of each acoustical ceiling area, and at locations where edge of units would otherwise be exposed after completion of the Work.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before fastening to vertical surface.
 - 2. Secure moldings to building construction by fastening with screw-anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches from each end and not more than 16 inches on centers along each molding.
 - 3. Level moldings with ceiling suspension system, to a level tolerance of 1/8 inch in 12 feet.
 - 4. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
- E. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush; cope flange of member supported by other member.
- F. Install acoustical panels in suspension system as recommended by the manufacturer.

3.3 ADJUSTMENT AND CLEANING

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace Work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

B. The installer shall advise CONTRACTOR and ENGINEER of required protection for the acoustical ceilings, including temperature and humidity limitations and dust control, so that the Work will be without damage and deterioration at the time of acceptance by OWNER. CONTRACTOR shall provide required protection.

+ + END OF SECTION + +

SECTION 09513
SUSPENDED METAL CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all suspended metal ceilings Work. The Work also includes:
 - a. Providing openings in suspended metal ceilings to accommodate the Work under this and other Sections and building into the suspended metal ceilings all items such as air diffusers and returns, lighting fixtures, access hatches and all other items to be embedded in suspended metal ceilings for which placement is not specifically provided under other Sections.
2. The extent of suspended metal ceilings is shown.
3. The types of suspended metal ceilings Work required includes, but is not necessarily limited to, the following:
 - a. Interior linear suspended metal ceiling with concealed suspension.
 - b. Access hatches to match linear suspended metal ceiling.
 - c. Miscellaneous accessories, inserts, fasteners, moldings and trim.

B. Coordination:

1. Review installation procedures under other Sections and coordinate them with the Work specified herein.
2. Coordinate required access hatches with the requirements of equipment access needs for equipment located above suspended metal ceilings.

C. Related Sections:

1. Section 15779, Ductwork and Accessories.
2. Division 16, Electrical (Lighting and Devices).

1.2 QUALITY ASSURANCE

- A. Erector Qualifications: Firms which have successful experience in the erection of suspended metal ceiling, similar to the type specified for this project, will be acceptable.

B. Design Criteria:

1. Standards for Terminology and Performance: Applicable publications by the Acoustical and Insulating Materials Association (AIMA), including "Performance Data, Architectural Acoustical Materials".
2. Light Reflectance Rating: Except as otherwise shown or specified, provide factory finished metal pan which have been tested by a recognized testing laboratory, in accordance with the procedure of ASTM C 523, to show light reflectance rating of not less than the required rating indicated.

- a. Light Reduction: Not less than 0.75 (AIMA value "a").
- 3. Noise Reduction Coefficient (NRC): The average of sound absorption coefficients (tested in accordance with ASTM C 423) reported by AIMA method for a specification range of 10 points, for middle frequencies of 250, 500, 1000, and 2000 Hertz. Provide not less than the required NRC rating specified.
 - a. NRC Rating: Range of 0.75 - 0.85, except as otherwise specified.
- C. Allowable Tolerances:
 - 1. Surfaces to receive suspended metal ceiling system: Free from irregularities and level to within 1/4 inch in 12 feet, with no discontinuities in linear metal pan alignment.
 - 2. Deflection:
 - a. Suspension system components, hangers, and fastening devices supporting light fixtures, ceiling grilles, and acoustical units: maximum deflection L/360 of the span.
 - b. Deflection Test: ASTM C 635.
 - 3. Allowable tolerance of suspended metal ceiling system: Level within 1/8 inch in 12 feet.
 - 4. Accessible Percentage: 10 percent or a minimum of one 2 foot-0 inch by 2 foot-0 inch access hatch, whichever is greater.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 - 1. Acoustical and Insulating Materials Associations Performance Data, Architectural Acoustical Materials.
 - 2. ASTM A 641, Zinc Coated (Galvanized) Carbon Steel Wire.
 - 3. ASTM C 423, Methods of Test for Sound Absorption of Acoustical Materials in Reverberation Rooms.
 - 4. ASTM C 523, Methods of Test for Light Reflectance of Acoustical Materials by the Intergrating Sphere Reflectometer.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Copies of manufacturer's product specifications and installation instructions for each suspended metal ceiling material required, and for each suspension system. Include certified laboratory test reports and other data as required to show compliance with these Specifications. Include manufacturer's recommendations for cleaning metal pan units, including precautions against materials and methods which may be detrimental to finishes.
 - 2. Details and reflected ceiling plans of suspension systems specified in this Section. Show location of ceiling units and other items of work which are to be coordinated with the ceiling, and show framing and support details for work supported by the suspension system.
 - 3. Copies of manufacturer's complete selection of standard and custom colors.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver all materials in original, unopened protective packaging, with manufacturer's labels indicating brand name.
- B. Storage of Materials:
 - 1. Store materials in original protective packaging to prevent soiling, physical damage or wetting.
 - 2. Store cartons open at each end to stabilize moisture content and temperature.
 - 3. Do not begin installation until sufficient materials to complete a room are received.

1.5 JOB CONDITIONS

- A. Environmental Requirements: Do not install interior suspended metal ceilings until space has been enclosed and is weather-tight, and until wet-work in the space has been completed and is normally dry, and until work above ceilings has been completed, and ambient conditions of temperature and humidity are continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.1 SUSPENDED METAL CEILING MATERIALS

- A. Provide linear ceiling panels of 0.020-inch aluminum for interior ceilings and 0.025-inch aluminum for exterior soffit of 3005H26 alloy. Provide a cross-sectional width of 3-5/16-inch by 5/8-inch depth, with round edges.
- B. Linear ceiling panel carriers shall be 0.040 aluminum, painted black and roll-formed into a hat section. Prongs shall be punched out of the flanges and shall be provided every 4-inches on the sides of the hat section. Provide carriers 1-3/4-inches deep. Provide flexible radius carrier in order to achieve curved ceiling profiles.
- C. Carrier Splice: Same material and finish as carrier, fitting inside the carrier.
- D. Access Panels: Provide access panels as required for access to all valves and equipment requiring periodic maintenance or adjustment or as directed by ENGINEER. Size of openings shall be made up of multiples of full slats. All access panels shall be shop fabricated and be provided by the ceiling manufacturer.
- E. Insulation: Provide 2-inch thick black fiberglass blanket, 1 pound density.
- F. Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, Direct Hung.

- G. Hanger Wires: Galvanized carbon steel, ASTM A 641, soft temper, prestretched, yield-stress load of at least 3 times design load, but not less than 12 gage.
- H. Edge Moldings: Manufacturer's standard channel molding for edges and penetrations of ceiling, with a single flange of molding exposed, baked enamel finish unless otherwise shown or specified.
- I. Product and Manufacturer: Provide one of the following:
 - 1. Alcan Planar Ceiling Systems by Alcan Aluminum Corporation.
 - 2. Round Edge Linear Ceiling by Hunter Douglas Limited.
 - 3. Or equal.

2.2 FINISHES

- A. Provide specified manufacturers complete selection of standard and custom colors. Provide baked enamel, bright and brushed metal finishes suitable for interior exposure. ENGINEER will select a maximum of two baked enamel colors and one bright and one brushed metal finish.
- B. Treat panels on both sides with a chemical wash and chromate conversion coating. Exposed side shall be finished with the best quality white polyester enamel over a prime coat.
- C. The underside of linear ceiling panels shall have a coppertone wash coat with a protective film.
- D. Provide carriers finished as specified above, finished with a low gloss, baked-on epoxy covering coat.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the conditions under which the suspended metal ceiling Work is to be performed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Supports in Concrete Slab: Furnish layout of required clips or slots for precast prestressed hollow slab unit installation.
- B. Measure each ceiling area and establish layout of suspended metal ceiling units to balance border widths at opposite edges of each ceiling. Avoid the use of half width units at borders, and comply with reflected ceiling plans wherever possible.

3.3 INSTALLATION

- A. General: Install materials in accordance with manufacturer's instructions.
- B. Arrange suspended metal ceiling units directionally in the manner shown by reflected ceiling plans.
- C. Install suspension systems with maximum carrier spacing of 2 foot by 4 foot on centers. Begin hanger spacing near each end of carrier.
- D. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws or other devices approved by ENGINEER.
- E. Install edge moldings of the type shown at edges of each suspended metal ceiling area, and at locations where edge of units would otherwise be exposed after completion of the Work.
 - 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before fastening to vertical surface.
 - 2. Secure moldings to building construction by fastening with screw-anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches from each end and not more than 16 inches on centers along each molding.
 - 3. Level moldings with ceiling suspension system, to a level tolerance of 1/8 inch in 12 feet.
 - 4. Miter corners of moldings accurately to provide hair-line joints, securely connected to prevent dislocation.
- F. Install snap-in metal pan units, complete with acoustical pads, in coordination with suspension system and moldings.
 - 1. Align joints in adjacent courses to form uniform, straight joints parallel to room axis in both directions.
 - 2. Scribe and cut units for accurate fit at borders and at penetrations by other work. Stiffen edges of cut units as required to eliminate evidence of oil-canning or buckling.
 - 3. Provide ceiling panels in maximum lengths to eliminate intermediate joints.

3.4 ADJUSTMENT AND CLEANING

- A. Clean exposed surfaces of suspended metal ceilings, including trim, and edge moldings. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace Work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

+ + END OF SECTION + +

SECTION 09660

RESILIENT TILE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all resilient tile Work.
2. The extent of resilient tile is specified in Schedules.
3. The types of resilient tile flooring Work required includes, but is not necessarily limited to, the following:
 - a. Raised round-embossed rubber tile flooring.
 - b. Resilient base for walls.
 - c. Cementitious underlayments.
 - d. Edging strips.
 - e. Rubber accessories.
 - f. Miscellaneous adhesives, fasteners and accessories.

B. Coordination:

1. Review installation and demolition procedures and products under other Sections and coordinate the installation and demolition of items that must be installed or demolished before the resilient tile flooring Work to provide an acceptable substrate for the Work of this Section as specified.
2. Coordinate the use of products specified in other Sections to provide substrates acceptable to the resilient tile flooring manufacturer.
3. Coordinate required thickness of cementitious underlayment with undercutting of existing doors to remain and removal and reinstallation of existing thresholds as may be required by the Work of this Section. Undercutting of doors and removal and reinstallation of thresholds shall be at no additional expense to OWNER.

C. Related Sections:

1. Section 09310, Ceramic Tile.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm specializing in resilient tile flooring Work and which is acceptable to manufacturer of resilient tile flooring required for the Work.
- B. Source Quality Control: Provide each type of resilient floor tile and accessories produced by a single manufacturer, including recommended primers, adhesives and edging strips, as required.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. Federal Specification SS-T-312B, Tile, Floor: Asphalt, Rubber, Vinyl, Vinyl-Asbestos.
2. Federal Specification SS-W-40A, Wall Base: Rubber and Vinyl Plastic.
3. Rubber Manufacturer's Association, Incorporated, Specifications for Rubber Flooring.
4. Rubber Manufacturer's Association, Incorporated, Specifications for Rubber Cove Base.

1.3 SUBMITTALS

- A. Samples: Submit for approval sets of 12-inch samples of each type and color of resilient tile flooring, base strips, stairtread, and each type of stair trim required, illustrating the range of color and pattern variation.
- B. Shop Drawings: Submit for approval the following:
 1. Manufacturer's technical data and installation instructions for each type of product required for resilient tile flooring Work as specified.
 2. Provide a schedule of substrate materials and conditions in each area to receive the Work of this Section. Provide proposed methods of substrate preparation and underlayment requirements as required to provide permanent adhesion and cohesion of underlayment to existing substrates and to provide underlayment which meets specified requirements.
 3. Complete plans and large scale details of all stair cladding items where stairs are shown to receive the Work of this section.
- C. Maintenance Data: Submit copies of manufacturer's instructions for recommended maintenance practices for each type of tile Work.
- D. Maintenance Materials: After completion of Work, deliver to OWNER at the project site not less than one box of each type, color, and pattern of resilient tile flooring and accessories for each 10 boxes or fraction thereof of each type resilient tile, color, and pattern installed.
 1. Furnish replacement materials from the same manufactured lot as the materials installed.
 2. Provide a minimum of two gallons of adhesive for replacement of flooring. Store replacement materials as directed by OWNER.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver materials to the project site in the manufacturers' original unopened containers, with labels indicating brand names, colors and patterns, and quality designations legible and intact.
 2. Do not open containers or remove markings until materials are inspected and accepted.
- B. Storage of Materials:
 1. Store and protect accepted materials in accordance with manufacturer's directions and recommendations.

2. Unless otherwise directed, store materials in original containers at not less than 70 F for not less than 24 hours immediately before installation.

1.5 JOB CONDITIONS

A. Environmental Requirements:

1. Continuously heat areas to receive tile to a temperature of 70 F., for at least 48 hours prior to installation, whenever project conditions are such that heating is required.
2. Maintain 70 F., temperature continuously during and after installation as recommended by the tile manufacturer, but for not less than 48 hours.
3. Install resilient tile flooring after other finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of underlayments, building air temperature, and relative humidity must be within limits recommended by resilient tile flooring manufacturer.

1.6 WARRANTY

- A. Provide specified manufacturer's ten year standard wear warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Colors and Patterns: Provide colors and patterns specified. Provide resilient tile units with uniformly distributed color and pattern throughout the thickness of the tile, except as otherwise specified. Variation in shades and off pattern matches between containers will not be acceptable.
- B. Rubber Tile: Provide the following:
 1. FS SS-T-312B, Type II, 39.37-inches by 39.37-inches by 0.20-inch gage.
 2. Raised round-embossed rubber tile flooring recommended by the manufacturer for heavy traffic areas.
 3. Maximum allowable wear index, Taber Abrasion Test: 0.46 grams.
 4. Wear Warranty: 10 years.
 5. Product and Manufacturer: Provide the following:
 - a. Norament 925B Duo Square and 985B Stone by Nora Flooring Incorporated.
 6. Color and Pattern:
 - a. 504 Coral Duo Square Stone.
 - b. 433 Platinum Grey/Stone Grey Duo Square.
- B. Adhesives (Cements): Waterproof, stabilized type as recommended by the tile manufacturer for the type of service specified.
- C. Concrete Primer: Non-staining type recommended by the tile manufacturer.

- D. Cementitious Underlayment: Provide cementitious underlayment of the type required to level and prepare existing substrates. Select underlayment to meet existing conditions including, but not limited to, out-of-level conditions. Select underlayment to provide manufacturer's minimum recommended thickness to provide uniform, level, smooth substrates which will not telegraph substrate marks or cracks to finished resilient tile flooring. Provide all additional materials such as compatible manufacturer primers, additives and reinforcement. Provide acrylic emulsion component additives which are recommended by the manufacturer to increase flexibility and resiliency of the underlayment and additives to increase bond and cohesiveness of underlayment to existing concrete substrates. Conduct tests as required to determine the suitability of selected underlayment products for conditions encountered.
- E. Resilient Base Strips: 1/8-inch thick by 4-inches high with 1-inch long toe type cove base, homogeneous rubber composition, tapered edge. Provide color to match resilient tile flooring background color. Provide factory-manufactured matching preformed seamless molded corners.
- F. Rubber Accessories: Provide the following:
 - 1. Rubber Stair Tread Covers: Provide heavy-duty abrasive strip design, with round nose. Provide material weight of 2-1/4-pounds per linear foot minimum.
 - 2. Rubber Risers: Provide covered rubber risers to match color of stair treads.
 - 3. Provide complete selection of manufacturer's standard and custom colors.
 - 4. Product and Manufacturer: Provide one of the following:
 - a. Norament Stairtread 825 C Square and Noraprofile molded rubber risers, stringers, and accessories such as Banister-side, landing trim and stair angle trim by Nora Flooring Systems Incorporated.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas and conditions under which resilient tile Work is to be placed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.
- B. Evaluate condition of existing substrates and submit required corrective actions to ENGINEER.
- C. Installation surface must be smooth, level, and at the required finish elevation, without more than 1/8 inch in 10 feet-0 inch variation from level.

- D. Surface must be free of concrete sealers, curing agents or other contaminants unacceptable to the manufacturer's of the resilient tile flooring and cementitious underlayment, which might interfere with the adhesion of the resilient tile flooring and underlayment. Remove all such contaminants to the Work of this Section at no additional expense to OWNER.

3.2 PREPARATION

- A. Subfloors: Existing residues or other contamination shall be evaluated according to underlayment manufacturer's written requirements before installation to determine if remedial action or removal of contaminants is required. Such corrective action shall be at no additional expense to OWNER. Prior to start of laying the resilient tile flooring, broom clean or vacuum all surfaces to be covered and inspect the underlayment. Start of resilient tile flooring installation will indicate acceptance of subfloor conditions and full responsibility for the completed Work.
 1. Grind underlayment with a terrazzo grinder to remove any trowel marks or other surface irregularities which will telegraph to the resilient tile flooring surface.
 2. Use leveling compound as recommended by resilient tile flooring manufacturer for filling small cracks and depressions in underlayment.
 3. Perform moisture tests on underlayment to determine that underlayment surfaces are sufficiently cured and are ready to receive flooring installation.
 4. Test substrate for adequate adhesion prior to commencing installation.
- B. Concrete Primer: Apply concrete primer, if recommended by resilient tile flooring manufacturer, prior to application of the adhesive. Apply in compliance with manufacturer's directions.
- C. Before existing substrate preparation begins provide a survey which indicates amount of out-of-level of existing substrates within each space to receive the Work of this Section. Submit information to ENGINEER.

3.3 INSTALLATION

- A. Install tile only after all finishing operations, including painting, have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity shall be within limits recommended by tile manufacturer.
- B. Place tile units with adhesive cement in strict compliance with the manufacturer's written instructions. Butt tile units tightly to vertical surfaces, thresholds, nosings and edgings. Scribe around obstructions to produce neat joints, laid tight, even and in straight, parallel lines. Extend tile units into toe spaces, door reveals, and into closet and similar openings.

- C. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on the finish tile as marked in the subfloor. Use chalk or other non-permanent marking devices.
- D. Install tile on covers for telephone, electrical ducts and floor hatches, and other such items as occur within the finished resilient tile floor areas. Maintain the overall continuity of color, joints, and pattern with tile installed in these covers. Tightly cement edges of tile to perimeter of floor around covers and to covers.
- E. Lay tile from center marks established with principal walls, discounting minor offsets, so that tile at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 1/2 tile at room perimeters. Lay tile square to room axis, unless otherwise shown.
- F. Lay tile so that square pattern is maintained at tile joints. Provide complete square pattern with adjacent units forming complete, true squares at their intersections.
- G. Match tiles for color and pattern by using tile from cartons in the same sequence as manufactured and packaged. Cut tile neatly around all obstructions. Broken, cracked, chipped or deformed tile shall be replaced.
- H. Tightly cement tile to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks through tile, or other surface imperfections.
- I. Lay tile with grain in all tile running in the same direction.
- J. Place resilient edge strips tightly butted to tile and secure with adhesive. Provide edging strips at all unprotected edges of tile.
- K. Resilient Base Strips: Apply to all columns, pilasters, casework and walls and partitions in rooms or areas where resilient tile is shown. Install base in as long lengths as practicable, with preformed corner units. Tightly bond base to backing throughout the length of each piece, with continuous contact at horizontal and vertical surfaces.
 - 1. On masonry surfaces, or other similar irregular surfaces, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
- L. Place resilient edge strips tightly butted to resilient tile flooring and secure with adhesive. Install edging strips at all unprotected edges of resilient tile flooring.
- M. Install rubber risers, treads and edge strips and other accessory items as specified, using manufacturer's recommended adhesive.

3.4 CLEANING AND PROTECTION

- A. Remove all excess adhesive or other surface blemishes from tile, using neutral type cleaners as recommended by the tile manufacturer. Protect installed flooring from damage by use of heavy kraft paper or other covering.
- B. Finishing: At a time approved by ENGINEER and just prior to final inspection of the Work, thoroughly clean tile floors and accessories. Apply wax and buff, with the type of wax, number of coats and buffing procedures in compliance with the tile manufacturer's written instructions.

+ + END OF SECTION + +

SECTION 09680

CARPETING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all carpeting Work.
2. The extent of the carpeting is specified in the Room Finish Schedule, as shown on the Plans.
3. The type of carpeting Work includes, but is not necessarily limited to, the following:
 - a. Anti-static, anti-microbial tufted level loop pile-type floor covering.
 - b. Carpet foundation.
 - c. Miscellaneous materials.

B. Coordination:

1. Review installation procedures and products under other Sections and coordinate the installation of items that must be installed before the carpeting Work to provide an acceptable substrate for the Work of this Section as specified.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a carpet installation firm, which has successful experience in carpet installations similar in size and type to the carpeting requirements of this Project.
- B. Manufacturer's Representative: Obtain carpeting materials from only manufacturers who will, when requested, send a qualified technical representative to the project site, to advise the Installer of proper installation procedures.
- C. Requirements of Regulatory Agencies: Provide only carpet which has been tested and passes the Federal Flammability Standard DOC-FF-1-70.
- D. Codes: Comply with applicable requirements of Uniform Building Code for the type of carpeting specified.
- E. Source Quality Control: Obtain all carpeting from same dye lot.
- F. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
 1. ASTM E 84 Surface Burning Characteristics of Building Materials.
 2. FS, DOC-FF-1-70, Pill Test.
 3. Uniform Building Code.

- G. Design Criteria: Flame Spread Rating: Provide only carpet which has been tested and passes the Federal Flammability Standard DOC-FF-1-70 (the pill test).

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. Samples, 12-inches by 12-inches, of each type, color, texture and pattern of carpet required. ENGINEER'S review of samples will be for color, pattern and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.
 - 2. Overrun Stock: Deliver overrun stock and scraps of unused carpet to OWNER.
- B. Shop Drawings: Submit for approval the following:
 - 1. Copies of manufacturer's data on carpet and carpeting materials, showing that materials comply with requirements of data sheets and specifications; also including installation instructions and maintenance recommendations.
 - 2. Certified laboratory test report for flammability, DOC-FF-1-70 (pill test).

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of materials: Deliver carpeting in original packages, clearly labeled to identify manufacturer, brand name, quality or grade and fire hazard classification.

1.5 JOB CONDITIONS

- A. Scheduling: Sequence carpeting with other work so as to minimize the possibility of damage and soiling of carpet during the remainder of the construction period.

1.6 GUARANTEES

- A. Provide specified manufacturer's standard ten year wear warranty for extra-heavy commercial use and specified manufacturer's standard anti-shock warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Carpet Fiber: Provide the following fiber with integral anti-microbial protection:
 - 1. Nylon.
 - 2. Construction: Tufted, level loop pile.
 - 3. Yarn Ply: 2.
 - 4. Color: French Maroon.
 - 5. Product and Manufacturer: Provide the following:
 - a. Zeftron 500 Nylon ZX Fiber by BASF Corporation, Fibers Division.
 - b. Or equal.

- B. Carpet Construction: Provide the following carpet construction rated by the manufacturer for extra-heavy (Class III) commercial use:
1. Pile Height: 3.18 millimeters (1/8-inch).
 2. Yarn Weight: 24 ounces per square yard.
 3. Primary Backing: Polypropylene.
 4. Secondary Backing: Woven polypropylene.
 5. Total Weight: 61 ounces per square yard.
 6. Width: 12 feet-0 inches.
 7. Gauge: 1/10-inch.
 8. Stitches per 6-inches: 51.
 9. Carpet Treatment: Treated for soil and water repellency.
 10. Flammability, ASTM E 84: Class B.
 11. Static Control: Permanent static control.
- C. Carpet Foundation and Miscellaneous Materials:
1. Carpet Foundation: Rippled-surface sponge rubber cushion which tests at a flame spread rating of less than 75 (ASTM E84); 68 ounces per square yard; 0.44-inches thick.
 2. Tackless Carpet Stripping: Manufacturer's standard water-resistant plywood stripping, with angular pins protruding from the top, designed to grip and hold stretched carpet from below at the edges. Provide stripping with 2 rows of pins wherever the carpet width is less than 20 feet, and with 3 rows of pins wherever carpet width is 20 feet or more. Provide prenailed stripping, ready for anchorage to concrete or similar substrate.
 3. Carpet Edge Guard: Manufacturer's standard bend-down type of formed or extruded aluminum carpet edge guard stripping. Form units with concealed teeth to grip the carpet from below, holes for nailing to the substrate, and tapered smooth safety top bar to be bent down over the carpet to secure it in the stripping. Provide clear anodized finished, as selected from manufacturer's standard finishes.
 4. Seaming Cement: Hot-melt seaming adhesive or similar product recommended by carpet manufacturer, for taping seams and buttering cut edges at backing to form secure seams and prevent pile loss at seams.
 5. Other miscellaneous materials as recommended by manufacturers of carpet, cushions and other carpeting products; and selected by installer to meet project conditions and requirements.
- D. Extra or Surplus Materials: Provide production overrun on each carpet, amounting to 6 percent excess over the amount necessary to ensure complete installation without excess seams. Deliver all unused carpet and large scraps to OWNER. Dispose of scraps less than 2 square foot in area, or less than 8 inches in width.
- E. Product and Manufacturer: Provide the following:
1. BT-1555 French Maroon Bolton by Stratton Industries Incorporated.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the substrate and conditions under which carpeting Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Measure each space to receive carpeting, as a basis of supplying, cutting and seaming the carpet. Do not scale ENGINEER'S Drawings or calculate sizes from dimensions shown.
- B. Vacuum substrate immediately prior to carpet installation, and remove all deleterious substances which would interfere with the installation or be harmful to the Work.

3.3 INSTALLATION

- A. General:
 - 1. Comply with manufacturer's instructions and recommendations. Place seams in the directions shown on approved Shop Drawings. Maintain direction of pattern and texture, including lay of pile. Do not seam weft to warp. Do not seam in traffic direction at doorways.
 - 2. Install carpet edge guard at every location where edge of carpet is exposed to traffic, except where another device, such as an expansion joint cover system or threshold, is indicated with an integral carpet binder bar.
 - 3. Extend carpet under open-bottomed obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
 - 4. Provide cut-outs where required, and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.
 - 5. Install carpet edge guard where edge of carpet is exposed; anchor guards to substrate.
 - 6. Expansion Joints: Do not bridge building expansion joints with continuous carpeting, provide for movement.
- B. Tackless Installation:
 - 1. Install tackless carpet stripping in accordance with manufacturer's instructions, using adhesive and coordinating with the indicated method of terminating the carpet at the wall base. Turn cut-edge of carpet down to substrate in tight slot between base and edge of stripping.
 - 2. Nail stripping to substrate as recommended by the manufacturer.
 - 3. Install carpet foundation over entire area to be carpeted. Butt carpet foundation tight against edge stripping. Hold carpet foundation back from terminal edge of carpeting, approximately 1 inch, but only where carpet edge is not secured by edge stripping or binder bar. Generally, place carpet foundation with

- slip-resistant face down; comply with carpet foundation manufacturer's recommendations.
4. Tape seams of carpet foundation with 4-inch wide tape, as recommended by manufacturer.
 5. Cement the edges of carpet foundation together, in a tight butt joint before applying seam tape.
 6. Install carpet with seams taped or sewn, or taped-and-sewn, using permanent type construction which is of sufficient strength for stretching and wear without failure during the life of the carpet. Apply seaming cement to edges without being in evidence on the face of the carpet. Maintain straight seams, running true with the lines of the building.
 7. Stretch, adjust and trim carpet in accordance with recognized installation practices. Secure edges in the manner indicated, and as recommended by the carpet manufacturer.
 8. Use power stretchers of the type recommended by the carpet manufacturer, in areas exceeding 18 feet-0 inch in width.
 9. Return to installation after a period of use (not exceeding one year) and restretch the carpet once, when requested by OWNER. Trim and resecure the edges as required.

3.4 CLEANING AND PROTECTION

- A. Remove debris from installation, carefully sorting pieces to be saved from scraps to be disposed of.
- B. Vacuum carpet with a commercial machine, with rotating agitator or beater in the nozzle. Remove soiled spots.
- C. Advise CONTRACTOR of areas which should be protected during the remainder of the construction period, so that carpet will be in undamaged and unsoiled condition at the time of acceptance. The type of cover material that should be used for protective cover.

+ + END OF SECTION + +

SECTION 09740
CONCRETE TOPPINGS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all concrete toppings Work. The Work also includes:
 - a. Providing openings in the concrete toppings to accommodate the work under other Sections and building into the concrete toppings all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete toppings for which placement is not specifically provided under other Sections.
2. The extent of concrete toppings is shown and in addition includes, but is not necessarily limited to, the following:
 - a. 8-inch high concrete topping cove bases for all walls in all areas receiving concrete toppings of same type as floor in that area.
 - b. Concrete topping on top and sides of all equipment pads and curbs using same type of concrete toppings as used for floor in that area.
 - c. Concrete topping on bottoms and sides of all trench drains, and horizontal pipe chases of same type as floor in that area.
3. The types of concrete topping Work required includes, but is not necessarily limited to, the following:
 - a. Heavy-duty concrete topping.
 - b. Chemical resistant concrete topping.
 - c. Miscellaneous materials and accessories.
 - d. Sandblasting, acid etching and other substrate preparations.

B. Coordination:

1. Coordinate and schedule sandblasting of substrates before equipment and similar items are installed to avoid later difficulty or delay in performing the Work of this section.
2. Coordinate the protection of existing equipment to remain in place during substrate preparation.
3. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the concrete toppings.
4. Coordinate the finishing of substrates for acceptability of substrates to concrete toppings manufacturers.
5. Coordinate floor drain mounting heights and types. Provide floor drain type which accommodates 1/4-inch thick concrete floor toppings.
6. Remove all chemicals, compounds and other materials from substrates to receive the Work of this Section, as may be required by the concrete toppings manufacturers, at no additional expense to OWNER even if chemicals, compounds and other materials are permitted by other Sections of this Specification.

- C. Related Sections:
1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications: Certified or licensed by the flooring materials manufacturer.
- B. Source Quality Control: Provide each component of concrete topping produced by a single manufacturer, including recommended primers (if any), base coat, aggregate, and top coat materials.
- C. Allowable Tolerances: Provide the following:
1. Finished toppings level to 1/8 inch in 10 feet-0 inches.
2. Smooth, continuous color with no color streaks or inconsistencies.
3. Uniformly textured non-slip finish.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM C 109, Compressive Strength of Hydraulic Cement Mortars.
2. ASTM C 150, Portland Cement.
3. ASTM C 190, Tensile Strength of Hydraulic Cement Mortars.
4. ASTM C 321, Bond Strength of Chemical-Resistant Mortars.
5. ASTM C 501, Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
6. ASTM D 696, Test for Coefficient of Linear Thermal Expansion of Plastics.
7. ASTM D 790, Test of Flexural Properties of Plastics.
8. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
9. ASTM D 2240, Rubber Property-Durometer Hardness.
10. ASTM E 84, Surface Burning Characteristics of Building Materials.
11. Military Specification, MIL-3134F.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. 12-inch by 12-inch samples of each type of concrete toppings on plywood. Show range of color and pattern variation. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
2. After samples have been approved, a sample of concrete toppings shall be applied to floor areas selected by ENGINEER. Upon acceptance by ENGINEER, the samples shall be the standard by which all Work shall be compared.
- B. Shop Drawings: Submit for approval the following:
1. Show floor plans indicating where concrete toppings occurs in each space. Show interface details with other items occurring in the spaces such as thresholds, floor drains, coves, equipment pads and trench drains or horizontal pipe chases.
2. Copies of manufacturer's technical data and installation instructions for concrete topping required.

3. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices.
4. Test Reports: Copies of test data from an independent testing laboratory for all the physical properties listed herein.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 1. Deliver material in manufacturer's original unopened and undamaged packages.
 2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
 3. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Storage of Materials:
 1. Store in original packaging under protective cover and protect from damage.
 2. Stack containers in accordance with manufacturer's recommendations.
- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.5 JOB CONDITIONS

- A. Environmental Requirements: Maintain substrate temperature and room temperature before, during and after installation above 50 F and rising in accordance with flooring material manufacturer's instructions. Provide adequate ventilation during application and curing periods.
- B. Scheduling:
 1. Schedule the installation of concrete topping Work in order to provide concrete topping on top of equipment pads, within horizontal pipe chases and similar locations where installation of equipment, piping and similar items would cause concrete topping installation difficulties, before such equipment, piping and similar items which would preclude later installation of concrete topping have been installed.
 2. Provide all temporary heat and shelters as may be required to schedule the installation of concrete topping Work at no additional expense to OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Heavy-Duty Concrete Topping: Provide the following three component, troweled mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments, capable of, and recommended by the manufacturer for resisting heavy traffic.

1. Acid Etch: Provide manufacturer's recommended acid etching compound in addition to sandblast surface preparation.
2. Bond Coat: As recommended by the manufacturer.
3. Aggregate: Acid resistant granite chips.
4. Binder: Type I Portland cement, ASTM C 150, with additives.
5. Top Coats: 2 component epoxy.
6. Termination Strips and Control Joints: White metal, neoprene filled type as recommended by the manufacturer.
7. Primer: Two-component, penetrating, moisture tolerant epoxy primer.
8. Color: To be selected from manufacturer's full selection of standard and custom colors.
9. Texture: Non-slip surface.
10. Physical Properties: The completed installation when thoroughly cured shall have the following physical properties:
 - a. Tensile Strength, ASTM C 190: 1,850 pounds per square inch minimum.
 - b. Flexural Strength, ASTM, C 580: 4,000 pounds per square inch.
 - c. Indentation, MIL-D-3134F: No indentation.
 - d. Bond Strength, ASTM C 321: 400 pounds per square inch minimum.
 - e. Flammability, ASTM D 635: Self-extinguishing.
 - f. Coefficient of Friction, ASTM D 2047: 0.6.
 - g. Resistance to Elevated Temperature, MIL-3134F: No Slip or flow.
 - h. Thermal Coefficient of Linear Expansion, ASTM E 831: 3.5×10^{-5} inches per inch per F maximum, temperature range, -12 F to 140 F.
 - i. Abrasive Resistance, ASTM D 1044: 0.10 grams maximum weight loss.
 - j. Flexural Strength Modulus of Elasticity, ASTM D 790: 2×10^6 pounds per square inch.
 - k. Compressive Strength, ASTM C 109: 10,000 pounds per square inch minimum.
 - l. Surface Hardness, ASTM D 2240: 85-90.
 - m. Water Absorption, ASTM C 413: 0.2 percent.
 - n. Chemical Resistance, ASTM-D-1308:

<u>Reagent</u>	<u>Film Integrity</u>
10% Nitric Acid	Unaffected
10% Phosphoric Acid	Unaffected
10% Hydrochloric Acid	Unaffected
10% Sulfuric Acid	Unaffected

<u>Reagent</u>	<u>Film Integrity</u>
10% Sodium Hydroxide	Unaffected
10% Potassium Hydroxide	Unaffected
Gasoline	Unaffected

11. Sealer: Two-component, solvent-based coating formulated from a solid bisphenol A epoxy resin and a polyamide curing agent.
12. Product and Manufacturer: Provide one of the following:
 - a. Stonclad GS with Clear Stoncrest Topcoat by Stonhard Incorporated.
 - b. Corguard 6000 by Corrosion Technology, Inc.

c. Or equal.

B. Chemical Resistant Concrete Topping: Provide the following chemical resistant topping all individual components of which shall be capable of and recommended by the manufacturer for immersion in the reagent specified for one year without loss of specified properties or color.

1. Acid Etch: Provide manufacturer's recommended acid etching compound in addition to sandblast surface preparation.
2. Bond Coat: As recommended by the manufacturer.
3. Aggregate: Acid resistant granite chips.
4. Reinforcement: Provide a glass reinforced system using materials recommended for the system and chemical resistance specified. Provide Type H glass cloth.
5. Underlayment Fill: As recommended by the manufacturer.
6. Binder: Troweled vinyl ester composition flooring.
7. Top Coats: Non-slip with complete selection of manufacturer's top coats for maximum chemical resistant.
8. Termination Strips: White metal, tapered bar type as recommended by the manufacturer.
9. Physical Properties: The complete installation when thoroughly cured shall have the following physical properties:
 - a. Tensile Strength, ASTM D 638: 13,000 pounds per square inch minimum.
 - b. Indentation, MIL-D-3134F, PAR. 4.7.3: 0.062 inches maximum.
 - c. Bond Strength, ASTM C 321: 300 pounds per square inch minimum.
 - d. Flame Spread, ASTM D 635: Self-extinguishing.
 - e. Thermal Coefficient of Linear Expansion, ASTM C 531: 7.2 by 10^{-6} inches per inch per °F maximum.
 - f. Abrasive Resistance, ASTM C 501: 27 wear index.
 - g. Flexural Strength, ASTM C 580: 22,000 pounds per square inch minimum.
 - h. Compressive Strength, ASTM C 109: 16,000 pounds per square inch minimum.
 - i. Surface Hardness, ASTM D 2240: Scale "D" 77.
 - j. Water Absorption, MIL-D-3134, 4.78: 0.12.
 - k. Chemical Resistance, ASTM D 1308:

Reagent

Film Integrity

50% Sodium Chlorite

Unaffected

10. Color: Selected from complete range of manufacturer's standard and custom colors.
11. Texture: Non-slip surface.
12. Product and Manufacturer: Provide one of the following:
 - a. DR3116 Vinyl Ester Trafficote #16 by General Polymers Corporation.
 - b. Corguard Flooring System 8000-9000 by Corrosion Technology, Inc.
 - c. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas and conditions under which concrete toppings are to be placed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Subfloor shall have a wood float finish. Concrete shall have cured for 28 days prior to initiation of this Work.

3.2 PREPARATION

- A. Subfloors: Prior to start of applying flooring, broom clean or vacuum surfaces to be covered and inspect the subfloor. Start of application operations will indicate acceptance of subfloor conditions and full responsibility for the completed Work.
- B. Sandblasting and Acid Etching: All areas to receive the Work of this Section shall be given a medium sandblast finish to insure maximum topping adhesion followed by concrete toppings manufacturer's recommended acid etching treatment.
- C. Primer: Apply primer as recommended by flooring manufacturer, prior to application of the base coat. Apply in accordance with manufacturer's directions.
- D. Fill or grind concrete substrate as may be required to achieve a smooth uniform, level finished appearance on finished Work.

3.3 APPLICATION

- A. Do not power trowel the heavy duty concrete topping unless manufacturer provides written certification to ENGINEER that material shall experience no loss in compressive strength or tensile strength.
- B. Apply termination and expansion joint strips at the junction of the flooring with other materials and at expansion joints as recommended by the manufacturer.
- C. Apply flooring only after finishing operations have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by manufacturer.
- D. Mix materials and apply bonding coat in accordance with manufacturer's instructions.
- E. Apply epoxy mortar floor topping body coat to 1/4-inch dry cured minimum thickness, or as specifically recommended to achieve the physical properties and dimensional tolerances specified.

- F. Apply glass reinforcement as specified.
- G. Apply grout coats to smooth body coat.
- H. Apply vinyl ester floor topping coat to 1/4-inch dry cured minimum thickness, or greater if specifically recommended to achieve the physical properties, chemical resistances and dimensional tolerances specified.
- I. Power sand to remove trowel marks.
- J. Apply top coat sealer material for maximum chemical resistance and cleanability as recommended by the manufacturers.

3.4 ADJUSTMENT AND CLEANING

- A. Finishing: Apply a final top coat, if required by ENGINEER, to match the texture of the approved samples.
- B. Protect installed flooring from damage, by use of heavy Kraft paper or other covering so that flooring is without damage, or unusual or accelerated wear at time of Final Acceptance.
- C. Flooring damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.
- D. The flooring at the time of Final Acceptance shall be clean and without damage, other than for normal wear associated with normal foot traffic, according to the manufacturer's published literature.

+ + END OF SECTION + +

SECTION 09743

HYDROFLUOSILICIC ACID-RESISTANT MONOLITHIC FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all hydrofluosilicic acid-resistant flooring Work. The Work also includes:
 - a. Providing openings in the flooring to accommodate the work under other Sections and building into the hydrofluosilicic acid-resistant flooring all items such as sleeves, anchor bolts, inserts and all other items to be embedded in the hydrofluosilicic acid-resistant flooring for which placement is not specifically provided under other Sections.
2. The extent of the hydrofluosilicic acid-resistant flooring is shown and in addition includes, but is not necessarily limited to, the following:
 - a. Floor areas of all hydrofluorsilicic acid contaminant areas.
 - b. Top and sides of all hydrofluorisilic acid contaminant dike walls.
 - c. Top and sides of all equipment pads and curbs within hydrofluosilicic acid containment dike areas.
 - d. Bottom and sides of all trench drains, sumps and horizontal pipe chases within the containment dike areas.
3. The types of hydrofluosilicic acid-resistant flooring Work required includes, but is not necessarily limited to, the following:
 - a. Three-component fiberglass reinforced polyester flooring.
 - b. Miscellaneous materials and accessories.
 - c. Sandblasting, acid etching and other substrate preparations.

B. Coordination:

1. Coordinate and schedule sandblasting of substrates to avoid later difficulty or delay in performing the Work of this Section.
2. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the hydrofluosilicic acid-resistant flooring.
3. Coordinate the setting of drains and other items interfacing with the recommended details of the hydrofluosilicic acid-resistant flooring manufacturer, whether or not these details agree with or are shown.
4. Remove all chemicals, compounds and other materials from substrates to receive the Work of this Section, as may be required by the hydrofluosilicic acid-resistant monolithic flooring manufacturer at no additional expense to OWNER, even if chemical compounds and other materials are permitted by other Sections of this Specifications.

- C. Related Sections:
 - 1. Section 03300, Cast-In-Place Concrete.
 - 2. Section 09740, Concrete Toppings.
 - 3. Section 09RFS, Room Finish Schedule.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 - 1. Engage a single installer with specific experience in the application of the type of flooring specified, and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER for approval.
 - 2. Certified or licensed by the flooring materials manufacturer.
- B. Design Criteria:
 - 1. The finished floor, equipment bases, horizontal pipe chases and other surfaces to receive the hydrofluosilicic acid-resistant flooring shall be capable of withstanding, under constant exposure, a 23 percent solution of hydrofluosilicic acid at ambient temperature, with no adverse effects. Products capable of only intermittent exposure resistance are not acceptable.
 - 2. Manufacturer's or "or equal" products shall provide direct property comparison with the material specified in addition to complying with all other requirements of the Specifications "Or equal" products shall employ the same generic materials as the product specified.
- C. Source Quality Control: Provide each component of flooring produced by a single manufacturer, including recommended primers, base coat, aggregate, and top coat materials.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
 - 1. ASTM C 307, Tensile Strength of Chemical-Resistant Mortars.
- E. Statement of Application: Upon completion of the Work under this Section, submit a statement to ENGINEER, signed by CONTRACTOR and the hydrofluosilicic acid-resistant flooring installer stating that the floor complies with the requirements of the Specifications and that the installation and materials complied with the manufacturer's printed recommendations and were proper and adequate for the condition of installation and use.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. 12-inch by 12-inch samples of flooring on 1/4-inch board showing the color and pattern to be expected in the finished Work. Show full thickness of system with all components in place. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

2. After samples have been approved, a sample of the flooring shall be applied to a floor area selected by ENGINEER. Upon acceptance by ENGINEER, the sample shall be the standard by which all Work shall be compared.
- B. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's technical data and installation instructions for flooring required.
 2. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for repairs and stain removal.
 3. Test Reports: Copies of test data from an independent testing laboratory for all the physical properties listed herein.
- C. Certificates: Submit manufacturer's certifications that materials have been approved for the installation conditions shown on the Drawings and as specified herein.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
1. Deliver material in manufacturer's original unopened and undamaged packages.
 2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
 3. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Storage of Materials
1. Store in original packaging under protective cover and protect from damage.
 2. Stack containers in accordance with manufacturer's recommendations.
- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.5 JOB CONDITIONS

- A. Environmental Requirements:
1. Maintain substrate temperature and room temperature before, during and after installation above 60 F and rising in accordance with flooring material manufacturer's instructions.
 2. Provide adequate ventilation during application and curing periods.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Hydrofluosilicic Acid-Resistant Flooring:
1. Type H fiberglass reinforced polyester topping with carbon fillers for installation on concrete substrate. Provide the following physical properties:
 - a. Coefficient of Expansion, inches per inch per degree F 70-210 F: $12-15 \times 10^{-6}$ inches per inch per degree F.
 - b. Compressive Strength, ASTM C 306: 12,500 pounds per square inch minimum.
 - c. Tensile Strength, ASTM C 307: 2,200 pounds per square inch minimum.
 - d. Abrasive Factor: Superior to concrete.
 - e. Shear strength to Concrete: Cohesive failure of concrete.
 - f. Color: Dark brown.
 2. The flooring system shall be a three-component monolithic floor topping, 1/8-inch thick, consisting of a deep penetration primer, trowel applied thixotropic basecoat, synthetic fabric, and trowel applied topcoat. Include manufacturer's recommended surfacing veil for maximum hydrofluosilicic acid resistance. CONTRACTOR shall provide all accessory components such as surfacers, primers, saturants and hardeners as recommended by the manufacturer for maximum hydrofluosilicic acid resistance and adherence to substrate.
- B. Product and Manufacturer: Provide one of the following:
1. Protecto-Coat 650B by Dudick Corrosion Proof Incorporated.
 2. Or equal.

2.2 MIXES

- A. Strictly follow manufacturer's written instructions for mixing, including catalyzing process.
- B. Mix materials in the sequence required by the manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas and conditions under which hydrofluosilicic acid-resistant flooring Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Commencement of the Work of this Section shall indicate that the floor substrate and other conditions of installation are acceptable to the CONTRACTOR and will produce a finished product meeting the requirements of the Specifications. All defects resulting from such

accepted conditions shall be corrected by CONTRACTOR at his own expense.

- C. Subfloor shall have a wood float finish. Concrete shall have cured for 28 days prior to initiation of this Work.

3.2 PREPARATION

A. Subfloors:

1. Concrete substrates shall have a wood float finish. Allow concrete to cure for 28 days before hydrofluosilicic acid resistant flooring is installed.
2. Concrete shall be free of curing compounds and form release agents.
3. Prior to start of applying flooring, broom clean or vacuum surfaces to be covered and inspect the subfloor. Start of application operations shall indicate acceptance of subfloor conditions and full responsibility for the completed Work.

- B. Level or grind concrete substrates to manufacturer's recommended tolerances and to produce a smooth, uniform installation.

- C. Sandblasting and Acid Etching: All areas to receive the Work of this Section shall be given a medium sandblast finish to insure maximum topping adhesion followed by hydrofluosilicic acid-resistant monolithic flooring system manufacturer's recommended acid etching treatment.

- D. Primer: Apply primer as recommended by flooring manufacturer, prior to application of the base coat. Apply in accordance with manufacturer's directions.

3.3 APPLICATION

- A. Flooring shall be installed on all exposed cast-in-place concrete surfaces located within the Fluoride Room including top and sides of equipment pads and the bottom and sides of horizontal pipe chases and trench drains. The flooring shall be carried 48 inches up the sides of concrete block and concrete walls to form a wainscot.

- B. Apply termination and expansion joint strips at the junction of the flooring with other materials as recommended by the manufacturer.

- C. Apply flooring only after finishing operations have been completed and permanent heating system is operating. Moisture content of concrete slabs, building air temperature and relative humidity must be within limits recommended by manufacturer.

- D. After primer has dried overnight examine floors for white spots. Reprime these areas.

- E. Mix materials and apply base coat in accordance with manufacturer's instructions, 1/16-inch thick.

- F. Press the synthetic fabric into the wet base coat. Lap all glass edges 1-inch minimum. Remove all air pockets and wrinkles.
- G. Saturate the glass with catalyzed resin; do not puddle saturant or allow to drop.
- H. Allow basecoat to cure overnight. Grind and repair sharp glass protrusions and fill voids.
- I. Apply top coat to 1/16-inch thick.
- J. Repeat top coat material as recommended by manufacturer for complete coverage.
- K. Apply materials in the recommended quantities to produce a finished floor system not less than 1/8-inch dry cured thickness.
- L. Flooring shall be given a nonslip, uniform finish.
- M. Expansion and construction joints shall be formed as recommended by the hydrofluosilicic acid-resistant flooring manufacturer.

3.4 ADJUSTMENT AND CLEANING

- A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.
- B. Clean all surfaces not designated to receive hydrofluosilicic acid-resistant flooring. Restore all other work in a manner acceptable to ENGINEER.
- C. All finished flooring shall be protected from damage until Final Acceptance of the Work. Flooring damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.
- D. Finishing: Apply a final top coat, if required by ENGINEER, to match the texture of the approved sample.
- E. Protect installed flooring from damage by use of heavy Kraft paper or other covering after the material has cured.
- F. Clean all flooring as recommended by the manufacturer to provide finished Work acceptable to OWNER, just prior to Final Acceptance.

+ + END OF SECTION + +

SECTION 09780
CONCRETE HARDENER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all concrete hardener Work.
 2. The extent of the concrete hardener includes all interior concrete floor not shown or scheduled to be finished with another material.
 3. The types of concrete hardener Work required includes, but is not necessarily limited to, the following:
 - a. Silicate penetrant.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the concrete hardener.
- C. Related Sections:
1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a single installer regularly engaged in the installation of concrete hardeners with experience in the application of the types of materials required, and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Installer shall meet the requirements of the concrete hardener manufacturer for providing guarantee coverage. Submit name and qualifications to ENGINEER.
- B. Source Quality Control: Obtain all material from only one manufacturer. Obtain material from only manufacturers who will, if required, send a qualified technical representative to the site, for the purpose of advising the installer of proper procedures and precautions for the use of the material.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval copies of manufacturer's specifications, recommendations and installation instructions. Include manufacturer's published data, indicating the material complies with the requirements and is intended for the application shown.

- B. Certificates: Submit for approval a certificate of coverage signed by a duly authorized representative of the manufacturer.
- C. Maintenance Data: Upon completion of the Work, furnish copies of detailed maintenance manual including the following information:
 - 1. Product name and number.
 - 2. Name, address and telephone number of manufacturer and local distributor.
 - 3. Detailed procedures for routine maintenance and cleaning.
 - 4. Detailed procedure for light repair such as scratches and staining.
- D. Guarantee: Submit for approval written guarantee agreeing to replace the concrete hardener should it fail to perform as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver materials in concrete hardener manufacturer's original unopened containers.
 - 2. Include the following information on the label:
 - a. Name of material and supplier.
 - b. Formula or specification number, lot number and date of manufacturer.
 - c. Mixing instructions, shelf life and curing time when applicable.
 - 3. Failure to comply with these requirements shall be sufficient cause for the rejection of the material in question, by ENGINEER, and his requiring its removal from the site. Supply new material conforming to the specified requirements at no additional cost to OWNER.
- B. Storage of Materials:
 - 1. Store materials so as to preclude the inclusion of foreign material.
 - 2. Protect material from freezing.
- C. Handling of Materials:
 - 1. Handle materials carefully to prevent inclusion of foreign materials.
 - 2. Do not open containers or mix components until all necessary preparatory Work has been completed.

1.5 JOB CONDITIONS

- A. Environmental Conditions:
 - 1. Do not apply concrete hardener to uncured concrete. Comply with manufacturer's written instructions for minimum 10 days of curing time.
 - 2. Apply hardener only when temperature of concrete is 50 F or above.

- B. Protection:
 - 1. Do not allow concrete hardener to overflow or spill onto adjoining surfaces.
 - 2. Remove concrete hardener that is splashed on surfaces not designated to receive concrete hardener immediately by flushing with water.
- C. Sequencing:
 - 1. Coordinate the Work so that the concrete hardener is installed when best results will be obtained, as recommended by the manufacturers technical representative.

1.6 GUARANTEE

- A. Provide a 2 year written guarantee, signed by CONTRACTOR and his installer, stating that should concrete floors show signs of dusting as a result of wear and abrasion they will be re-installed, in the manner specified herein, at no further cost to OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Concrete Hardener: Provide a clear, colorless, aqueous solution of chemically active silicates and fluosilicates, plus a wetting and penetrating agent, which reacts with the free lime and calcium carbonates binding soft, loose particles together to form a hard dense vitreous surface, resistant to chemical attack and the growth of mildew, fungi and other organisms.
- B. Product and Manufacturer: Provide one of the following:
 - 1. Lapidolith by Sonneborn Division of Contech Incorporated.
 - 2. Armortop by Anti-Hydro Waterproofing Company.
 - 3. Or equal.
- C. Water: Potable and free of all injurious contaminants.

2.2 MIXES

- A. Follow manufacturer's written instructions for the proper mixing, dilution and coverage of each coat.

2.3 FINISH

- A. The finished installation of the concrete hardener shall have a smooth, uniform even finish without discontinuities or discolorations.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates and the conditions under which the concrete hardener Work is to be performed, and notify ENGINEER in writing of any conditions detrimental to the proper and timely completion of the Work and performance of the concrete hardener. Do not proceed with the concrete hardener Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 SUBSTRATE PREPARATION

- A. Steel trowel concrete in strict accordance with printed directions supplied by the concrete hardener manufacturer.
- B. Provide concrete free of all honeycombing and fins.
- C. Do not use sealers, curing or parting compounds on the concrete unless these products have been chemically and/or mechanically removed.
- D. Provide wet curing for best results.
- E. Surfaces to receive concrete hardener shall be clean, dry and free of all loose dirt, oil, wax and other foreign matter.

3.3 INSTALLATION

- A. Provide the services of a manufacturer's technical representative during the installation of the concrete hardener.
- B. Apply concrete hardener using the coverage recommended by the manufacturer per coat.
- C. Apply a minimum of three separate coats.
- D. Apply a fourth coat using undiluted material should the manufacturer's technical representative recommend this procedure based on field conditions, and as directed by ENGINEER.
- E. Apply each coat by spray.
- F. Mop up excess solution or puddles.
- G. After each of the first and second applications allow the floor to dry until no longer visibly wet.
- H. To avoid the development of crystals, when applying the third coat, flush the surface liberally with clean, hot water. At the same time brush the floor rapidly with a stiff-bristle broom. Mop up excess water.

- I. Follow manufacturer's written instructions should white crystals develop after the first or second coat. Consult manufacturer's technical representative.

3.4 ADJUSTMENT AND CLEANING

- A. Clean adjacent surfaces of concrete hardener resulting from the Work. Use solvent or cleaning agent recommended by the concrete hardener manufacturer. Leave all finished work in a clean neat appearance.
- B. Protect the concrete hardener until fully cured.

+ + END OF SECTION + +

SECTION 09800

SULFURIC ACID RESISTANT MONOLITHIC COATING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install acid resistant concrete coating Work to new and existing concrete surfaces.
2. The areas to be protected are as follows:
 - a. All concrete surfaces below EL.1300.50 in the Chemical Handling Building as shown on the plans including containment curbs:
 - 1) Alum Area.
 - 2) Caustic Room.
 - 3) Sulfuric Acid Area.
 - 4) Polymer Area.
 - 5) Future Zinc Area.
 - 6) Future Ammonia Room.
 - b. All concrete to EL.1297.0 in the chemical pipe trench inside the Chemical Handling Building.
 - c. All concrete surfaces below EL.1305.50 in the Caustic Bulk Storage Containment Area (including all stair risers).
 - d. All concrete surfaces below EL.1306.00 in the Sulfuric Acid Bulk Storage Containment Area (including all stair risers).
 - e. All concrete surfaces below EL.1308.50 in the Existing Alum Bulk Storage Containment Area (except underneath existing tanks), including all stair risers.
 - f. Chemical Fill Station concrete pad and walls to EL.1317.0 as shown on the plans.
 - g. All concrete surfaces to 2.0 ft. above the floor slab (EL. varies) in the Chemical Pipe Trench as shown on the plans.
 - h. All concrete surfaces to EL.1290.0 in the Pump Mixer Containment Vault including all stair risers.
 - i. All concrete surfaces to EL.1299.50 in the Emergency Chlorine Scrubber Containment Area including stair risers.
 - j. All concrete surfaces to EL.1286.90 in the Chemical Waste Tank Containment area including sump and stair risers.
3. The types of coating Work required includes, but is not necessarily limited to, the following:
 - a. Amine cured, trowel applied, Reinforced Epoxy Lining/Topping with silica filled base coat and fiberglass roving.
 - b. Miscellaneous materials.
 - c. Sandblasting and other substrate preparations.
 - d. Miscellaneous materials and accessories.

B. Coordination:

1. Coordinate sandblasting of substrates to avoid later difficulty or delay in performing the Work of this Section.

2. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the coating.
3. Remove all chemicals, compounds and other materials from substrates to receive the Work of this Section, as may be required by the coating manufacturer at no additional expense to OWNER.

C. Related Sections:

1. Section 03300, Cast-In-Place Concrete.

1.2 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Engage a single installer with specific experience in the application of the type of coating specified, and who agrees to employ only tradesmen with specific skill and experience in this type of Work. Submit name and qualifications to ENGINEER for approval.
2. Certified or licensed by the coating manufacturer.

B. Design Criteria: The concrete floors, walls, concrete ceilings and other surfaces to receive the concrete coating shall be capable of withstanding, immersion exposure to 93% sulfuric acid at ambient temperature for up to one year, with no adverse effects. Products capable of only intermittent exposure resistance are not acceptable.

C. Source Quality Control: Provide each component of coating produced by a single manufacturer, including recommended primers, base coat, aggregate, and top coat materials.

D. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.

1. ASTM C 882, Test Method for Bond Strength of Epoxy-Resin Systems used with Concrete.
2. ASTM D 638, Test Method for Tensile Properties of Plastic.
3. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.
4. ASTM D 790, Test Method for Flexural Properties of Unreinforced and Reinforced Plastics.
5. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
6. ASTM D 2240, Rubber Property-Durometer Hardness.

E. Statement of Application: Upon completion of the Work under this Section, submit a statement to ENGINEER, signed by CONTRACTOR and the coating installer stating that the existing and new concrete surfaces comply with the requirements of the Specifications and that the installation and materials complied with the manufacturer's printed recommendations and were proper and adequate for the condition of installation and use.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 - 1. 12-inch by 12-inch samples of coating on 1/4-inch mineral board showing the color and pattern to be expected in the finished Work. Show full thickness of system with all components in place. Sample submittals will be reviewed for color, texture, and pattern only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
 - 2. After samples have been approved, a sample of the coating shall be applied to an area selected by ENGINEER. Upon acceptance by ENGINEER, the sample shall be the standard by which all Work shall be compared.

- B. Shop Drawings: Submit for approval the following:
 - 1. Copies of manufacturer's technical data and installation instructions for coating required.
 - 2. Maintenance Manual: Copies of manufacturer's written instructions for recommended maintenance practices. Include the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for repairs and stain removal.
 - 3. Test Reports: Copies of test data from an independent testing laboratory for all the physical properties listed herein.

- C. Certificates: Submit manufacturer's certifications that materials have been approved for the installation conditions shown on the Drawings and as specified herein.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver material in manufacturer's original unopened and undamaged packages.
 - 2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
 - 3. Packages showing indications of damage that may affect condition of contents are not acceptable.

- B. Storage of Materials
 - 1. Store in original packaging under protective cover and protect from damage.
 - 2. Stack containers in accordance with manufacturer's recommendations.

- C. Handling of Materials: Handle materials in such a manner as to prevent damage to products or finishes.

1.5 JOB CONDITIONS

- A. Environmental Requirements: Maintain substrate temperature and air temperature before, during and after installation above 50°F and rising in accordance with material manufacturer's instructions. Provide adequate ventilation during application and curing periods.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Coating:
1. Amine cured reinforced epoxy coating with silica filled base coat and fiberglass roving reinforcement for installation on concrete substrate. The coating shall have the following physical properties:
 - a. Coefficient of Expansion, 12 - 15 x 10⁶ inches per inch per degree F.
 - b. Compressive Strength, ASTM C 306: 12,500 pounds per square inch minimum.
 - c. Tensile Strength, ASTM C 307: 2,500-2,800 pounds per square inch minimum.
 - d. Abrasive Factor: Superior to concrete.
 - e. Barcol hardness: 70-75.
 - f. Flexural strength: 8,600 psi.
 - g. Chemical Resistance: ASTM D-1308:

Reagent

98% Sulfuric Acid

Film Integrity

Unaffected

h. Color: Grey.

2. The coating system shall be a three-component monolithic coating, 35-40 mils thick, consisting of a deep penetration primer, spray applied basecoat, and spray applied topcoat. Include manufacturer's recommended materials for maximum acid resistance. CONTRACTOR shall provide all accessory components such as surfaces, primers, saturants and hardeners as recommended by the manufacturer for maximum acid resistance and adherence to substrate.

- B. Product and Manufacturer: Provide one of the following:
1. Protecto Line 100-XT by Dudick Corrosion Proof Incorporated.
 2. Or Equal.

2.2 MIXES

- A. Strictly follow manufacturer's written instructions for mixing, including catalyzing process.
- B. Mix materials in the sequence required by the manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas and conditions under which concrete coating Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Commencement of the Work of this Section shall indicate that the concrete substrate and other conditions of installation are acceptable to the CONTRACTOR and will produce a finished product meeting the requirements of the Specifications. All defects resulting from such accepted conditions shall be corrected by CONTRACTOR at his own expense.

3.2 PREPARATION

- A. Allow concrete to dry for a minimum of 24 hours before sandblasting of concrete is commenced.
- B. Concrete Surfaces: Concrete shall be free of curing compounds and form release agents. Prior to start of applying coating, broom clean or vacuum surfaces to be covered and inspect the concrete. Start of application operations shall indicate acceptance of conditions and full responsibility for the completed Work.
- C. Level or grind concrete substrates to manufacturer's recommended tolerances to produce a smooth, uniform installation.
- D. Abrasive Blast: All existing and new areas to receive the Work of this Section shall be given a medium sandblast finish to expose solid concrete, remove all loose particles and to insure maximum coating adhesion. After cleaning the surfaces shall be inspected by the ENGINEER prior to application of coating.
- E. Primer: Apply primer as recommended by coating manufacturer, prior to application of the base coat. Apply in accordance with manufacturer's directions. Primer shall be Primer 67 as manufactured by Dudick Corrosion Proof, Inc., or equal.

3.3 APPLICATION

- A. Coating shall be installed on all existing and new exposed cast-in-place concrete surfaces as shown on the Drawings and specified herein.
- B. Apply coating only after finishing operations have been completed. CONTRACTOR shall provide temporary heating, if required. Moisture content of concrete, air temperature and relative humidity must be within limits recommended by manufacturer.

- C. After primer has dried overnight examine concrete coating surfaces for white spots. Reprime these areas.
- D. Mix materials and apply base coat in accordance with manufacturer's instructions. Base coat shall be filled with graded silica to reduce the coefficient of expansion and provide a thixotropic base on which to imbed the fiberglass roving.
- E. Apply the woven fiberglass roving to the wet basecoat.
- F. Allow basecoat to cure overnight.
- G. Apply unfilled resin/hardener saturant to wet out the fiberglass roving and provide a mechanical bond.
- H. Apply top coat of silica filled epoxy resin.
- I. Repeat top coat material as recommended by manufacturer for complete coverage.
- J. Apply materials in the recommended quantities to produce a finished coating system not less than 1/4-inch thick.
- K. Coating shall be given a smooth, uniform finish.

3.4 ADJUSTMENT AND CLEANING

- A. At the completion of the Work, CONTRACTOR shall remove all materials and debris associated with the Work of this Section.
- B. Clean all surfaces not designated to receive concrete coating. Restore all other work in a manner acceptable to ENGINEER.
- C. All concrete coatings shall be protected from damage until Final Acceptance of the Work. Coatings damaged in any manner shall be repaired or replaced at the discretion of ENGINEER, at no additional cost to OWNER.
- D. Finishing: Apply a final top coat, if required by ENGINEER, to match the texture of the approved sample.
- E. Clean all coatings as recommended by the manufacturer to provide finished Work acceptable to OWNER, just prior to Final Acceptance.

+ + END OF SECTION + +

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all painting Work.
2. The extent of painting Work is specified herein.
3. The Work includes the painting of all items and surfaces throughout the project included in Parts A, B and C of this Contract. The painting systems schedule for Parts B and C of this Contract is included in Part B, Division 9, Finishes, and in Part C, Section 09900, Coating Systems. The Work also includes painting of existing surfaces that are marred or damaged as a result of Work in this Contract; cleaning and painting of existing Wash Water Tanks Nos. 1 and 2; and painting of buried structures and piping as shown on the Schedules in Contract Parts B and C.
 - a. Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under other Sections of the Work.
 - b. Removal of all substances, top coats, primers and all intermediate coats of paint and other protective or decorative toppings on all existing substrates (to remain) in order to provide the substrate preparation specified herein.
 - c. Preparation of all existing substrates to remain shall be as specified herein.
4. The term "paint" as used herein means all coating systems materials, which includes pretreatments, primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.
5. Paint all exposed surfaces whether or not colors are designated in any schedule, except where the natural finish of the material is specifically noted as a surface not to be painted. The term "exposed" as used herein means all items not covered with concrete. Ducts, conduits and other materials with corrosion resistant surfaces which are in chases, above finished ceilings, or other inaccessible areas shall not require field painting. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.
6. Structural and miscellaneous metals covered with concrete, shall only receive a primer compatible with the covering material.
7. Pipe markers as specified.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be field painted in this Section.

2. Coordinate the painting of areas that are inaccessible once equipment has been installed.
 3. Provide finish coats which are compatible with the prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. CONTRACTOR shall be responsible for the compatibility of all shop primed and field painted items. Furnish information on the characteristics of the finish materials proposed to use, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and reprime as required. Notify ENGINEER in writing of anticipated problems using the coating systems as specified with substrates primed by others.
- C. Related Sections:
1. Equipment markers in appropriate equipment section.
- D. Painting Not Included: The following categories of Work are not included as part of the field-applied finish Work, but are included in other Specification Sections.
1. Shop Priming: Unless otherwise specified, shop priming of structural metal, miscellaneous metal fabrications, other metal items (fabricated components) such as shop-fabricated or factory-built tanks, pumps, hoists, heating and ventilating equipment, mechanical equipment, instrumentation and electrical equipment, panels and accessories, meter panels, transmitters, and sample sinks shall conform to applicable requirements of Section 09900, Painting, as included under the appropriate paragraphs of this Specification.
 2. Pre-Finished Items:
 - a. Items furnished with factory finishes such as baked-on enamel, porcelain, polyvinylfluoride, epoxy or other similar finishes.
 - b. Touch up factory finished items with paint supplied by the item manufacturer. CONTRACTOR shall field paint damaged prefinished items as directed by ENGINEER with matching paint systems.
 3. Concealed Surfaces:
 - a. Nonmetallic wall or ceiling surfaces in concealed from view areas and generally inaccessible areas, such as furred areas, pipe spaces, duct shafts and elevator shafts, as applicable to this project.
 - b. Paint all piping, equipment, and other such items within these areas, that do not have a galvanized or other corrosion resistant finish as specified.
 4. Concrete floors (unless otherwise shown on the plans).
 5. Metal surfaces of anodized aluminum, stainless steel, chromium plate, bronze, and copper will not require finish painting, unless shown or specified.
 6. Operating Parts and Labels:
 - a. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, linkages, sensing devices, motor and fan shafts do not require finish painting unless otherwise specified.

- b. Do not paint over any code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
- c. Remove all paint, coating or splatter inadvertently placed on these surfaces.

1.2 QUALITY ASSURANCE

- A. Applicator Qualifications:
 1. Submit the name and experience record of the painting applicator. Include a list of utility or industrial installations painted, responsible officials, architects, or engineers concerned with the project and the approximate contract price.
 2. Painting applicators whose submissions indicate that they have not had the experience required to perform the Work will not be approved.
 3. Painting applicator shall be recommended by the paint manufacturer as being qualified to apply the specified products.
- B. All paint products shall be supplied by the same manufacturer unless otherwise approved.
- C. Source Quality Control: Obtain all materials from the same manufacturer unless otherwise approved. Obtain materials only from manufacturers who will:
 1. Provide the services of a qualified manufacturer's representative at the Project site at the commencement of Work to advise on materials, installation and finishing techniques.
 2. Certify long term compatibility of all coatings with all substrates.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
 1. ANSI A13.1, Scheme for the Identification of Piping Systems.
 2. OSHA 1910.144, Safety Color Code for Marking Physical Hazards.
 3. SSPC Volume 2, Systems and Specifications, Surface Preparation Guide and Paint Application Specifications (including Inspection Requirements).
 4. All requirements of the Air Pollution Regulatory Acts concerning the application and formulation of paints and coatings in which paints are applied.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. Pipe Markers: Each type of marker specified.
- B. Shop Drawings: Submit for approval the following:
 1. Copies of manufacturer's technical information, including paint label analysis and application instructions for each material proposed for use.
 2. Copies of CONTRACTOR'S proposed protection procedures in each area of the Work.

3. List each material and cross-reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification.
 4. Copies of manufacturer's complete color charts for each coating system.
 5. Pipe Markers: Copies of manufacturer's technical brochure, including color chart and list of standard markers.
 6. Maintenance Manual: Upon completion of the Work, furnish copies of a detailed maintenance manual including the following information:
 - a. Product name and number.
 - b. Name, address and telephone number of manufacturer and local distributor.
 - c. Detailed procedures for routine maintenance and cleaning.
 - d. Detailed procedures for light repairs such as dents, scratches and staining.
- C. Test Reports: Submit for approval certified laboratory test reports for required performance tests.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information.
1. Name or title of material.
 2. Manufacturer's stock number and date of manufacture.
 3. Manufacturer's name.
 4. Contents by volume, for major pigment and vehicle constituents.
 5. Thinning instructions where recommended.
 6. Application instructions.
 7. Color name and number.
- B. Storage of Materials:
1. Store only acceptable project materials on project site.
 2. Store in a suitable location approved by ENGINEER. Keep area clean and accessible.
 3. Restrict storage to paint materials and related equipment.
 4. Comply with health and fire regulations including the Occupational Safety and Health Act of 1970.
- C. Handling of Materials:
1. Handle materials carefully to prevent inclusion of foreign materials.
 2. Do not open containers or mix components until necessary preparatory Work has been completed and application Work will start immediately. Approved materials shall be delivered to the job site in their original unopened containers bearing manufacturer's name, number, and batch number.

1.5 JOB CONDITIONS

- A. Existing Conditions:
1. Before painting is started in any area, it shall be broom cleaned and excessive dust shall be removed.

2. After painting operations begin in a given area, broom cleaning will not be allowed; cleaning shall then be done only with commercial vacuum cleaning equipment.
- B. Environmental Requirements:
1. Apply water-base paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 55° F and 90° F unless otherwise permitted by the paint manufacturer's printed instructions.
 2. Apply other paints only when the temperature of surfaces to be painted and the surrounding air temperatures are between 65° F and 95° F, unless otherwise permitted by the paint manufacturer's printed instructions.
 3. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces.
 4. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application and drying periods.
 5. Adequate illumination and ventilation shall be provided in all areas where painting operations are in progress.
 6. Install piping markers only after all painting and finish Work has been completed.
- C. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.
- D. *SP* Spent abrasive containing lead and/or chromate paint resulting from the blasting of the "affected surfaces" may be classified as a hazardous waste. "Spent abrasive" shall be understood to mean the abrasive generated during the blasting operation, including the spent water imposed over the abrasive flow, paint residue and any other debris.
- E. Care shall be exercised to prevent spent abrasive, water or dust from falling on surrounding buildings, unprotected vegetation, walkways, soils, structures and equipment by covering these areas with non-tearing tarps. Spent abrasive collecting on the ground shall be vacuumed regularly to prevent it from becoming wind blown. The site shall at all times be kept as clean as possible. At the end of the work day, all spent abrasive shall be thoroughly vacuumed and the site left with a neat appearance.
- F. *SP* Spent abrasive resulting from the blasting of the "affected surfaces" shall be captured. Non-tearing tarps or plastic sheathing, platforms, partial or total enclosures, temporary barriers or structures, or similar containment methods may be employed for this purpose. These methods must be reviewed by the ENGINEER prior to start of work. A detailed procedure describing the proposed blast cleaning operation, abrasive capture and containment techniques, and safety measures to avoid the contamination of the natural environment or surrounding structures.

- G. *SP* Spent abrasive resulting from the blasting of the "affected surfaces" will be disposed by the City. However, CONTRACTOR is responsible for gathering this waste. CONTRACTOR shall notify the ENGINEER when he is ready to begin collection of this waste. At that time, the ENGINEER will test a representative sample of such waste to determine the toxicity level. The City will provide a roll-off bin to contain the waste and will dispose of the waste at the end of the abrasive blasting phase. The bin shall be kept covered at all times, and labeled by the CONTRACTOR as "Hazardous Waste." All other waste, including spent abrasive generated by the blasting of non-affected surfaces, shall be disposed by the CONTRACTOR.
- H. All materials including painting equipment, shall be stored in accordance with local, state and federal requirements for paints, toxic materials and hazardous materials. All rags shall be removed from the premises. All possible precautions shall be taken to prevent spontaneous fires.
- I. All reasonable care shall be taken to protect against paint splatter and overspray. CONTRACTOR shall be responsible for any damage incurred to surrounding property resulting from his work.
- J. Signs shall be posted, as required, to alert the public of any risks associated with sandblasting debris, painting overspray, etc. All efforts shall be made to prevent debris from becoming wind blown.
- K. It is the responsibility of the CONTRACTOR to inquire and comply with all City ordinances. Certain residential areas have restriction's regarding work hours and noise levels.
- L. Tanks are expected to be relatively free of significant corrosion pits. However, if in the course of his work, CONTRACTOR detects pits which can have a detrimental effect on the structural integrity of the tank, he is to contact the ENGINEER for additional instructions.
- M. CONTRACTOR shall be capable of performing repair work (or be able to subcontract such work) in potable water tanks. This work may involve welding of pits, and/or welding of patch plates. Any welding shall be done by AWS certified welders.
- N. CONTRACTOR shall be responsible for obtaining any and all permits required to perform the work. Work shall be in compliance with the City of Phoenix Building and Fire Codes.
- O. *SP* Spent water, resulting from the cleaning operation of "affected surfaces" due to wet sandblasting, may contain hazardous particulates. It shall be contained, recovered and disposed of as stipulated in 1.5.G.

PART 2 - PRODUCTS

2.1 MATERIAL QUALITY

- A. Manufacturer: Provide products of one of the following:
 - 1. KOP-COAT, INC.
 - 2. Tnemec Company, Incorporated.
 - 3. Or equal.
- B. Provide manufacturer's best grade of the various types of coatings suitable for use in water treatment projects as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying the manufacturer's identification as a standard, best-grade product will not be acceptable.
- C. Provide primers produced by the same manufacturer as the finish coats. Use only thinners recommended by the paint manufacturer, and use only to recommended limits.
- D. Provide paints, and pipe markers of durable and washable quality. Use materials which will withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining, or other damage. No lead paints shall be used.

2.2 SUBSTITUTIONS

- A. No substitutions shall be considered that decrease the film thickness, the surface preparation or the generic type of coating specified. Approved manufacturers must furnish the same color selection as the manufacturers specified, including accent colors and custom colors in all coating systems.

2.3 COLORS AND FINISHES

- A. Surface treatments, and finishes, are shown under "Painting Systems" below. All substrates referenced under "Painting Systems" shall be painted whether or not shown, or scheduled, unless an item is specifically scheduled as not requiring the painting system scheduled below.
- B. Color Selection:
 - 1. A maximum of 5 different colors shall be selected for the project, in addition to color coding of all piping and ducts. Provide colors which match existing substrate colors as closely as possible where Work is performed adjacent to existing substrates to remain.
 - 2. ENGINEER reserves the right to select non-standard colors for all paint systems specified within the ability of the manufacturer to produce such non-standard colors. Selection of non-standard colors shall not be cause for CONTRACTOR rejecting ENGINEER'S color selections and CONTRACTOR shall provide such colors at no additional expense to OWNER.

- C. After approval of submittals and prior to beginning Work, ENGINEER will furnish color schedules for surfaces to be painted listed in the painting systems below.
- D. Piping and Sign Color Coding: In general, and unless otherwise specified, all color coding of piping, ducts and equipment shall comply with applicable standards of ANSI A13.1 and OSHA 1910.144.
- E. Use representative colors when preparing samples for ENGINEERS' review.
- F. Color Pigments: Pure, nonfading, applicable types to suit the substrates and service indicated.
 - 1. Lead: Lead content shall not exceed amount permitted by federal, state and local government laws and regulations.
 - 2. Paints specified for application in contact with potable water systems shall be approved by the U.S. Environmental Protection Agency (EPA), National Sanitary Foundation (NSF Std. 61), and FDA for use with potable water and shall not impart taste or odor to the water.
- G. Submit proposed application techniques to ENGINEER. Submit proof of acceptability, of technique proposed, by the paint manufacturer selected.

2.4 PAINTING SYSTEMS

- A. Concrete Block Walls; Interior:
 - 1. Surface Preparation: Remove grease, oil and all foreign matter as specified in 3.2.B.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Epoxy Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 54-660 Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- B. Ferrous Metals Including All Structural Steel, Miscellaneous Ferrous Metals, and All Ferrous Piping and All Ferrous Piping To Be Covered With Insulation; Interior Non-Submerged:
 - 1. Surface Preparation: SSPC-SP 6 Commercial Blast Cleaning as specified in 3.2.C.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Shop Primer: 654 Epoxy - 2 coats, 1.5-2.0 dry mils per coat, 285-385 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: 654 Epoxy - 1 coat, 1.5-2.0 dry mils per coat, 285-385 square feet per gallon.

- 3) Finish: Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Shop Primer: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: 66-1211 Epoxy - 1 coat, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon.
 - 3) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- C. Ferrous, Non-Ferrous Metals, Fiberglass and Galvanized Metals; Exterior Non-Submerged:
- 1. Surface Preparation:
 - a. Ferrous Metals: SSPC-SP 6 Commercial Blast Cleaning as specified in 3.2.C.
 - b. Galvanized and Non-Ferrous Metal: SSPC-SP 1 Solvent Cleaning as specified in 3.2.E. and 3.2.D.
 - c. Fiberglass: Sand as specified in 3.2.F.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer:
 - a) Ferrous Metals: 654 Epoxy - 2 coats, 1.5-2.0 dry mils per coat, 285-385 square feet per gallon per coat.
 - b) Non-Ferrous and Galvanized: None.
 - 2) Intermediate: Hi-Gard - 2 coats, 4.0-5.0 dry mils each, 250-370 square feet per gallon.
 - 3) Finish: 1122BRS Polyurethane - 1 coat, 1.0-1.5 dry mils per coat, 360-540 square feet per gallon.
 - b. Tnemec:
 - 1) Primer:
 - a) Ferrous Metals: 66-1211 Epoxy - 2 coats, 2.0-3.0 dry mils per coat, 270-460 square feet per gallon per coat.
 - b) Non-Ferrous and Galvanized: Series 27 Typoxy - 1 coat, 2.5 mils dry thickness.
 - 2) Intermediate: 66 H.B. Epoxoline - 2 coats, 4.0-5.0 dry mils each, 240-360 square feet per gallon.
 - 3) Finish: 71 Endura-Shield - 1 coat, 1.5- 2.5 dry mils, 270-460 square feet per gallon.
 - c. Or equal.
- D. Galvanized Metal and Non-Ferrous Metal; Interior and Exterior Covered (Not Exposed to Sunlight):
- 1. Surface Preparation: SSPC-SP 1 Solvent Cleaning, as specified in Sections 3.2.D., and 3.2.E.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard - 1 coat, 2.0-3.0 dry mils, 250-370 square feet per gallon.
 - 2) Finish: Glamor Glaze 200 - 2 coats, 4.0-5.0 dry mils each, 250-370 square feet per gallon.

- b. Tnemec:
 - 1) Primer: 66 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 4.0-5.0 dry mils each, 240-360 square feet per gallon.
 - c. Or equal.
- E. All Metal Surfaces Exposed to Temperatures Over 250° F:
 - 1. Surface Preparation: SSPC-SP 10 Near White blast as specified in Section 3.2.C.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Finish: Bitumastic Hi-Heat Gray - 1 coat, 2.0-3.0 dry mils, 270-403 square feet per gallon.
 - b. Tnemec:
 - 1) Finish: 1261 Silicone Aluminum - 2 coats, 0.8 dry mils per coat, 500 square feet per gallon per coat.
 - c. Or equal.
- F. All Aluminum in Contact with Dissimilar Materials:
 - 1. Surface Preparation:
 - a. Remove all foreign matter.
 - b. Pretreatment Wash Coat of Polyvinyl Butyryl Resin: 1 coat, 0.3-0.5 dry mils.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- G. Pipe and Duct Insulation, Cloth; Interior:
 - 1. Surface Preparation: Remove all foreign matter as specified in 3.2.G.
 - 2. Products and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Glamorglaze Wallboard Primer - 1 coat, 0.5 dry mils, 400 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 51-792 PVA Sealer - 1 coat, 1.0 dry mils, 400 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- H. PVC Piping, Fiberglass, Plastic, Fiberglass Insulation Covering; Exposed Interior & Exterior (Not Exposed to Direct Sunlight):
 - 1. Surface Preparation: Sand as specified in 3.2.F.

2. Product and Manufacturer: Provide one of the following finish coats:
 - a. KOP-COAT, INC.:
 - 1) Finish: Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon.
 - b. Tnemec:
 - 1) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
 - d. Color: Paint all piping with colors as specified in Section 2.5 below. Colors shall be ANSI standard where noted.
 - e. Pipe to receive insulation shall have insulation finish coating as specified.

- I. Steel and Galvanized Steel Pipe; Buried Concrete; Metal, Immersed, Non-Potable; Non-Immersed, Corrosive Environment (color not required); Buried Exterior:
 1. Surface Preparation: Ferrous shall be prepared in accordance with SSPC-SP 10, Near-White Blast, as specified in Section 3.2.C. Non-Ferrous and Galvanized shall be prepared in accordance with Sections 3.2.D and 3.2.E. Concrete shall be cleaned by sandblasting and chipping, and voids and cracks shall be repaired as specified in Division 3.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Shop Primer: 654 Epoxy - 2 coats, 1.5-2.0 dry mils per coat, 285-385 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: 654 Epoxy - 1 coat, 1.5-2.0 dry mils, 285-385 square feet per gallon.
 - 3) Finish: Bitumastic No. 300-M - 2 coats, 8.0-10.0 dry mils per coat, 90-115 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Shop Primer: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: Surface preparation as specified.
 - 3) Finish: 46H-413 Tneme-Tar - 2 coats, 8.0-10.0 dry mils per coat, 90-120 square feet per gallon per coat.
 - c. Or equal.

- J. Above-Grade Cast-In-Place Concrete; Exterior, Non-Submerged:
 1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.B
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Ramuc Exterior Masonry Paint - 1 coat, 1.5-2.5 dry mils, 150-250 square feet per gallon.
 - 2) Finish: Ramuc Exterior Masonry Paint - 1 coat, 1.5-2.5 dry mils, 150-250 square feet per gallon.
 - b. Tnemec:
 - 1) Primer: 13 Choroline - 1 coat, 1.5-2.5 dry mils, 190-316 square feet per gallon.
 - 2) Finish: 13 Choroline - 1 coat 1.5-2.5 dry mils, 190-316 square feet per gallon.
 - c. Or equal.

- K. Cast-In-Place Concrete (Except Floors and Walks) With "Smooth Form and Grout Cleaned Finish", and Precast Concrete; Interior Non-Submerged:
1. Surface Preparation: Remove grease, oil and all foreign matter as specified in Section 3.2.B.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard thinned 25 percent - 1 coat, 1.5-2.0 dry mils, 370-490 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 666666 H.B. Epoxoline - 1 coat, 2.0-3.0 dry mils, 240-360 square feet per gallon per coat.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- L. Concrete Block Walls, Masonry, Plaster, Gypsum Board, and Cast-In-Place Concrete (Except Floors and Walks) Not Conforming to "Smooth Form and Grout Cleaned Finish"; Exterior, Interior Non-Submerged:
1. Surface Preparation: Remove grease, oil and all foreign matter as specified in 3.2.B.
 2. Product and Manufacturer: Provide one of the following (semi-gloss or flat as scheduled):
 - a. KOP-COAT, INC.:
 - 1) Primer: 620 Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
 - 2) Finish: Latex 620 - 2 coats, 2.0-3.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: Block Filler - 1 coat, 10.0 dry mils, 75-100 square feet per gallon.
 - 2) Finish: Series 6 or 7 - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- M. Concrete Floors and Walks; Interior:
1. Surface Preparation: Acid etch as specified in 3.2.B.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: 200 Epoxy thinned 10 percent - 1 coat, 1.6 dry mils, 480 square feet per gallon.
 - 2) Finish: 200 Epoxy Non-Skid - 1 coat, 1.75-2.0 dry mils, 330-350 square feet per gallon.
 - b. Tnemec:
 - 1) Primer: 67 Tneme-Tread - 1 coat, 2.0-3.0 dry mils, 210-315 square feet per gallon.
 - 2) Finish: 67 Tneme-Tread Non-Slip - 1 coat, 2.0-3.0 dry mils, 158-260 square feet per gallon.
 - 3) Or equal.

- N. Submerged or Intermittently Submerged Concrete and Masonry - Potable Water; Interior and Exterior; Potable Water Tanks and Reservoirs:
1. Surface Preparation: SSPC-SP 7 Brush-Off Blast Cleaning as specified in 3.2.B.
 2. Product and Manufacturer: Provide one of the following (NSF-61 certified):
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard thinned 25 percent - 1 coat, 1.5-2.0 dry mils, 370-490 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 6.0-8.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 20-1255 Pota-Pox - 1 coat, 1.5-2.5 dry mils, 285-475 square feet per gallon.
 - 2) Finish: 20-2000 Pota-Pox - 1 coat, 6.0-8.0 dry mils, 240-360 square feet per gallon.
 - c. Or equal.
- O. Submerged or Intermittently Submerged Concrete - Wastewater, Sludges and Other Non-Potable Liquids: Interior and Exterior; Corrosive Environment:
1. Surface Preparation: SSPC-SP 7 Brush-Off Blast Cleaning as specified in 3.2.B.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Bitumastic No. 300-M thinned 33 percent - 1 coat, 3.0-4.5 dry mils, 200-300 square feet per gallon.
 - 2) Finish: Bitumastic 300-M - 2 coats, 8.0-10.0 dry mils, 90-115 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 46-41 thinned 20 percent - 1 coat, 4.0-6.0 dry mils, 200-300 square feet per gallon.
 - 2) Finish: 46-41 - 2 coats, 8.0-10.0 dry mils, 90-120 square feet per gallon.
 - c. Or equal.
 3. Total dry mil thickness of coating system shall be 20 mils minimum.
- P. Masonry; Exterior (Clear Finish):
1. Surface Preparation: Remove grease, oil, efflorescence and all foreign matter as specified in 3.2.B.
 2. Product and Manufacturer: Provide one of the following:
 - a. Euclid Chemical Company:
 - 1) Finish: Architectural Sealer - 2 coats, 200 square feet per gallon.
 - b. Standard Drywall Products:
 - 1) Finish: Thoroglaze - 2 coats, 200 square feet per gallon per coat.
 - c. Or equal.

- Q. Concrete and Masonry; Immersed, Non-Potable; Non-Immersed, Corrosive Environment:
1. Surface Preparation: Concrete shall be cleaned by sandblasting and chipping, and voids and cracks shall be repaired as specified in Division 3.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard - 2 coats, 1.5-2.0 dry mils per coat, 285-385 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: 654 Epoxy - 1 coat, 1.5-2.0 dry mils, 285-385 square feet per gallon.
 - 3) Finish: Hi-Gard - 2 coats, 6.0-8.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 66-1211 Epoxy - 2 coats, 1.5-2.5 dry mils per coat, 270-460 square feet per gallon per coat.
 - 2) Field Primer or Field Touchup: 66-1211 Epoxy - 1 coat, 1.5-2.5 dry mils, 270-460 square feet per gallon.
 - 3) Finish: 66 H.B. Epoxoline - 2 coats, 4.0-6.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- R. Submerged or Intermittently Submerged Ferrous Metals; Interior and Exterior; Immersed, Non-Potable; Non-Immersed, Corrosive Environment:
1. Surface Preparation: SSPC-SP 10 Near-White Blast Cleaning as specified in Section 3.2.C.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard - 2 coats, 1.5-2.0 dry mils per coat, 280-385 square feet per gallon per coat.
 - 2) Finish: Hi-Gard - 2 coats, 6.0-8.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 20-1255 - 2 coats, 1.5-2.5 dry mils per coat, 285-475 square feet per gallon per coat.
 - 2) Finish: 20-2000 - 2 coats, 6.0-8.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- S. Submerged or Intermittently Submerged Galvanized Ferrous Metal; Interior and Exterior; Immersed, Non-Potable; Non-Immersed, Corrosive Environment:
1. Surface Preparation: SSPC-SP 1 Solvent cleaning as specified in Section 3.2.E.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: 40 Passivator - 1 coat, 0.3-0.5 dry mils, 260-435 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 6.0-8.0 dry mils per coat, 90-125 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 66-1211 Epoxy - 1 coat, 1.5-2.5 dry mils, 270-460 square feet per gallon.

- 2) Finish: 66 H.B. Epoxoline - 2 coats, 6.0-8.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- T. All Mill Coated Pipe:
- 1. Surface Preparation: Provide substrate preparation in accordance with intended use and material, as specified herein. Mill coatings shall not be considered as an acceptable substrate for the Work of this Section.
- U. Plaster and Gypsum Wallboard; Interior:
- 1. Surface Preparation: Sand and seal.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Glamorglaze Wallboard Primer - 1 coat, 0.5 dry mils, 400 square feet per gallon.
 - 2) Finish: Hi-Gard - 2 coats, 4.0-5.0 dry mils per coat, 250-370 square feet per gallon per coat.
 - b. Tnemec:
 - 1) Primer: 51-792 PVA Sealer - 1 coat, 1.0-2.0 dry mils, 400 square feet per gallon.
 - 2) Finish: 66 H.B. Epoxoline - 2 coats, 4.0-5.0 dry mils per coat, 120-300 square feet per gallon per coat.
 - c. Or equal.
- V. Wood surfaces, Interior, Opaque or Clear:
- 1. Surface Preparation: Sand and seal.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard thinned 10 percent - 1 coat, 1.3-1.8 dry mils, 410-570 square feet per gallon.
 - 2) Finish: Hi-Gard - 1 coat, 2.0-2.5 dry mils, 370-490 square feet per gallon.
 - b. Tnemec:
 - 1) Finish: 66 H.B. Epoxoline - 2 coats, 2.0-3.0 dry mils per coat, 240-360 square feet per gallon per coat.
 - c. Or equal.
- W. Submerged Ferrous, Non-Ferrous, and Galvanized Metal Surfaces, Potable Water Tanks and Reservoirs:
- 1. Surface Preparation:
 - a. Ferrous metal interior surfaces shall be prepared in accordance with SSPC SP-5 (White Metal Blast Cleaning). Exterior surfaces shall be blast cleaned in accordance with SSPC SP-6.
 - b. Non-ferrous and galvanized metal shall be prepared in accordance with paragraphs 3.2.D and 3.2.E.
 - c. Excessive scale shall be removed by Hand Tool Cleaning or SSPC SP-3.
 - 2. Product and Manufacturer: Provide one of the following (NSF-61 Certified):
 - a. Tnemec:
 - 1) Primer: 20-1255 Pota-Pox Primer, (Sand beige) 1 coat, 3.0-5.0 total dry mils thickness.

- 2) Finish (Interior): 20-2000 Pota-Pox Finish, (white) or approved, 2 coats, 4.0-6.0 total dry mils thickness. Total dry film thickness 7.0-11.0 mils.
 - 3) Finish (Exterior): Tnemec 71AD32 Endura-Shield (Color to be selected), to a dry film thickness of 1.5-2.5 mils. Total dry film thickness 4.5-7.5 mils.
 - b. Or approved equal.
- X. Ferrous Metal Surfaces, Submerged and Exposed, Non-Potable, and Corrosive Environment:
- 1. Surface Preparation: Ferrous metal surfaces shall be prepared in accordance with Section 3.2.C.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC. Inertol Grease
 - b. Texaco: Rust Inhibitive Grease
 - c. Or equal.
 - 3. Coverage: Apply with stiff brush, hard swab, or airless spray gun at 50 square feet per gallon coverage.
- Y. Metal Surfaces Exposed to Temperatures to 750⁰ F.:
- 1. Surface Preparation: SSPC SP-10 (Near White Metal Blast Cleaning).
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.: Inorganic Zinc P-1500
 - 1) Primer: 1 coat - 1.0 mil dry thickness.
 - 2) Finish: 1 coat - 2.0-3.0 mils dry thickness.
 - b. Tnemec: Inorganic Zinc 90E92.
 - 1) Primer: 1 coat - 1.0 mil dry thickness.
 - 2) Finish: 1 coat - 2.0-3.0 mils dry thickness.
- Z. Metal Surfaces Exposed to Temperatures of 1000⁰ F.:
- 1. Surface Preparation: Metal Surfaces to be prepared in accordance with SSPC SP-10 (Near White Metal Blast Cleaning).
 - 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Finish: Bitumastic High-Heat Gray - 1 coat, 3.0-4.0 mils dry film thickness.
 - b. Tnemec:
 - 1) Finish: Heat Resistant 39-1030 - 2 coats, 0.7-1.5 mils dry film thickness each.
 - c. Or equal.
- AA. Metal surfaces, Exterior, Exposed to Direct Sunlight:
- 1. Surface Preparation:
 - a. Shop primed surfaces shall be prepared in the field by cleaning all surfaces in accordance with SSPC SP-2 (Hand Tool Cleaning). Damaged shop coated areas shall be cleaned in accordance with SSPC SP-3 (Power Tool Cleaning) and recoated with the primer specified.
 - b. Bare ferrous metal surfaces shall be prepared in the field by cleaning in accordance with SSPC SP-6 (Commercial Blast Cleaning).
 - c. Non-ferrous and galvanized metal shall be prepared in accordance with Sections 3.2.D and 3.2.E.

2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Hi-Gard, 2 coats - 2.0-2.5 dry mils thickness each.
 - 2) Finish: 1122-B Urethane, 1 coat - 2.0 dry mils thickness.
 - b. Tnemec:
 - 1) Primer: Series 69 Epoxy, 2 coats - 2.0-2.5 dry mils thickness each.
 - 2) Finish: Series 73 Urethane, 1 coat - 2.0 dry mils thickness.
 - c. Or equal.
- BB. Metal, Ferrous, Non-Ferrous and Galvanized, Interior:
1. Surface Preparation: Bare metal shall be prepared in the field by cleaning in accordance with SSPC SP-2 (Hand Tool Cleaning). Galvanized or non-ferrous surfaces shall be prepared in accordance with Sections 3.2.D and 3.2.E.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Latex 620, 1 coat - 1.0 mil dry thickness.
 - 2) Finish: Latex 620, 2 coats - 1.5-2.0 mils dry thickness each.
 - b. Tnemec:
 - 1) Primer: Latex Series 7, 1 coat - 1.0 mil dry thickness.
 - 2) Finish: Latex Series 7, 2 coats - 1.5-2.0 mils dry thickness each.
 - c. Or equal.
- CC. Wood, Masonry Block, Sheet Rock, Interior:
1. Surface Preparation: Clean with mineral spirits, sand paper, scrapers, or wire brush.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Latex 620, 1 coat - 1.0 mil dry thickness.
 - 2) Finish: Latex 620, 2 coats - 1.5-2.0 mils dry thickness each
 - b. Tnemec:
 - 1) Primer: Latex Series 7, 1 coat - 1.0 mil dry thickness.
 - 2) Finish: Latex Series 7, 2 coats - 1.5-2.0 mils dry thickness each.
 - c. Or equal.
- DD. Metal, Below Grade (Buried):
1. Surface Preparation: In accordance with SSPC SP-2 (Hand Tool Cleaning). Sharp projections shall receive a liberal amount of priming paste to ensure maximum protection.
 2. Product and Manufacturer: Provide one of the following:
 - a. DENSO: System T-1 Petrolatum based primer and mastic tape, spirally wrapped with a 55 percent (55%) overlap and sufficient tension and pressure to provide continuous adhesion with a minimum thickness of 50 mils for smooth contours and a thickness of 100 mils for sharp projections.

- b. TRENTON: No.1 wax tape primer and tape system with same thickness as above.
 - c. Or equal.
- EE. Metal, Interior, Corrosive Environment, Confined Enclosures, Minimal Surface Preparation:
1. Surface Preparation:
 - a. Uncoated ferrous metal surfaces shall be prepared in accordance with SSPC SP-3 (Power Tool Cleaning). All welds smoothed and primed.
 - b. Non-ferrous and galvanized metal shall be prepared in accordance with Sections 3.2.D and 3.2.E.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Aluminum Epoxy Mastic, 1 coat - 2.0-3.0 mils dry thickness.
 - 2) Finish: Aluminum Epoxy Mastic, 2 coats - 6.0-7.0 mils dry thickness each.
 - b. Tnemec:
 - 1) Primer: Series 135 primer, 1 coat - 2.0-3.0 mils dry thickness.
 - 2) Finish: Series 104 Aluminum Epoxy Mastic, 2 coats - 6.0-7.0 mils dry thickness each.
 - c. Or equal.
- FF. PVC/CPVC Piping Exposed to Direct Sunlight:
1. Surface Preparation: Clean with compatible solvent and sand rough surface.
 2. Product and Manufacturer: Provide one of the following:
 - a. Porter: 1 coat of 3400 Latex primer and 1 coat of 3410 Latex finish to 3.0 mils dry film thickness total.
 - b. Tnemec: Series 7 Latex, 1 coat of primer and 1 coat of finish paint to 3.0 mils dry film thickness total.
 - c. Or equal.
- GG. Sliding Faces of Slide Gates and Sluice Gates (if required), Threaded Portions of Gate Stems, All Other Moving Submerged Parts, Mechanisms or Parts of Mechanisms:
1. Surface preparation: Clean scale, dirt, grease, or other foreign matter.
 2. Product and Manufacturer: Provide one of the following:
 - a. NO-OX-ID A Special, 1/32 inch minimum thickness.
 - b. Or equal.
- HH. Metal or Concrete Below Grade (Buried):
1. Surface Preparation: Ferrous Metal Surfaces shall be prepared in accordance with SSPC SP-7 (Brush-Off Blast Cleaning). Concrete surfaces shall be prepared by sandblasting and chipping, and voids and cracks shall be repaired as specified in Division 3.
 2. Product and Manufacturer: Provide one of the following:
 - a. KOP-COAT, INC.:
 - 1) Primer: Provide 1 coat of Bitumastic 50 Solution, 3.0-5.0 mils thickness.

- 2) Finish: Provide 1 or more coats of Bitumastic 50 Solution to a finished dry film thickness of 15 mils.
- b. Or equal.

II. Special Color and Painting Requirements

1. Items specified in the following shall be finish color coated as specified. ANSI colors shall conform with (OSHA) ANSI Z53.1-1971 and latest revisions. Color coating shall be with the system specified for the equipment.
 - a. RED
Items listed in ANSI Z53.1-1971, Section 2.1 shall be painted ANSI Red. In general, these items shall include fire protection equipment and apparatus; danger signs and locations; and stop bars, buttons, or switches. In addition all hose valves and riser pipes, fire protection piping and sprinkler systems, and electrical stop switches shall be painted ANSI Red.
 - b. ORANGE
Items listed in ANSI Z53.1-1971, Section 2.2 shall be painted ANSI Orange. ANSI Orange shall be used as a basic color for designating dangerous parts of machines or energized equipment which may cut, crush, shock, or otherwise injure and to emphasize such hazards when enclosure doors are open or when gear belt or other guards around moving equipment are open or removed, exposing unguarded hazards. In addition, moving machinery having a linear or peripheral speed in excess of 10 feet per minute, which is either inadequately guarded due to physical problems or may be operated with the guard removed, rims of sprockets, gears, pulleys, etc.; crossheads of large engines and compressors; and flywheels shall be coated ANSI Orange.
 - c. YELLOW
Items listed in ANSI Z53.1-1971, Section 2.3 shall be painted ANSI Yellow. Yellow shall be the basic color for designating caution and for marking physical hazards such as striking against, stumbling, falling, tripping, and "caught in between." In addition, an 8-inch wide strip on the top and bottom tread of stairways shall be coated.
 - d. GREEN
Items listed in ANSI Z53.1-1971, Section 2.4 shall be painted ANSI Green. Green shall be the basic color for designating safety and the location of first-aid equipment. In general, gas masks, first-aid kits, eye wash facilities, and safety deluge showers shall be coated ANSI Green.
 - e. PURPLE
Items listed in ANSI Z53.1-1971, Section 2.5 shall be painted ANSI Purple. In general, atomic sludge density meters shall be coated ANSI Purple.

2.5 PIPE COLOR CODING AND IDENTIFICATION SCHEDULE

<u>ABOVE GROUND PIPE</u>	<u>PIPING COLOR</u>	<u>BACKGROUND COLORS</u>	<u>COLOR OF LETTERS</u>
<u>Air and Gas</u>			
High Pressure Air	Green	White	Black
High Instrumentation Air	Green	White	Black
Scrubber Air Duct	Green	Blue	White
Intake Air	Green	Blue	White
Service Air	Green	Blue	White
Argon	Red	Yellow	Black
Acetylene	Red	Yellow	Black
Natural Gas	Red	Yellow	Black
Helium	Red	Blue	White
Nitrous Oxide	Red	Blue	White
Hydrogen	Red	Blue	White
Diesel Fuel Oil	Yellow	Yellow	Black
Vacuum	Green	Blue	White
<u>Process Chemical Solutions and Slurries</u> (other than disinfectants and dechlorination agents)			
Alum	Orange	Medium Green	Black
Ferric Chloride	Yellow	Medium Green	Black
<u>ABOVE GROUND PIPE</u>			
Coagulant Polymer	Yellow	Medium Green	Black
Polyphosphate	Violet	Medium Green	Black
Carbon	Black	Medium Green	Black
Sulfuric Acid	Yellow	Medium Green	Black
Caustic Soda	Yellow	Medium Green	Black
Lime	Lt. Green	Medium Green	Black
Fluoride	Lt. Blue/Red	Medium Green	Black
<u>Disinfectants</u>			
Chlorine - Gas	Yellow	Yellow	Black
Chlorine - Liquid	Yellow	Yellow	Black
Chlorine - Solution	Yellow	Yellow	Black
<u>Water</u>			
Water - Potable	Blue	Light Blue	Black
Water - Raw (NPW)	Olive Green	Light Grey	Black
Air Conditioning Water	Blue	Green	White
Backwash Water	Gray	Green	Black
Distilled Water	Lt. Blue	Green	White
Deionized Water (SPW)	Blue	Green	White
Engine Jacket Water	Blue	Green	White
Engine Cooling Water	Blue	Green	White
Filtered Water	Drk. Blue	Green	White
Hot Water Supply	Blue/Red Bands	Yellow	Black
Hydraulic Control Water	Blue	Green	White
Seal Water	Gray	Green	Black

	PIPING COLOR	BACKGROUND COLORS	COLOR OF LETTERS
<u>Wastewater</u>			
Domestic Waste (pressure or gravity)	Gray	Green	Black
Process Waste-Settled	Lt. Brown	Light Brown	Black
Process Waste- Supernatant	Black	Brown	Black
Process Waste- Thickened	Brown	Brown	Black
<u>Exposed Electrical Conduits</u>			
<u>120V/480V/4160V</u> (NO LABEL)	Orange	Orange	NONE
<u>Fire Quenching Materials:</u>			
<u>Water, Foam, CO₂, Halon,</u> <u>Fire Hydrants, including</u> <u>sections of potable water</u> <u>for Fire Dept. access.</u> (NO LABEL)	Red	Red	NONE
<u>Process</u>			
Sample Lines Piping	Dark Blue	Dark Blue	Black
Clarifier Drains	Gray	Green	Black
Floor Drains	Gray	Green	Black
Scrubber Drains	Gray	Yellow	Black
Storage Tank Drains	Gray	Green	Black
Sump Drains	Gray	Green	Black
Storage Tank Overflow	Brown	Green	Black
Vents (high & low temp.)	Yellow	Yellow	Black
Roof Drains	Gray	None	None

Pipes above ground shall be color coded as listed above, except submerged pipes. Pipes less than 3/8" diameter shall be painted the same as the wall or piece of equipment to which it is attached.

2.6 PIPING MARKERS

- A. Manufacturer: Provide products produced by one of the following:
1. W.H. Brady Company.
 2. Seton Name Plate Corporation.
 3. Or equal.
- B. General:
1. Piping markers shall be formed from laminated plastic. All printing shall be sealed with a formed butyrate plastic film. Markers for piping up to 6-inch diameter shall be preformed to completely wrap around the pipe requiring no adhesive. Markers for pipes over 6-inch diameter shall be preformed to the contour of the pipe and attached with stainless steel spring fasteners.
 2. For pipes under 3/4-inch outside diameter: Provide brass tags, 1-1/2-inch diameter, with depressed 1/4-inch high black filled letters above 1/2-inch high black filled numbers.

3. Positive identification of the contents of a piping system shall be lettered legend, giving the name of the contents in full or abbreviated form at not greater than 25 foot intervals between markings. Arrows shall be used to indicate direction of flow. Contents shall be identified by additional details, such as temperature, pressure, etc., as necessary to identify the hazard.
4. Legend shall be brief and applied close to valves or flanges and adjacent to changes in direction, branches and where pipes pass through walls or floors.
5. Where two or more pipes run parallel, marking shall be applied in the same relative location on each as to be in vertical or horizontal line and present a neat appearance.
6. In case a pipe is in such location that it can be seen only from one direction, such as pipes near a wall, two sets of the code designation shall be applied at each location, placed in two visible quadrants with respect to normal viewing positions.

<u>Recommended Sizes of Letters</u>	
<u>O.D. of Pipe (Inches)</u>	<u>Height of Letters (Inches)</u>
3/4" - 1-1/4"	1/2"
1-1/2" - 2"	3/4"
2-1/2" - 6"	1-1/4"
8" - 10"	2-1/2"
Over 10"	3-1/2"

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his applicator shall examine the areas and conditions under which painting Work is to be performed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.2 SURFACE PREPARATION

- A. General:
 1. Perform all preparation and cleaning procedures as specified herein and in strict accordance with the paint manufacturer's instructions for each particular substrate and atmospheric condition.
 2. Prepare existing substrates required to be painted under this Section as specified for new substrates. Where other methods of preparing existing substrates are proposed by the CONTRACTOR they shall be submitted to the ENGINEER for approval. ENGINEER'S approval of alternate substrate preparation shall not relieve the CONTRACTOR of his required performance under this Section.

3. Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide surface applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.
4. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. All surfaces which were not shop painted or which were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted, as determined by ENGINEER, shall be prepared as specified below.

B. Masonry Surfaces:

1. Prepare surfaces of concrete block to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, with soap and water.
2. Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Provide ENGINEER with suitable testing materials in order to carry out alkalinity and moisture tests.
3. Do not paint over surfaces where the moisture content exceeds 8 percent, unless otherwise permitted in the manufacturer's printed directions.
4. Concrete block surfaces that cannot be adequately cleaned by soap and water shall be acid etched.
5. Remove loose or incompatible existing finish coats as recommended by the paint manufacturer for full product responsibility. Brush blast to clean all residue and create uniform rough texture.

C. Ferrous Metals:

1. Clean ferrous surfaces including structural steel and miscellaneous metal to be shop primed, of all oil, grease, dirt, mill scale and other foreign matter by commercial blast cleaning complying with SSPC-SP 6. Where called for in the painting systems, clean surfaces in accordance with other SSPC specifications.
2. Clean ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by commercial blasting, complying with SSPC-SP 6.
3. Treat bare and blasted or pickled clean metal with metal treatment wash coat, prior to priming only if recommended by the paint manufacturer.
4. Touch-up shop-applied prime coats which have damaged or bare areas, with primer recommended by the coating manufacturer after commercial blasting complying with SSPC-SP 6.

5. Remove all rust and contamination on existing ferrous metals to sound substrate with abrasive wheels.
- D. Non-Ferrous Metal Surfaces: Clean non-ferrous metal surfaces in accordance with the coating system manufacturer's instructions for the type of service, metal substrate, and application required.
- E. Galvanized Surfaces:
 1. Clean free of oil and surface contaminants with a non-petroleum based solvent, recommended by the coating manufacturer, complying with SSPC-SP 1.
 2. Remove shop applied chromic acid treatments on galvanized surfaces to be painted. Galvanized metals which have been given a humid storage stain treatment shall be prepared for painting by sanding or by other techniques as recommended by the paint manufacturer at no additional expense to OWNER.
- F. PVC Piping and Fiberglass: Lightly sand and clean all surfaces to be painted.
- G. Covering on Pipe: Clean free of oil and surface contaminants as recommended by the coating manufacturer for substrate and application required. Do not cut or damage the insulation in any way.

3.3 MATERIALS PREPARATION

- A. General:
 1. Mix and prepare painting materials in strict accordance with the manufacturer's directions.
 2. Do not mix coating materials produced by different manufacturers, unless otherwise permitted by the manufacturer's instructions.
 3. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.
 4. Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surface into the material. Remove the film and, if necessary, strain the material before using.
 5. Mixing:
 - a. Mix only in containers placed in suitably sized non-ferrous or oxide resistant metal pans to protect concrete floor from splashes or spills which could stain exposed concrete or react with subsequent finish floor material.
 - b. Mix and apply paint only in containers bearing accurate product name of material being mixed, or applied.

3.4 APPLICATION

- A. General:
 1. Apply paint by brush, roller, air spray, or airless spray in accordance with the manufacturer's directions and recommendations of Paint Application Specifications No. 1 in SSPC Vol. 2,

where applicable. Use brushes best suited for the type of material being applied. Use rollers of carpet, velvet back, or high pile sheeps' wool as recommended by the paint manufacturer for material and texture required. Use air spray and airless spray equipment recommended by the paint manufacturer for specific coating system specified. Submit a list of application methods proposed, listing paint systems and location.

2. The paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has completely dried.
 3. Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense primary accent colors. Insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
 4. Surfaces not exposed to view do not require color coding but require the same coating system specified for exposed surfaces.
 - a. "Exposed to view surfaces" is defined as those areas visible when permanent or built-in fixtures convector covers, covers, covers for finned tube radiation, grilles, etc. are in place in areas scheduled to be painted.
 5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint as specified, before final installation of equipment.
 6. Paint aluminum parts in contact with dissimilar materials as specified with appropriate primer.
 7. Omit field primer on metal surfaces which have been shop primed touch-up paint shop prime coats only when approved by ENGINEER.
 8. Paint the backs of access panels, and removable or hinged covers to match the exposed surfaces.
- B. Heating, Ventilating, Air Conditioning and Electrical Work:
1. Heating, ventilating, and air conditioning items to be painted include, but are not limited to, the following:
 - a. Piping, pipe hangers, and supports.
 - b. Heat exchangers.
 - c. Tanks.
 - d. Ductwork and insulation.
 - e. Motors, mechanical equipment, and supports.
 - f. Accessory items.
 2. Electrical items to be painted include, but are not limited to, the following:
 - a. Conduit and fittings.
 - b. Switchgear, panels, junction boxes, motor control centers, motors and accessories.
- C. Minimum Coating Thickness:
1. Apply each material at not less than the manufacturer's recommended spreading rate, and provide total dry film thickness as specified.
 2. Apply extra coat if required to obtain specified total dry film thickness.

- D. Scheduling Painting:
1. Apply the first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
 2. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- E. Prime Coats: Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.
- F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.
- G. Transparent (Clear) Finishes:
1. On exposed to view portions, use multiple coats to produce glass-smooth surface film continuity of even matt luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
 2. Provide satin finish for final coats, unless otherwise indicated.
- H. Brush Application:
1. Brush-out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. Neatly draw all glass and color break lines.
 2. Brush apply all primer or first coats, unless otherwise permitted to use mechanical applicators.
- I. Mechanical Applicators:
1. Use mechanical methods for paint application when permitted by governing ordinances, paint manufacturer, and approved by ENGINEER. If permitted, limit to only those surfaces impracticable for brush applications.
 2. Limit roller applications, if approved by ENGINEER, to interior wall finishes for second and third coats. Apply each roller coat to provide the equivalent hiding as brush-applied coats.
 3. Confine spray application to metal framework, siding, decking, wire mesh and similar surfaces where hand brush work would be inferior and to other surfaces specifically recommended by paint manufacturer.
 4. Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.

- J. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish, or repaint Work not in compliance with specified requirements as required by ENGINEER.
- K. Piping Markers: Apply piping markers in accordance with the manufacturer's written instructions in locations herein specified.

3.5 PROTECTION

- A. Protect work of other trades, whether to be painted or not, from the Work of this Section. Leave all such work undamaged. Correct all damages by cleaning, repairing or replacing, and repainting, as acceptable to ENGINEER.
- B. Provide "Wet Paint" signs as required to protect newly painted finishes. Remove all temporary protective wrappings provided for protection of this Contract and other contracts after completion of painting operations.

3.6 INSPECTION AND WARRANTY FOR EXISTING WASH WATER STORAGE TANKS NOS. 1 AND 2

- A. Prior to expiration of the Contract correction period, existing Wash Water Storage Tanks will be drained by City personnel to facilitate a walk-through inspection of the coating by the CONTRACTOR and ENGINEER. The CONTRACTOR shall provide labor and equipment necessary to remove any standing water and sediment from the floor of each tank, before the walk-through, to insure that any defects in the coating are readily visible.
- B. In the event that defects in the coating are detected, the CONTRACTOR shall submit to the ENGINEER his proposed repair method along with a completion schedule. The CONTRACTOR shall complete the repair work within the scheduled time period.
- C. Upon completion of the warranty repair work to the satisfaction of the ENGINEER, or if no repairs were necessary, the CONTRACTOR shall be responsible for disinfection of the tanks in accordance with AWWA D-105, prior to its being returned to service.
- D. CONTRACTOR shall provide a one (1) year warranty, from the time of final acceptance by the City of Phoenix, against defects in materials and workmanship.

3.7 CLEAN-UP

- A. During the progress of the Work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
- B. Upon completion of painting Work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces as determined by ENGINEER.

+ + END OF SECTION + +

SECTION 09951
VINYL WALLCOVERING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all vinyl wallcovering Work.
 2. The extent of vinyl wallcovering is specified.
 3. The types of vinyl wallcovering Work required includes, but is not necessarily limited to, the following:
 - a. Type II Osnaburg Blend vinyl wall covering.
 - b. Miscellaneous adhesives, and metal moldings.
- B. Related Sections:
1. Section 09250, Gypsum Wallboard.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: A specialized installer with experience in the installation of vinyl wallcovering.
- B. Design Criteria:
1. Two colors may be chosen by ENGINEER for each room to receive vinyl wallcovering.
 2. Wallcoverings shall be extended continuously over entire wall surface including concealed from view areas in the finished Work.
 3. Colors shall be provided as specified in the Room Finish Schedule.
 4. Manufacturer's of "or equal" material shall provide exactly the same product specifications, colors, pattern, texture and other features as the specified manufacturer.
- C. Requirements of Regulatory Agencies: Wherever a fire-hazard classification is shown or scheduled for wallcovering, provide wallcovering which complies with the Uniform Building Code.
- D. Job Mock-Up: Install test panels for full-width and corner applications including finish areas designated by ENGINEER. Test panels accepted by ENGINEER will be used as the standard of comparison for the Work. Replace test panels which are not acceptable to ENGINEER until satisfactory installation is achieved.
- E. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified.
1. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.
 2. ASTM E 84, Surface Burning Characteristics of Building Materials.
 3. Federal Specification, FS CCC-W-408, Wallcovering, Vinyl-Coated.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of each type of wallcovering, and moldings, with samples mounted on hardboard backing. Submit 12-inch square samples to illustrate the range of color and pattern variation. Include finished materials as required. Review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval copies of each manufacturer's technical data and installation instructions for each type of wallcovering and installation materials.
- C. Maintenance Instructions; Vinyl Wallcovering: Submit for approval copies of the vinyl wallcovering manufacturer's printed instructions for maintenance of the installed work. Include name of manufacturer, material brand name, color and texture designation, and precautions for the use of cleaning materials and methods which could damage the wallcovering.
- D. Maintenance Materials: After completion of Work, deliver to the project site not less than 5 lineal yards of each type, color, and pattern of wallcovering installed.
 - 1. Furnish replacement materials from the same manufactured sequence as the materials installed.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Deliver materials to the project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire hazard classification.
- B. Storage of Materials: Store materials in original undamaged packages or containers. Do not store wallcovering fabric in an upright position. Maintain temperature in storage area above 40 F.

1.5 JOB CONDITIONS

- A. Environmental Conditions: Maintain a constant minimum temperature of not less than 60 F. at areas of installation for at least 72 hours before, and 48 hours after the application of materials.
- B. Install specified materials only when normal temperature and humidity conditions approximate the interior conditions that will exist when the building is occupied.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fire Hazard Classification
 - 1. Provide materials bearing the UL label and marking, indicating the fire hazard classification of the wallcovering, as determined by ASTM E 84.
 - 2. Provide materials complying with the following U.L. fire hazard classifications:
 - a. Flame Spread: 15 maximum.
 - b. Fuel Contributed: 0.
 - c. Smoke Developed: 20 maximum.
- B. Vinyl Wallcovering
 - 1. Comply with FS CCC-W-408 for the type and class required, and as herein specified. Provide Class 2 mildew-resistant backing unless otherwise specified. Comply with the requirements of ASTM D 1308 for determining stain resistance.
 - a. Medium Duty: Type II; total weight not less than 16.7 ounces per square yard with minimum vinyl coating (less fabric) 14.3 ounces per square yard; Fabric: Osnaburg; 0.031 minimum thickness.
- C. Color and Pattern: A maximum of five colors selected from the complete selection of stock colorways of the Cezanne Vinyl Wallcovering Series.
- D. Product and Manufacturer: Provide one of the following:
 - 1. Cezanne Vicrtex wall coverings by L.E. Carpenter and Company.
 - 2. Or equal.
- E. Adhesive:
 - 1. Manufacturer's recommended adhesive, primer and sealer, manufactured expressly for use with the selected vinyl wallcovering. Provide materials which are mildew-resistant and nonstaining to the wallcovering.
- F. Metal Molding:
 - 1. Manufactured expressly for use with wallcovering of 6063 aluminum alloy, with fine satin mechanical finish. Provide a one-piece cap strip type with wall flange tapering to a feather-edge, with nail holes at 6 inches on center.
- G. Adhesive for Molding:
 - 1. Use a contact adhesive recommended by the manufacturer to firmly bond moldings to substrate materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine the areas and conditions under which vinyl wallcovering is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Remove wallcovering materials from its packaging and allow to acclimatize to the area of installation 24 hours before application.
- B. Remove switchplates, wall plates, and surface-mounted fixtures, where wallcovering is to be applied.
- C. Prime and seal substrates in accordance with the wallcovering manufacturer's recommendations for the type of substrate material to be covered.
 - 1. Gypsum wallboard preparation is included in Section 09250, Gypsum Wallboard.

3.3 INSTALLATION

- A. Metal Moldings:
 - 1. Provide vertical metal moldings for perimeter edging where fabric terminates at an exposed edge.
 - 2. Install metal moldings in longest practicable lengths, by nailing and cementing to the wall surfaces in accordance with the molding manufacturer's instructions. Prepare surface and apply contact adhesive in accordance with the contact adhesive manufacturer's instructions. Tightly butt end joints and miter corner joints.
- B. Wallcovering:
 - 1. Place wallcovering panels consecutively in the order they are cut from rolls, including filling of spaces above or below openings. Hang by reversing alternate strips except on match patterns.
 - 2. Apply adhesive to back of wallcovering and place in accordance with the manufacturer's instructions. Install seams vertically and plumb, and at least 6 inches away from any corner; horizontal seams will be permitted only where specifically indicated. Place wallcovering continuously over internal and external corners. Roll, brush, or use a broad knife to remove air bubbles, wrinkles, blisters and other defects. Cut wall covering evenly to the edges of the outlet box or support.
 - 3. Trim salvages as required to assure color uniformity and pattern match at seams.
 - 4. Remove excess adhesive along finished seams using warm water and a clean sponge, and wipe dry.
 - 5. Install wallcovering with an intimate substrate bond, smooth, clean, without wrinkles, gaps and overlaps.
 - 6. Replace removed plates and fixtures to verify cut edges of wallcovering are completely concealed.

3.4 ADJUSTMENT AND CLEANING

- A. Upon completion of Work, remove surplus materials, rubbish, and debris resulting from wallcovering installation and leave areas of Work in a neat, clean condition.

+ + END OF SECTION + +

SPECIALTIES

Division 10

SECTION 10100
CHALKBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all chalkboard and tackboard Work.
2. The location of chalkboards and tackboards is shown.
3. The types of chalkboard and tackboard Work required includes, but is not necessarily limited to, the following:
 - a. Dry marker boards.
 - b. Tackboards.
 - c. Chalkboards.
 - d. Chalkboard/Tackboard combination.
 - e. Bulletin board case.
 - f. Miscellaneous trim and mounting accessories.

1.2 QUALITY ASSURANCE

A. Source Quality Control:

1. Furnish all chalkboard and tackboard Work by one manufacturer for the entire project.
2. In addition to the requirements of these Specifications, comply with manufacturer's instructions and recommendations for all phases of the Work, including preparation of substrate, installation of grounds and anchors, and application of materials.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples for each type and color of chalkboard and tackboard Work including trim and accessories required. Provide 4-inch square samples of sheet materials and 4-inch lengths of trim members. ENGINEER'S review of samples will be for color, pattern and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for each type of chalkboard and tackboard unit. Include full-scale sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories and installation details.
 2. Manufacturer's technical data and installation instructions for each material and component part. Include methods of installation for each type of substrate to receive units. Transmit copy of each instruction to the installer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chalkboards: Provide the following:
1. Porcelain Enamelled Facing Sheet:
 - a. Nickel Cobalt Primer: 0.0025-inches thick, minimum.
 - b. Writing Surface: Vitreous porcelain enamel; 0.003-inch minimum thickness. Side opposite writing surface nickel cobalt ground coat 0.0025-inches minimum thickness with silica spray coat for lamination adhesion.
 - c. Panel edges at butt joints porcelain coated.
 - d. Total Finish Thickness: 0.0055-inches.
 - e. Face Sheet Steel: 18 gage minimum; especially manufactured enameling steel with low metalloids and copper content, chemically bathed and rinsed prior to enameling.
 - f. Colors: Complete selection of manufacturer's standard and custom colors. Manufacturer's of "or equal" materials shall supply exactly the same color selection as manufacturer specified. ENGINEER will select a maximum of three colors for the Work.
 - g. Reflectance Factor: 20 percent maximum; 15 percent minimum.
 2. Core Material:
 - a. Thickness: 1/2-inch minimum.
 - b. Material: Fiberboard.
 3. Panel Construction: Balanced, high-pressure laminated, 3-ply construction with facing sheet, core and moisture-proof backing.
 4. Panel Backing: 26 gage galvanized steel.
 5. Mounting: Concealed, continuous hanger bar support at top; angle clips at bottom.
 6. Size: 3 foot - 0 inches wide by 5 foot - 0 inches long.
 7. Product and Manufacturer: Provide one of the following:
 - a. AX Series Chalkboards by Greensteel Division of Adience Company.
 - b. Or equal.
- B. Tackboards: Provide the following:
1. Plastic Impregnated Cork Facing Sheet:
 - a. Seamless sheet, 1/4-inch thick with washable vinyl finish, of ground natural cork compressed with resinous binder and integral color throughout entire thickness and laminated to burlap backing.
 - b. Colors: Complete selection of manufacturer's standard and custom colors. Manufacturer's of "or equal" materials shall supply exactly the same color selections as manufacturer specified. ENGINEER will select a maximum of three colors for the Work.
 2. Core Material:
 - a. Thickness: 1/4-inch minimum.
 - b. Material: Hardboard.
 3. Panel Backing: 26 gage galvanized steel.
 4. Panel Construction: Balanced, high-pressure laminated, 3-ply construction with facing sheet, core and moisture-proof backing.
 5. Mounting: Concealed, clip angle support top and bottom.
 6. Size: 3 foot - 0 inches wide by 5 foot - 0 inches long.

7. Product and Manufacturer: Provide one of the following:
 - a. AX Series Tackboard with Tac-Tex Facing Sheet by Greensteel Division of Adience Company.
 - b. Or equal.

- C. Dry Marker Board: Provide the following:
 1. Porcelain Enameled Facing Sheet:
 - a. Nickel deposition coat of 2 grams per square foot.
 - b. Nickel cobalt primer of 0.0025-inches minimum thickness.
 - c. Dry marker surface coat of high-fired type porcelain frits of 0.0025-inch minimum thickness.
 - d. The side opposite the writing surface shall have two uniform coats as follows:
 - 1) Nickel deposition coat of 2 grams per square foot.
 - 2) Nickel cobalt ground coat of 0.0025-inch minimum thickness with a spray coat of silica for better lamination adhesion.
 - e. Color: Complete selection of manufacturer's standard and custom colors. Manufacturer's of "or equal" materials shall supply exactly the same color selections as manufacturer specified. ENGINEER will select a maximum of one color for the Work.
 2. Dry Markers: Five complete sets of one of each of four standard colors.
 3. Core Material:
 - a. Thickness: 1/2-inch minimum.
 - b. Material: Fiberboard.
 4. Panel Construction: Balanced, high-pressure laminated, 3-ply construction with facing sheet, core and moisture-proof backing.
 5. Mounting: Concealed, continuous hanger bar support at top; angle clips at bottom.
 6. Size: 4 foot - 0 inches wide by 8 foot - 0 inches long.
 7. Product and Manufacturer: Provide one of the following:
 - a. AX Series Markerboards by Greensteel Division of Adience Company.
 - b. Or equal.

- D. Chalkboard/Tackboard Combinations: Provide the following:
 1. Porcelain Enamel Facing Sheet: Same as 2.1.A.1. above.
 2. Tackboard Facing Sheet: Same as 2.1.B.1, above.
 3. Chalkboard Core Material: Same as 2.1.A.2. above.
 4. Tackboard Core Material: Same as 2.1.B.2. above.
 5. Size: 1 foot - 0 inches wide cork faced panel along entire top of assembly; 2 foot - 0 inch wide end panels on both sides of assembly; 4 foot - 0 inch wide porcelain enameled chalkboard panel at center of assembly. Total height if assembly shall be 5 foot - 0 inches. Total length of assembly shall be 8 foot - 0 inches.
 6. Product and Manufacturer: Provide one of the following:
 - a. AX Series Combination Chalkboard/Tackboard by Greensteel Division of Adience Company.
 - b. Or equal.

- E. Bulletin Board Case: Provide the following:
1. Case: Surface-mounted extruded aluminum 6063-T5 alloy with satin anodized clear finish. Continuous piano hinged case shall be provided with 1/4-inch safety glass front with heavy aluminum channel frame reinforcement. Door frame shall not rely on glass for rigidity and shall be equipped with lock, keys and elbow catch. The rear wall of the case shall be fitted with a tackboard panel as specified in 2.1.B.
 2. Size: 2 foot - 0 inches wide by 3 foot - 0 inches high.
 3. Product and Manufacturer: Provide one of the following:
 - a. B Series Bulletin Board Case by Greensteel Division of Adience Company.
 - b. Or equal.
- F. Trim and Accessories: Provide the following:
1. General: Fabricate frames and trim of not less than 0.062-inch thick aluminum alloy. Provide straight, single-length units wherever possible and keep joints to a minimum. Miter corners to a neat, hairline closure. Furnish exposed aluminum trim, accessories and fasteners with clear anodized finish AA-M31A31.
 - a. Provide manufacturer's deluxe wide-profile trim units, approximately 1-inch wide with cork inserts.
 - b. When structural support accessories are required for chalkboards and tackboard Work in addition to normal trim, provide such additional support or modify trim as required to provide necessary support.
 2. Chalktrough: Furnish continuous aluminum chalktroughs for each chalkboard, as follows:
 - a. Box type, with slanted front and cast aluminum end closures.

2.2 FABRICATION

- A. Assembly: Provide factory-assembled Work.
1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to the ENGINEER.
 2. Provide mullion trim at joints between chalkboard and tackboard.
 3. Provide manufacturer's standard vertical joint system between abutting sections of chalkboard.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR shall examine areas and conditions under which units are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until satisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install chalkboard and tackboard Work in locations specified and mounting heights as directed by ENGINEER and in accordance with the manufacturer's instructions. Provide all grounds, clips, backing materials, brackets and anchors, trim, and accessories for a complete installation.
- B. Deliver factory-built chalkboard and tackboard Work completely assembled in one piece without joints, whenever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length, as acceptable to ENGINEER. When overall dimensions require delivery in separate units, prefit at the factory, disassemble for delivery, and make final joint at a site. Use splines at joints to maintain surface alignment and smooth joints.
- C. Install units with concealed hangers plumb and level, in accordance with the manufacturer's printed instructions.
- D. Coordinate job-assembled units with grounds, trim and accessories. Join all parts with neat, precision fit.

+ + END OF SECTION + +

SECTION 10160

TOILET PARTITIONS AND URINAL SCREENS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all toilet partition and urinal screen Work.
2. The extent of the toilet partitions and urinal screens is shown.
3. The types of toilet partition and urinal screen Work required includes, but is not necessarily limited to, the following:
 - a. Floor supported, no headrail partitions.
 - b. Wall hung screens.
 - c. Privacy screens.
 - d. Miscellaneous fittings, fasteners, anchors and accessories.

B. Coordination:

1. Furnish inserts and anchoring devices which must be built into masonry and drywall for the installation of toilet partitions and related Work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
2. See concrete, masonry and gypsum wallboard sections of these Specifications for installation of inserts and anchorage devices.

C. Related Sections:

1. Section 04201, Unit Masonry Construction.
2. Section 09250, Gypsum Wallboard.
3. Section 09310, Ceramic Tile.
4. Section 10800, Toilet and Bath Accessories.

1.2 QUALITY ASSURANCE

A. Source Quality Control:

1. Take field measurements prior to preparation of Shop Drawings and fabrication, where possible, to ensure proper fitting of Work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the Work.
2. Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Requirements of Regulatory Agencies:

1. Codes: Comply with applicable provisions of the Uniform Building Code and ANSI A117.1.

- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
 - 1. ANSI A117.1, Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped.
 - 2. ASTM A 167, Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
 - 3. ASTM A 591, Electrolytic Zinc-Coated Steel Sheets.
 - 4. ASTM B 633, Electrodeposited Coatings of Zinc on Iron and Steel.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Shop Drawings for the fabrication and erection of toilet partition and urinal screen assemblies. Include plans and elevations at not less than 1 inch to 1 foot-0 inches scale. Show all anchorage and accessory items, and finishes. Provide location template drawings for bolt locations in supporting members.
 - 2. Manufacturer's detailed technical information and installation instructions. Include catalog cuts of hardware, anchors, fastenings, complete color charts and other data as required. Indicate by transmittal form that copy of each instruction has been distributed to the installer.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials:
 - 1. Deliver material in manufacturer's original unopened and undamaged packages.
 - 2. Clearly identify manufacturer, brand name, contents, color stock number, and order number on each package.
 - 3. Packages showing indications of damage that may affect condition of contents are not acceptable.
- B. Storage of Materials: Store in original packaging under protective cover and protect from damage.
- C. Handling of Materials: Handle materials in such manner as to prevent damage to products or finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on the finished units are not acceptable.
- B. Steel Sheets for Baked Enamel Finish: ASTM A 591, galvanized-bonderized, of the following minimum thicknesses:
 - 1. Pilasters, Unbraced: 16 gage.
 - 2. Panels: 20 gage.
 - 3. Doors: 22 gage.

4. Concealed Reinforcement for Anchorages: 12 gage.
 5. Concealed Reinforcement for Tapping: 14 gage.
- C. Galvanized steel concealed reinforcements: minimum thickness of 12 gage for anchorages and 14 gage for tapping.
- D. Door, Panel and Pilaster Core: Manufacturer's standard sound-deadening, double-faced honeycomb, impregnated Kraft paper core.
- E. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel, as follows:
1. Height: 3-inches.
 2. Thickness: Not less than 20 gage.
 3. Finish: To match hardware.
- F. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, as follows:
1. Type 302 formed stainless steel.
- G. Hardware and Accessories: Manufacturer's standard design, heavy duty operating hardware and accessories, as follows:
1. Stainless steel, with No. 4 bright directional polish finish.
- H. Anchorages and Fasteners: Provide manufacturer's standard exposed fasteners of stainless steel or brass, with finish to match hardware. Use theft-resistant, one-way, type heads and nuts for exposed anchorages.
1. For concealed anchors use hot-dip galvanized steel items.

2.2 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for the partition system, unless otherwise as shown or specified. Pressure laminate face sheets to core material with edges sealed with a continuous locking strip or lapping and formed edges. Miter and weld corners with welds ground smooth.
1. Provide concealed reinforcement for installation of hardware, fittings, brackets, and required accessories.
 - a. Internally reinforce partition panels for attachment of grab bars.
- B. Panel and Door Dimensions: Not less than 1-inch thick units. Provide 32-inch wide, swing out doors in wheelchair stalls, in accordance with ANSI A117.1.
- C. Floor Supported Pilasters: Not less than 1-1/4-inch thick units, with galvanized steel anchorage devices for securing to the floor. Furnish anchorage devices complete with threaded rods, lock washers, and leveling adjustment nuts. Provide shoes at each pilaster.
1. Product and Manufacturer: Provide one of the following:
 - a. Normandie by Sanymetal Products Company.
 - b. Series 500 by The Mills Company.
 - c. Or equal.

- D. Wall Hung Screens: Not less than 1-inch thick panel units, size as shown or specified, of same construction and finish as doors and panels. Provide extra heavy stirrups for securing to walls.
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Type C by Sanymetal Products Company.
 - b. Model 2 by The Mills Company.
 - c. Or equal.
- E. Privacy Screens: Same construction as the toilet partitions.
- F. Hardware and Accessories: Provide for each door in the partition system, as follows:
 - 1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide spring-action cam type, to comply with manufacturer's recommendations.
 - 2. Latch and Keeper: Recessed latch unit, with combination rubber faced door strike and keeper. Provide latch unit which has capabilities for emergency access.
 - 3. Coat Hook: Manufacturer's standard unit.
 - 4. Door Pulls: Manufacturer's standard unit.
 - 5. Push Plate: Surface mounted, for entrance screen unit door only.
 - 6. Reinforcing: Reinforce internally partitions receiving grab bars.
 - 7. International handicapped symbol on handicapped stall doors.
- G. Baked Enamel Finish: After fabrication and before applying enamel coating system, clean the galvanized steel surfaces to remove processing compounds, oils and other contaminants.
 - 1. Pretreat the metal surfaces with a phosphate coating.
 - 2. Prime the metal with a baked-on rust-inhibiting primer.
 - 3. Apply two finish coats of thermosetting acrylic enamel, applied by the electrostatic process, and baked in accordance with the paint manufacturer's instructions. Apply materials to provide a minimum total of 1.5 mils dry film thickness.
 - 4. Provide complete selection of manufacturer's standard and custom colors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which toilet partitions and related items are to be installed. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion on the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner to ENGINEER.

3.2 INSTALLATION

- A. General: Install partitions rigid, straight, plumb and level, with the panels laid out as shown. Provide clearances of not more than 1/2 inch between pilasters and panels, and not more than 1 inch

between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of the panel. Locate wall brackets so that holes for wall anchorages occur in masonry or joints. Secure panels to supporting walls with manufacturer's recommended anchoring devices, as shown on final Shop Drawings or in manufacturer's instructions.

- B. Floor Supported Partitions: Secure pilasters to the supporting floor system with the specified anchorage device. Level, plumb and tighten the installation with the leveling device. Set tops of doors level with the tops of pilasters when the doors are in the closed position. Set pilaster units with anchorages having not less than 2 inch penetration into the supporting floor system.
- C. Hardware Adjustments: Adjust and lubricate hardware for proper operation after installation.
 - 1. Set hinges on inswing doors to hold doors open approximately 30 degrees from closed position when unlatched.
 - 2. Set hinges on outswing doors and entrance swing doors, if any, to return to the fully closed position.
- D. Wall Mounted Screens: Attach with heavy duty concealed anchoring devices, including wall channels, wall plates and studs as recommended by the manufacturer to suit the supporting wall construction. Set units in accordance with the manufacturer's instructions to provide support for the units and to resist lateral impact.

3.3 ADJUSTMENT AND CLEANING

- A. Perform all final adjustments to pilaster leveling devices, door hardware, and other operating parts of the partition assembly just prior to final inspection. Clean exposed surfaces of partitions, hardware, fittings and accessories and touch up minor scratches and other finish imperfections using materials and methods recommended by the partition manufacturer.
- B. Protect units during delivery, storage, and after erection so that there will be no indication of use or damage at the time of Final Acceptance. Replace damaged Work as directed.

+ + END OF SECTION + +

SECTION 10200
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all louvers and vent Work.
 2. The extent of louvers and vents is shown.
 3. The types of louvers and vent Work required includes, but is not necessarily limited to, the following:
 - a. 6-inch drainable blade fixed louvers.
 - b. 6-inch dual combination drainable blade motor operable louvers.
 - c. Sill extensions and other miscellaneous trim, fasteners, blank-off panels and other accessories.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the louvers and vent Work.
 2. Coordinate louver selections with Section 15933, Automatic Temperature Controls.
- C. Related Sections:
1. Section 15933, Automatic Temperature Controls (for actuators for operable louvers).

1.2 QUALITY ASSURANCE

- A. Design Criteria: Comply with Sheet Metal and Air Conditioning Contractor's National Association, Architectural Sheet Metal Manual, recommendations for fabrication, construction details, and installation procedures, except as otherwise shown or specified.
- B. Source Quality Control: Verify size, location and placement of louver units prior to fabrication, wherever possible. Coordinate field measurements and Shop Drawings with fabrication and shop assembly to minimize field adjustments, splicing, mechanical joints and field assembly of units. Preassemble units in as large sections as practicable.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following except as otherwise shown or specified.
1. ASTM B 117, Salt Spray (Fog) Testing.
 2. ASTM D 523, Specular Gloss.
 3. ASTM D 659, Evaluating Degree of Resistance to Chalking of Exterior Paints.
 4. ASTM D 1308, Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

5. ASTM D 1737, Elongation of Attached Organic Coatings with Cylindrical Mandrel Apparatus.
6. ASTM D 2244, Color Differences of Opaque Materials.
7. ASTM D 2247, Coated Metal Specimens at 100 Percent Relative Humidity.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
 1. 12-inch by 12-inch corner section of each louver specified with specified finish.
 2. ENGINEER'S review will be for color, general appearance and workmanship only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
 1. Shop Drawings for the fabrication and erection of louver and vent assemblies. Include details of sections and connections. Show anchorage and accessory items.
 2. Copies of manufacturer's technical data including free area, air infiltration, anchor details and installation instructions including finishing products.
 3. Manufacturer's written guarantees as specified.

1.4 GUARANTEE

- A. Provide written guarantee agreeing to replace louver and vent Work which fail in materials or workmanship within 3 years of the date of Final acceptance. Failure of materials or workmanship shall include, but is not limited to, excessive leakage or air infiltration, excessive deflections, deterioration of finish or metal in excess of normal weathering, and defects in accessories, weatherstripping, and other components of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Sheet: ASTM B 209, 5005 with temper as required for forming, or as otherwise recommended by the metal producer to provide the required finish.
- B. Aluminum Extrusions: ASTM B 221, Alloy 6063-T52.
- C. Fastenings: Use same material as items fabricated. Provide types, gages and lengths to suit unit installation conditions. Use Phillips flat-head machine screws for exposed fasteners, unless otherwise specified. Use continuous aluminum closure angles on the inside perimeter frame of all louver and vent Work, finished to match louvers and vents.
- D. Anchors and Inserts: Use stainless expansion bolt devices for drilled-in-place anchors.

- E. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).
- F. Blank-Off Panels: Provide 16 gage aluminum sheet with A42 Dark Bronze anodized finish. Provide stainless steel fasteners, 12 inches on centers.

2.2 DUAL COMBINATION LOUVERS

- A. Furnish 6-inch electrically operable drainable blade dual combination louvers at all locations where operable louvers are shown. Furnish manufacturer's recommended bearings and operating mechanisms to suit the louver sizes and method of operation.
- B. Air Leakage: Do not exceed 3.5 cubic foot per minute per square foot at a static pressure of 0.5-inch of water gage.
- C. Provide all drainable operable blades 0.125-inch thick pivoted with two reinforcing bosses and 1/2-inch diameter zamac alloy pinions operating in self-lubricating nylon bearings. Drainable fixed blades shall be 0.081-inches thick with front lip gutter and recessed second gutter, both of which direct water to jamb and mullion drains. Mullions shall be of the sliding interlock type with integral drainage profile. All louver blades shall have vinyl gaskets on all edges and shall be operated by concealed drive arms at each jamb and assembled with aluminum shoulder rivets. Head, sill and jambs shall be one piece structural members with integral calking strips and retaining beads.
- D. Provide closed cell polyvinylchloride compression gaskets between bottom of mullion and jamb and top of sill to insure leak tight connections.
- E. Provide head, sill, and jamb of one piece structural member with integral calking strips and retaining beads.
- F. Provide louver supports designed to carry 30 pounds per square foot wind load.
- G. Product and Manufacturer: Provide one of the following:
 - 1. No. 6967 by Construction Specialties, Incorporated.
 - 2. Or equal.

2.3 FIXED LOUVERS

- A. Furnish 6-inch fixed drainable blade louvers where shown. Drainable blades shall incorporate a front lip gutter and recessed second gutter, both of which direct water to jamb and mullion drains.
- B. Free Area Velocity: Maximum 960 feet per minute free area velocity at a pressure drop of not more than 0.17-inches water gage carrying less than 0.001 ounces of water per square foot of free area.
- C. Provide all drainable blades 0.081-inch thick. Frame shall be 0.125-inches thick. Mullions shall be of the sliding interlock type with integral drainage profile.

- D. Provide AMCA test data to show a 4 foot by 4 foot unit to have a minimum of 7.3 square feet free area.
- E. Provide louver supports designed to carry 30 pounds per square foot wind load.
- F. Install gravity backdraft damper and louver screen behind the louver.
- G. Product and Manufacturer: Provide one of the following:
 - 1. No. 6157 by Construction Specialties, Incorporated.
 - 2. Or equal.

2.4 FINISHES

- A. Exposed Aluminum Polyvinylidene Fluoride Based Coating: Apply full strength polyvinylidene fluoride based coatings at the factory by coil coating for sheet material and spray coating for extruded material. Provide the following three coat system complying with the following:
 - 1. Alkali clean and hot water rinse all surfaces to receive polyvinylidene fluoride based finish.
 - 2. Prepare a chemical conversion coating on the surface, using phosphates or chromates followed by a cold water rinse. Seal with a chromic acid rinse and dry, except where manufacturer recommends another method to achieve greater coating reliability.
 - 3. Apply a base prime coat of epoxy paint to the prepared surface in its coil form, by reverse roller coating. Fully cure in a gas-fired oven to a dry film thickness of 0.2 - 0.4 mils.
 - 4. Apply color coat over the primer by roller coating for coil material and airless or Ransburg Elastostatic Hand Spray for extrusions and fuse at a peak metal temperature of 440 F for a dry film thickness of 0.7 mils for coil coating and 1.2 mils for spray coating.
 - 5. Apply clear fluoropolymer topcoat to provide a dry film thickness of 0.4-0.8 mils. The entire three coat system shall have a dry film thickness of 1.6 mils minimum.
 - 6. Provide the following physical properties, as proven by appropriate and recognized laboratory test methods acceptable to ENGINEER:
 - a. Weathering, ASTM D 659: Chalking, not more than No. 8, after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - b. Color Change, ASTM D 2244: No greater than 5 N.B.S units after removal of external deposits and after exposure for 5000 hours in Sunshine Arc Weatherometer XWR using 60/60 cycle.
 - c. Humidity Resistance, ASTM D 2247; few scattered blisters no larger than ASTM No. 4, after 1000 hours.
 - d. Salt Spray, ASTM B 117: Few scattered blisters no larger than ASTM No. 4, and no more than 1/16 inch creep from areas scribed to bare metal after 500 hours.
 - e. Dry Adhesion: No pick-off when tape tested over 1/16 inch cross hatch.
 - f. Wet Adhesion: No pick-off when tape tested over 1/16 inch cross hatch; extruded material only.

- g. Boiling Water Adhesion: No pick-off when tape tested over cross hatch area after 1 hour immersion in distilled boiling water.
- h. Water Immersion: No pick-off when tape tested over cross hatch area after immersion in aerated distilled water 80 ±10F after 500 hours.
- i. Abrasion Resistance, ASTM D 968: Coefficient of abrasion of 67 minimum.
- j. Gloss, ASTM D 523: 30±5 reflectivity at 60 F.
- k. Pencil Hardness: HB-H minimum.
- l. Dry Film Thickness: Primer, 0.2-0.4 mils, polyvinylidene fluoride color coating, 0.7-1.5 mils; clear top coat, 0.4-0.8 mils.
- m. Solvent Resistance: 100 Double MEK rubs minimum.
- n. Flexibility, ASTM D 1737: No cracking prior to metal fracture.
- o. Acid Resistance, ASTM D 1308: 16 hour spot test with 5% hydrochloric acid - no effect.
- p. Alkali Resistance, ASTM D 1308: 16 hour spot test with 5% sodium hydroxide - no effect.

B. Product and Manufacturer: Provide one of the following:

- 1. Kynar 500 TRI-X by DeSoto Incorporated.
- 2. Duranar XL by PPG Industries, Incorporated.
- 3. Or equal.

C. Provide the following colors:

- 1. Fixed and Operable Louvers, Sill Extensions and Continuous Closure Angles: All Components: Metallic Dark Bronze.
- 2. Exposed Fasteners: Color and finish to match substrate.

2.5 LOUVER SCREENS

- A. Provide removable screens for all louvers.
- B. Fabricate screen frames of the same metal and finish as the louver units to which secured. Provide frames consisting of extra heavy duty extruded 0.090-inch aluminum for permanently securing screen mesh. Frames shall be rewirable.
- C. Use insect screen of 18 by 14 mesh, 0.0123-inch diameter stainless steel intercrimp wire.
- D. Locate screens on inside face of louvers. Secure screens to louver frames with machine screws, spaced at each corner and at 12 inches on centers.
- E. Provide minimum No. 8 stainless steel metal screws unless larger screws are required by screen size.
- F. Provide cross bar screen reinforcement of same material and finish as louver which subdivides screens into maximum area of 50 square feet.

2.6 SILL EXTENSION

- A. Gage and Finish: Same as louver.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which louvers and vent Work and associated items are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

- A. Coordinate setting drawings, diagrams, templates, instructions and directions for the installation of anchorages which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items to the project site.

3.3 INSTALLATION

- A. Locate and place louver units plumb, level and in proper alignment with adjacent work.
- B. Use stainless steel expansion bolt anchors with stainless steel washers and neoprene gaskets. Use spring clips at all anchors to stop deflection of the louver frame. Provide anchors spaced 2 feet-0 inches on centers. Provide continuous aluminum angles for anchoring all operable louvers.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers, as shown.
- D. Repair finishes damaged by cutting, welding, soldering and grinding operations required for fitting and jointing. Restore finishes and prime coats of paint so that there is no evidence of corrective Work. Return items which cannot be refinished in the field to the shop, make the required alterations, and refinish the entire unit, or provide new units, as determined by ENGINEER.
- E. Protect non-ferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry or dissimilar metals.
- F. Provide aluminum sheet frames of same color and finish as louvers around all louver frames projecting beyond the masonry walls on the interior, and install as the Work progresses to make the installations weathertight.

3.4 FIELD QUALITY CONTROL

- A. Determine conformity of louver and vent finish to the specifications as follows:
 - 1. The manufacturer of the louver and vent shall set aside and label samples of the metal from each production lot for the job. Protect samples from weather.
 - 2. Make sample louver and vent available at all times, for comparison with installed louver and vent Work as requested by OWNER, for the full time of the warranty.
 - 3. Make color comparison measurements with a Hunter Tristimulus Color Difference Meter employing methods of computation in use at the National Bureau of Standards conforming to ASTM D 2224.

3.5 ADJUSTMENT AND CLEANING

- A. Set adjustable louver blades for uniform alignment in open and closed positions.
- B. Adjust louvers so moving parts operate smoothly.
- C. Check the motor operator installation for the operable louver.

+ + END OF SECTION + +

SECTION 10283
PROJECTION SCREENS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all project screen Work.
 2. The extent of projection screens is shown and specified.
 3. The types of project screen Work required includes, but is not necessarily limited to, the following:
 - a. Electrically operated ceiling recessed heavy duty projection screen.
 - b. Miscellaneous brackets, fasteners, and other accessories.
 - c. Glass beaded screen viewing surface.
 - d. Separate ball bearing permanently lubricated gear reduction motor and starter.
- B. Coordination:
1. Review installation procedures under other Sections and coordinate them with the Work specified herein.
 2. Furnish inserts and anchoring devices which must be built into masonry, concrete and gypsum wallboard ceilings for the installation of projection screen Work. Provide setting diagrams, template, instruction and directions for installation of anchorage devices.
- C. Related Sections:
1. Section 09250, Gypsum Wallboard.
 2. Section 16122, 600 volt Cable.

1.2 QUALITY CONTROL

- A. Source Quality Control: Provide projection screen Work as a complete unit produced by a single manufacturer, including necessary mounting brackets, accessories, fittings and fastenings.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications and installation instruction for the projection screen Work.
 2. Detailed, dimensioned Shop Drawings showing all motors, mounting, and wiring diagrams.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not deliver projection screen Work until building is enclosed and ready for projection screen installation Work.

- B. Protect projection screen Work from damage during delivery, handling, storage and installation.

PART 2 - PRODUCTS

2.1 ELECTRICALLY OPERATED CEILING RECESSED HEAVY-DUTY PROJECTION SCREENS

- A. Provide projection screen units completely housed in a metal-lined wood case, listed by UL and bearing re-examination markers of UL. Mount top of screen fabric to metal roller, with roller supported on brackets with self-aligning bearings.
- B. Wood Case: Metal -lined motor compartment, with hinged or removable access panel to motor compartment, electrical outlet box and finished with manufacturer's standard prime coat. Equip case with hinged bottom connected to drive mechanism for automatic opening and closing with raising and lowering of screen surface. Mount hinges to allow alignment of bottom panel to adjacent ceiling surface.
- C. Motor Unit: 115 Volt, 60 Hertz, 3.5 amperes; size and capacity recommended by the projection screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection, and preset limit switches to automatically stop screen in "up" and "down" position. Provide a 3-button remote control switch ("up", "down", and "stop") in a box with cover plate for flush wall-mounting. Stop action to be positive to prevent coasting.
- D. Screen Fabric: Manufacturer's standard, flame and mildew-resistant, as follows:
 - 1. Glass-beaded with chemical coating.
 - 2. Size: 70-inches by 70-inches.
 - 3. Specified Manufacturer's Mounting: Type 1.
- E. Product and Manufacturer: Provide the following:
 - 1. Executive Electrol Automatic Projection Screen by Da-Lite Screen Company.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates and conditions under which the Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install projection screen Work at the locations shown in accordance with the manufacturer's instructions. Install level, plumb, secure,

and at the proper height. Cooperate with other trades for securing projection screen units to finished surfaces. Repair or replace damaged units as directed by ENGINEER.

- B. Provide protections for installed units so that they will be in perfect operating condition, without damage at time of Final Acceptance.

+ + END OF SECTION + +

SECTION 10350

FLAGPOLE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope: This section provides specifications for the aluminum flagpole, complete with all accessories, and concrete base.
- B. Type: The flagpole shall be ground set, cone tapered type, standard pattern.

1.2 QUALITY ASSURANCE

- A. The flagpole and accessories shall be as manufactured by American Flagpole Co., Baarpol Co., Babcock-David Associates, Acme Flagpole, Co., AABEC Pole, Hortie-Van Manufacturing, or equivalent.

1.3 SUBMITTALS

- A. Submittals shall comply with applicable paragraphs of Division 1. Within 180 days after award of contract, the contractor shall submit for the ENGINEER'S review Shop Drawings showing cross sections and the installation details, and manufacturer's brochures for specified flagpole and accessories.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Height: The flagpole shall have an exposed height of 30 feet above ground, and an embedded length of 3 feet.
- B. Dimensions: Dimensions, including wall thickness, shall be approved manufacturer's standard for the material, type, pattern, and pole height specified.
- C. Finish: Finish on all aluminum shall be duranodic No. 313 Dark Bronze Anodized Architectural Class I coating.

2.2 MATERIALS AND FABRICATION

- A. Flagpole:
 - 1. The flagpole shall consist of a straight butt section and a uniformly straight tapered section, in accordance with manufacturer's standard for height and pattern specified.
 - 2. Pole shall be machine made from 6063-T6 seamless extruded aluminum tubing. Tubing made from rolled plate with welded seam is not acceptable.
 - 3. Pole shall have a smooth uninterrupted finish without visible joints or offsets.

4. The flagpole shall be fabricated and shipped in a single piece. No field joints will be allowed.
- B. Painting: The unexposed portion of flagpole below ground shall receive a heavy shop coat of black asphaltic paint, inside and outside, before shipment.
- C. Fittings:
1. Ball: The final shall be a 5-inch diameter aluminum ball, having a flush seam, and mounted on 5/8-inch diameter dural rod attached to truck.
 2. Truck: The truck shall be manufacturer's standard ball bearing, non-fouling truck, with aluminum body revolving on aluminum spindle, with ballrace containing approximately 26-1/4 inch stainless steel balls. Truck shall have two (2) 2-3/8 inch nylon bushed aluminum sheaves, rotating on 3/8-inch dural pins.
 3. Cleats: Two (2) 9-inch cast aluminum cleats shall be provided, each attached to the pole with two (2) 5/16-inch flat head dural machine screws.
 4. Halyards: Two (2) 5/16-inch diameter No. 10 white braided polypropylene rope halyards shall be provided, each with two (2) white vinyl covered bronze shaps for securing to flap.
 5. Foundation Tube: A 16 -gauge galvanized corrugated steel tube shall be provided, length and diameter for size. Welded steel bottom plate shall be provided, lower welded steel internal centering wedges, steel lightning ground spike and steel plate support, all galvanized and as detailed.
- D. Wrapping: Before shipment, pole shall be heavily spiral-wrapped with waterproof polyethylene, and properly packaged for protection of pole and finish during transit.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Concrete for footings shall be mixed and proportioned as specified under Concrete Section, to develop an ultimate 28-day compressive strength of 2000 psi.
- B. The Sleeve shall be cast in concrete.
- C. The Pole shall be set in a sleeve and carefully plumbed by removable wedges at the top of the sleeve. Space between pole and sleeve shall be filled with screened dry sand to within inches of the top of the sleeve and tamped solidly in place. The upper 4 inches shall be dry packed with concrete. Poles shall be braced and protected from movement for not less than seven (7) days after erecting.

+ + END OF SECTION + +

SECTION 10400
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals, as shown, specified and required to furnish and install all identification device Work.
2. The extent of identification devices is specified herein and shown.
3. The type of identification device Work includes, but is not necessarily limited to, the following:
 - a. Self-luminous exit signs.
 - b. Fire extinguisher location signs.
 - c. Interior room identification signs.
 - d. Dedication plaque.
 - e. Exterior building identification signs.
 - f. Cast oxidized bronze individual cast letters.
 - g. Plant entry and site direction and information signs.
 - h. Right-to-know labels and tags.
 - i. Miscellaneous fasteners and supports.

1.2 QUALITY ASSURANCE

- A. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication, where possible, to ensure proper fitting of the Work.
- B. Inserts and Anchorages:
 1. Furnish inserts and mechanical anchoring devices for the installation of identification devices and related Work.
 2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
- C. Shop Assembly: Preassemble items in the shop to the greatest extent possible. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.3 SUBMITTALS

- A. Samples: Submit for approval samples of each color and finish of exposed materials and accessories required for identification devices. ENGINEER'S review of samples will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of CONTRACTOR.

- B. Shop Drawings: Submit for approval the following:
1. Shop Drawings for fabrication and erection of identification devices. Include plans, elevations, and full-size graphic layout. Show anchorages and accessory items. Furnish location template drawings for items supported or anchored to permanent construction.
 2. Copies of manufacturer's technical data and installation instructions for each type of device required.
 3. Complete selection of specified manufacturer's standard and custom colors.
 4. Plans showing location of all required exit signs with information indicating mounting position, location and substrate. Coordinate location of exit signs for non-interference with other Work as required by governing building code.

PART 2 - PRODUCTS

2.1 SELF-LUMINOUS EXIT SIGNS

- A. Provide self-luminous exit signs. Sign housing shall consist of an A42 color anodized extruded aluminum frame. The size, graphics and background color of the sign legend shall conform to all relevant code requirements. The legend shall be protected by a temper-resistant acrylic shield.
- B. Lumination for exit signs shall be provided by sealed phosphor-coated tubes containing tritium located directly behind each portion of each letter. The tritium light sources shall be housed in a single impact resistant module.
- C. Signs shall be listed by Underwriters Laboratories as being capable of providing a 10-15 year service life.
- D. Mount exit signs in locations shown. Surface mount signs above all exit doors unless otherwise shown. Provide manufacturer's standard universal mounting bracket.
- E. Product and Manufacturer: Provide one of the following:
1. Everglo Signs by Self Powered Lighting Incorporated.
 2. Isolite Model 2040-01 Signs by Safety Light Corporation.
 3. Or equal.

2.2 FIRE EXTINGUISHER LOCATION SIGNS AND INTERIOR ROOM IDENTIFICATION SIGNS

- A. Material: Subsurface silkscreened graphics on a transparent acrylic sheet, 0.08-inches thick with Helvetica Medium alphabet and matching arrows type face. Provide 2-inch high upper case letters and 1-inch high lower case letters.
- B. Fire Extinguisher Identification Sign: Provide 15-inch by 15-inch with square corners, unframed. Provide one for each surface mounted fire extinguisher. Background color red with white lettering. Sign shall incorporate a directional arrow as located by ENGINEER.

- C. Room Identification Signs: Provide 15-inch by 15-inch with square corners, unframed. Colored background with white lettering. Provide one sign for each door shown. Use room names shown to determine extent of graphics.
- D. Chemical Area Identification Signs:
1. Provide Safety signs for the following chemical areas as noted on the plans:
 - a. Chemical Building.
 - b. Chemical Bulk Storage Area.
 - c. Chemical Waste Tank Containment Area.
 - d. Pump Mixer Vault.
 - e. Chemical Piping Yard Vaults and Manholes.
 - f. Emergency Chlorine Scrubber Area.
 - g. Paint and Oil Storage Area.
 2. Safety signs shall comply with the following standards.
 - a. Occupational Safety and Health Administration (OSHA), Standards for General Industry, Subparts 1910.200 Hazard Communication (July, 1986).
 - b. National Fire Protection Association (NFPA) Standard No. 704 - Label System.
 - c. Uniform Fire Code, Latest Edition.
 - d. Uniform fire Code Standard 79-3.
 3. Safety signs shall be of height and width required by layout and shall be formed from semi-rigid butyrate, polyethylene or fiberglass compatible with chemicals being handled. They shall be attached with four stainless steel screws or anchor bolts as required for substrate. Lettering shall be 3-inch high and 1/2-inch in stroke.
 4. Safety signs shall conform to the following schedule:

SAFETY SIGN NUMBER	WORDING	AREA/ LOCATION	BACKGROUND COLOR	LETTER COLOR
1	"Caution Caustic Soda (Sodium Hydroxide) Protective Clothing Required Avoid Skin Contact"	Caustic Bulk Storage Caustic Room Emergency Scrubber Fill Station	Yellow	Black
2	"Caution Fluoride (HF) (Fluosilicic Acid) Protective Clothing Required Avoid Skin Contact Avoid Fumes"	Fluoride Bulk Storage Fluoride Day Tanks Fill Station	Yellow	Black
3	"Caution Sulfuric Acid Protective Clothing Required Avoid Skin Contact Avoid Fumes"	Sulfuric Acid Bulk Storage Sulfuric Day Tanks Fill Station	Yellow	Black
4	"Polymer Storage"	Polymer Bulk Storage Polymer Day Tank	Yellow	Black
5	"Caution Hazardous Chemicals Area Protective Clothing Required Avoid Skin Contact Avoid Fumes"	Yard Chemical Vaults Yard Manholes Fill Station Chem. Bldg. Chem. Bulk Storage	Yellow	Black
6	"Caution Alum (Aluminum Sulfate) Protective Clothing Required Avoid Skin Contact"	Alum Bulk Storage Alum Day Tanks Fill Station	Yellow	Black
7	"Caution Chlorine"	Chlorine Room Chlorine Storage Emergency Scrubber	Yellow	Black
8	"No Smoking Within 25 Feet"	As shown on the Plans	White	Black
9	"Safety Shower/Eyewash"	As shown on the Plans	Green	White
10	"Caution Slippery When Wet"	As shown on the Plans	Yellow	Black
11	"Caution Hearing Protection Required"	As shown on the Plans	White	Black
12	"Caution 480 Volts"	MS-3 next to Plant II Filters (on doors) Chemical Building Control Room Doors	White	Black/ Red
13	"Caution 4160 Volts"	Lincoln/Sunnyslope P.S. (on doors) Main Switchgear Building (on doors)	White	Black/ Red

SAFETY SIGN NUMBER	WORDING	AREA/ LOCATION	BACKGROUND COLOR	LETTER COLOR
14	"Caution - Automatic Equipment May Start at Anytime."	1). Each Chemical day tank area Chemical Building 2). Compressor Room Chemical Building 3). Each Chemical Bulk Storage area 4). At each pump a). Raw Water pump station b). Lincoln/Sunnyslope pump station c). Backwash pump station 5). Cross Collector & Longitudinal Collector	White	Black

5. Fire/Safety Placards and Label Notes
 - a. Provide diamond shaped placards - 12 inches square. The placard provides recognition information in a number of ways:
 - 1) The colored background
 - 2) The symbol at the top;
 - 3) The United Nations hazard class number at the bottom; and
 - 4) The hazard class wording or the identification number in the center.
 - i. Color:
 - orange indicates explosive;
 - red indicates flammable;
 - green indicates nonflammable;
 - yellow indicates oxidizing material;
 - white indicates poisonous material;
 - white with vertical red stripes indicates flammable solid;
 - yellow over white indicates radioactive material; and
 - white over black indicates corrosive material.
 - ii. Symbols:
 - the bursting ball symbol indicates explosive;
 - the flame symbol indicates flammable;
 - the slash W (--) indicates dangerous when wet;
 - the skull and crossbones indicates poisonous material;
 - the circle with the flame indicates oxidizing material;
 - the cylinder indicates nonflammable gas;
 - the cylinder indicates nonflammable gas;
 - the propeller indicates radioactive;
 - the test tube/hand/metal symbol indicates corrosive; and
 - the word Empty indicates that the product has been removed, but a harmful residue may still be present.
 - iii. United Nations Hazard Class Numbers:
 - 1 - Explosives
 - 2 - Gases
 - 3 - Flammable Liquids
 - 4 - Flammable Solids
 - 5 - Oxidizing Substances
 - 6 - Poisonous and Infectious Substances
 - 7 - Radioactive Substances
 - 8 - Corrosive Substances
 - 9 - Miscellaneous Dangerous Substances
 - iv. Hazard Class or Identification Number
 - b. Provide safety placards and fire protection placards in accordance with the following schedule:

HAZARDOUS MATERIALS SAFETY PLACARD SCHEDULE

SAFETY PLACARD NUMBER	PLACARD WORDING	UN CLASS NUMBER	PLACARD SYMBOL	BACKGROUND COLOR	LETTER/SYMBOL COLOR	AREA/LOCATION
1	Chlorine	2	Skull and Cross Bones	White	Black	Chlorine Room Chlorine Storage Emergency Scrubber Chemical Building
2	Oxidizer	5.1	Circle with Flame	Yellow	Black	Sulfuric Acid Bulk Storage Sulfuric Acid Day Tanks Chlorine Room Chlorine Storage
3	Corrosive	8	Test Tube/Hand/Metal	White (top half) Black (bottom half)	White/ Black	Sulfuric Acid Bulk Storage Sulfuric Acid Day Tanks Fluoride Bulk Storage Fluoride Day Tanks Alum Bulk Storage Alum Day Tanks
4	Flammable Gas	2	Flame	Red	White	Admin. Bldg. Gas Storage Room

(1) Safety Placards shall conform to NFPA Standard No. 704 and nationally recognized symbols.

HAZARDOUS MATERIAL FIRE PROTECTION PLACARD SCHEDULE

FIRE PROTECTION PLACARD NUMBER	MATERIAL	HEALTH	FLAMMABILITY	REACTIVITY	SYMBOL
1	Fluoride (HF) (Fluosilicic Acid) Alum (Aluminum Sulfate)	3	0	0	Test Tube/Hand/Metal
2	Caustic Soda (Sodium Hydroxide)	3	0	1	Test Tube/Hand/Metal
3	Sulfuric Acid	3	0	2	Slash W
4	Chlorine	4	2	1	Circle with Flame
5	Chlorine	4	2	1	Skull and Crossbones

Notes:

- (1) Placards shall conform to NFPA Standard NO. 704 and UFC Standard No. 79-3.
- (2) Placards shall be located adjacent to chemical handling areas as shown on the plans.

- 6. Manufacturer: Provide chemical safety signs, safety placards and fire protection placards manufactured by one of the following
 - a. W.H. Brady Company.
 - b. Seton Name Plate Corp.
 - c. Or equal.

- E. Product and Manufacturer: Provide one of the following:
 - 1. ASI/SPE MH (Four Corners) Plaque by ASI Sign Systems, Incorporated.
 - 2. Or equal.

2.3 DEDICATION PLAQUE

- A. Cast bronze, 83-4-6-7 alloy, 24-inches wide by 30-inches high with a raised flat border ornamental rosette screwhead covers and raised Times New Roman alphabet. In general, four sizes of letters shall be used to insure a symmetrical, well spaced tablet. These shall be generally as follows: City of Phoenix and Date - 7/8-inch; (NAME) Water Treatment Plant - 1/2-inch; Names and Companies - 7/16-inch; Title and Cities - 5/16-inch. The general arrangement shall be as follows:

CITY OF PHOENIX

(NAME OF FACILITY)

MAYOR

(Name)

CITY COUNCIL

(Name) , VICE-MAYOR
 (Name)
 (Name)

(Name)
 (Name)
 (Name)

DIRECTOR OF PUBLIC UTILITIES

(Name)

ASST. DIRECTOR OF PUBLIC UTILITIES

(Name)

CONSULTING ENGINEER AND ARCHITECT
 MALCOLM PIRNIE, INC.
 ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS
 PHOENIX, ARIZONA

CONTRACTOR

(Name)

(City)

199__

The specific arrangement of dedication plaque will be provided after award of Contract.

2.4 INDIVIDUAL CAST LETTERS

- A. Material: Oshalloy C83450; 88 percent copper, 2.5 percent tin, 2 percent lead, 6.5 percent zinc and 1 percent nickel; with a dark statuary bronze oxidized finish produced by an aqueous sulfide solution meeting NAAMM M42-C55-060.
- B. Number Style and Height: Provide 3-inch high, 3/8-inch deep Times New Roman type face.
- C. Mounting: Provide each letter with a minimum of two 4-inch long by 1/8-inch diameter threaded bronze studs.
- D. Provide the following signs:
 - 1. Administration Building.
 - 2. Maintenance Building.
 - 3. Reception.
- E. Product and Manufacturer: Provide one of the following:
 - 1. Cast Bronze Individual Letters by Matthews International Corporation.
 - 2. Or equal.

2.5 PLANT ENTRY AND SITE DIRECTION AND INFORMATION SIGNS

- A. Fiberglass sheets, 1/8-inch thick minimum, bonded to a extruded aluminum internal structure, to form a seamless monolithic sign panel. Provide the following:
 - 1. Posts: 4-inch diameter 6063-T52 alloy extruded aluminum round posts notched to receive sign panel. Provide posts height of 6 foot-0 inches above finished grade.
 - 2. Finish: 2 coats of colored polyurethane and one coat of clear polyurethane; factory applied to posts and sign panels. Provide complete selection of manufacturer's standard and custom colors.
 - 3. Graphics: Photo-mechanically incorporated utilizing an integral graphic process. Graphics to be furnished after award of Contract; approximately 100 letters per sign plus Phoenix City logo symbol.

4. Color: ENGINEER may select a maximum of 3 colors to be used in the Work, in addition to white and black. All three colors, in addition to white and black, will appear on each sign and city logo.
5. Quantity: Six signs to be located as directed by ENGINEER.
6. Sign Panel Size: 48-inches high by 72-inches long by 4-inches thick.
7. Letter Style: Times New Roman typeface with matching directional arrows.

- B. Product and Manufacturer: Provide one of the following:
1. 871 Series by ASI Sign Systems, Incorporated.
 2. Custom Site Signs by Andco Industries Corporation.

2.6 EXTERIOR BUILDING IDENTIFICATION SIGNS

- A. Material: Subsurface silkscreened graphics on 1/8-inch thick flat glass-reinforced polyester sheet. Provide 4-inch high Times New Roman alphabet; upper and lower case letters and matching arrow type face.
- B. Provide opaque white letters on opaque burnt sienna background with concealed flush mounted fasteners at each corner. Provide one hundred signs each 15-inches by 15-inches with 1/8-inch radiused corners; graphics to be furnished after award of Contract.
- C. Product and Manufacturer: Provide one of the following:
 1. GOF/MH Wall Mounted Signs by ASI Sign Systems, Incorporated.
 2. Or equal.

2.7 RIGHT-TO-KNOW LABELS AND TAGS

- A. Provide right-to-know target organ labels for each chemical storage tank. Provide right-to-know tags along chemical pipelines and fill pipes as specified.
- B. Right-to-know labels for storage tanks shall have adhesive backs and shall be provided with stick-on numbers/symbols and legends. Labels shall provide information such as chemical name and/or CAS number, fire and health hazard, reactivity, personal protection and target organ legends.
- C. Provide right-to-know tags for attaching to pipelines and fill lines. Locate tags at 25 feet maximum center to center distance within range on each side of through-wall pipe penetrations and as directed by ENGINEER. Tags shall be constructed of laminated plastic and furnished with nylon tie fasteners.
- D. Quantity:
 1. Right-to-know Labels: 250 labels minimum.
 2. Right-to-know Tags: As required based on criteria specified and installed lengths of pipelines and fill lines.

- E. Product and Manufacturer: Provide one of the following:
1. Right-to-know Labels and Style RTK-T2 Tags by Seton Name Plate Company.
 2. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the substrates and conditions under which the devices are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install identification devices and components at the locations shown or, if not shown, as directed by ENGINEER, securely mounted with concealed theft-resistant fasteners. Attach signs to substrates in accordance with the manufacturer's instructions, unless otherwise shown.
- B. Use stainless steel fasteners.
- C. 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 ENGINEER.

+ + END OF SECTION + +

SECTION 10500

LOCKERS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all locker Work.
1. The extent of lockers is shown.
 2. The types of locker Work required includes, but is not necessarily limited to, the following:
 - a. All welded, factory-assembled, heavy duty single-tier metal lockers.
 - b. Laminated maple benches.
 - c. Miscellaneous accessories, closures, identification labels and other components, trim and fasteners.
- B. Related Sections:
1. Section 03300, Cast-In-Place Concrete.
 2. Section 09310, Ceramic Tile.

1.2 QUALITY ASSURANCE

- A. Provide metal lockers as complete units produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.
- B. Color:
1. Provide locker units in color selected by ENGINEER from manufacturer's standard and custom colors. Minimum order requirements of the manufacturer shall not be acceptable cause by CONTRACTOR for rejection of ENGINEER'S color selection.
 2. Unless otherwise indicated, non-exposed surfaces may be manufacturer's standard neutral color as selected by ENGINEER.
 3. Where manufacturer requires a minimum order for either size, color, type, accessory, or custom Work, CONTRACTOR shall provide the lockers and benches as shown and specified herein taking into consideration all special requirements of the manufacturer. Minimum order requirements shall not be cause for rejection, by CONTRACTOR, of ENGINEER'S requirements specified herein.
 4. Manufacturer's of "or equal" products shall be able to supply exactly the same construction and color selections as the manufacturer's specified.

1.3 SUBMITTALS

- A. Samples: Submit samples, on metal, of each color and finish that are required for lockers. Review will be for color and texture only. Compliance with other requirements is the exclusive responsibility of CONTRACTOR.

- B. Shop Drawings: Submit for approval the following:
 - 1. Shop Drawings for metal lockers, verifying dimensions affecting locker installations. Show lockers in detail, method of installation, fillers, trim, base and accessories. Include locker numbering sequence information.
 - 2. Copies of manufacturer's technical data, and installation instructions for the metal locker units.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not deliver metal lockers until building is enclosed and ready for their installation. Protect from damage during delivery, handling, storage, and installation.

1.5 GUARANTEE

- A. Provide manufacturer's 10 year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet Steel: Cold-rolled steel for doors and door frames. Cold-rolled steel or annealed, specially treated steel for other parts. All steel shall be free from buckle, scale, and surface imperfections.
- B. Fasteners: Stainless steel. Exposed fasteners shall not be used in the Work. Provide self-locking nuts or lock washers for the nuts on moving parts, or otherwise prevent loosening of nuts.

2.2 HEAVY DUTY LOCKER CONSTRUCTION

- A. Frames: Minimum 16 gage channels or 12 gage angles, with corners electrically welded to form a rigid one-piece structure. Form door stop at vertical members.
- B. Backs and Sides: Minimum 18 gage steel for backs; 16 gage steel for sides. Flange backs on vertical edges, and sides where they intermember with backs, making double-flanged rear corners.
 - 1. Exposed ends of non-recessed lockers; minimum 16 gage steel.
- C. Tops, Bottoms and Shelves: Minimum 16 gage steel, flanged edges.
- D. Double Panel Doors: One-piece, formed solid doors with louvers top and bottom minimum 14 gage cold-rolled sheet steel with double bends on both sides and single bends on top and bottom and an 18 gage formed inner panel welded to outer door to form a reinforcing channel. Construct doors to prevent springing when opening or closing. Fabricate doors to swing 180 degrees.
 - 1. Provide stamped louvered vents in door faces, as follows:
 - a. For single-tier double door lockers, not less than 6 louver openings top and bottom.

- E. Door Hinges: Heavy-duty, not less than 0.070-inch thick steel, full-loop, continuous full length piano hinges. Weld hinges to inside of frame and secure to door with not less than 2 factory-installed fasteners, completely concealed and tamperproof when locker door is closed.
- F. Center Partition: Provide center partition in each locker.
- G. Latching: Positive, automatic, prelocking, pry-resistant latch and fully recessed latch with rubber bumpers riveted to door stops and heavy-duty, rigid non-moving 11 gage hasp containing strike and hole for padlock.
 - 1. Provide stainless steel pan recessed into door containing no moving parts for through-the-door padlock.
 - 2. Provide single point latch welded to door frame.
- H. Size: 18-inches wide by 18-inches deep by 72-inches high.
- I. Product and Manufacturer: Provide one of the following:
 - 1. Bulldog Corridor Lockers AMP-1005 Corridor Locker by Art Metal Products Division of Fort Knox Storage Company.
 - 2. Or equal.

2.3 LOCKER ACCESSORIES

- A. Locking: Fabricate lockers to receive padlocks which shall be provided by OWNER.
- B. Equipment: Furnish each locker with the following accessories:
 - 1. Single-Tier Units: Clothing rod, 7/8-inch diameter heavy chrome plated steel, 3 single-prong wall hooks, and shelf.
- C. Number Plates: Manufacturer's standard etched, embossed, or stamped, non-ferrous metal number plates with numerals not less than 3/8-inch high. Number the lockers in sequence as directed by ENGINEER. Attach plates to each locker door, near top, centered, with at least 2 fasteners of the same finish as number plate.
- D. Trim: Provide fill-in-panels, solid end panels and recessed trim consisting of 16 gage minimum cold-rolled steel, as necessary, to provide complete and finished installation. Factory-finish trim to match lockers. Secure trim to lockers with concealed fastening clips. Provide recessing trim on all top and sides as required for a complete and finished installation.

2.4 LOCKER ROOM BENCHES

- A. Manufacturer's standard units with laminated hardwood tops approximately 9-1/2-inch wide by 1-1/4-inch thick, in lengths as indicated. Furnish steel pedestal supports not more than 6 feet-0 inch on centers, with provisions for concealed fastening to floor and securing to bench. Furnish all anchorages. Finish bench tops with manufacturer's standard clear coatings and pedestals with baked enamel paint custom finished to match locker color.

2.5 FABRICATION

- A. Construction: Provide all seams and joints including sides, back, top and bottom and hinges and shelves of welded construction. Bolts, screws or pop rivets are not approved. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make all exposed metal edges and welds safe to the touch.
- B. Finishing: Electro-plated galvanized finish followed by enamel finish. Chemically pretreat metal with degreasing and phosphatizing process. Electrostatically spray and bake enamel finish to all surfaces, exposed and concealed, except plates and non-ferrous metal. Provide manufacturer's full selection of standard and custom colors.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which locker Work is to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install metal lockers and benches at the locations shown in accordance with the manufacturer's instructions for a plumb, level, rigid, and flush installation.
- B. Space fastenings about 48-inch on centers and apply through back-up reinforcing plates where necessary to prevent metal distortion. Conceal all fasteners.
- C. Install trim, and sloping units, to provide a flush, hairline joint against adjacent surfaces. Install with concealed fasteners.
- D. Touch-up marred finishes, or replace if not acceptable to ENGINEER. Use only materials and finishes as recommended or furnished by the locker manufacturer.
- E. Adjust doors and latches to operate easily without bind. Verify satisfactory operation of integral locking devices.
- F. Install benches in accordance with manufacturer's instructions.

+ + END OF SECTION + +

SECTION 10601
MESH PARTITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all mesh partition Work.
 2. The extent of the mesh partitions is shown.
 3. The types of mesh partitions Work includes, but is not necessarily limited to, the following:
 - a. Heavy duty industrial woven wire mesh.
 - b. Sliding doors with heavy duty hardware.
 - c. Formed channel uprights, caps, center channels and cast floor sockets.
 - d. Miscellaneous accessories, fasteners and trim.
- B. Related Sections:
1. Section 05503, Anchor Bolts, Expansion Anchors and Concrete Inserts.
 2. Section 08710, Finish Hardware.

1.2 QUALITY ASSURANCE

- A. Provide each type of wire mesh partition specified as a complete unit produced by a single manufacturer, including necessary mounting accessories, hardware, fittings and fastenings.
- B. Field Measurements: Take field measurements prior to preparation of Shop Drawings and fabrication to ensure proper fitting of the Work. However, do not delay job progress; allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the Work.
- C. Inserts and Anchorages:
1. Furnish inserts and anchoring devices which shall be set in concrete or built into masonry for the installation of the mesh partition Work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.
 2. Installation of inserts and anchorage devices shall be in accordance with the manufacturer's recommendations.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM A 123, Specification for Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip.
 2. W&M Gage, Washburn and Moen Gage.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Shop Drawings for fabrication and erection. Include plans, elevations, and large scale details. Show doors, openings, anchorage and accessory items. Provide locations template drawings for items supported or anchored to permanent construction.
 2. Manufacturer's specifications and installation instructions for all materials required.
 3. Submit complete selection of manufacturer's standard and custom colors for selection by ENGINEER.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Do not deliver units until construction is substantially complete and ready for them. Protect from damage during delivery, handling, storage and installation. After delivery, store in a covered, dry and ventilated area acceptable to ENGINEER.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

- A. General: All dimensions specified are minimum. Do not use components less than the size specified; use larger size components as recommended by partitions components manufacturer. Height of partition system shall be 8 feet-0 inches. Field verify all dimensions.
- B. Product and Manufacturer: Provide one of the following:
1. Type No. 135 by Acorn Wire and Iron Works, Incorporated.
 2. Or equal.
- C. Mesh: No. 6 W & M gage crimped steel wire woven into 1-1/2-inch diamond mesh, clinched and secured to frame members.
- D. Frames: Provide cutouts for pipes, ducts, beams, and other items shown or necessary for partition installation. Finish edges of cutouts with channels matching adjacent frame members.
1. Vertical Members: 1-1/4-inches by 5/8-inch by 1/8-inch cold-rolled steel C-section channels with 1/4-inch bolt holes approximately 12 inches on centers. Extend about 3 inches below bottom horizontal frame members.
 2. Horizontal Members: 1-inch by 1/2-inch by 1/8-inch cold-rolled steel channels, mortised, tenoned and welded to vertical members.
 3. Horizontal Reinforcing Members: 1-1/2-inches by 3/4-inches by 1/8-inch cold-rolled steel channel, with wire woven through and secured to vertical members. Provide number of horizontal reinforcing members to suit panel height as recommended by partition manufacturer.

- E. Stiffening Bars: Provide flat bar stiffener posts between abutting panel frames. Size as recommended by partitions manufacturer for partition height required. Increase size of stiffening bars as required for partition rigidity.
- F. Top Capping Bars: 2-1/4 or 2-3/8-inches by 1-inch cold-rolled steel channels, secured to top framing channel with 1/4-inch U-bolts spaced not more than 28 inches on centers.
- G. Floor Shoes: Cast iron, sized to suit vertical framing. Provide 4-inch high toe plate along entire partition length. Provide units with set screw for leveling adjustment.
- H. Sliding Doors: Provide doors where shown and of the type and size specified in the Door Schedule. Door frame of 1-1/2-inches by 3/4-inch by 1/8-inch channel with 1-1/2-inches by 1/8-inch flat bar cover plate on all four sides. Provide doors with bronze mortise type cylinder lock operated by key outside and recessed knob inside. Align bottom of doors to meet bottom of adjacent panels.
 - 1. Provide cylinders for lock, keyed and masterkeyed to building system.
- I. Finish: Manufacturer's standard shop-applied enamel finish, color from manufacturer's standard and custom colors as selected by ENGINEER. Use primer standard with the manufacturer before applying enamel finish.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer shall examine the areas on which mesh partitions units are to be installed, and the conditions under which the Work will be performed. Notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Provide all bolts, hardware, fasteners and accessories for complete installation.
- B. Erect partitions plumb, rigid, properly aligned and securely fastened in place. Adjust opening and closing units to operate freely without bind.
- C. Provide additional field bracing, as shown or recommended by the manufacturer, for rigid, secure installation.
- D. Touch-up any damaged finish after completion of installation using field-applied materials, supplied by the manufacturer, to match shop-applied finish.

+ + END OF SECTION + +

SECTION 10800
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all toilet and bath accessories Work.
2. The extent of toilet and bath accessories are shown.
3. The types of toilet and bath accessories Work required includes, but is not necessarily limited to, the following:
 - a. Recessed paper towel dispenser/disposal.
 - b. Toilet tissue dispensers.
 - c. Mirrors.
 - d. Grab bars.
 - e. Soap dispensers.
 - f. Shower stall swing doors.
 - g. Electric hand and hair dryer.
 - h. Miscellaneous items.

B. Coordination:

1. Furnish inserts and anchoring devices which must be set in concrete or built into masonry and gypsum wallboard for the installation of toilet accessories. Coordinate delivery with other work to avoid delay.
2. See concrete and masonry Sections of these Specifications for installation of inserts and anchorage devices.

C. Related Sections:

1. Section 09310, Ceramic Tile.
2. Section, 10160, Toilet Partitions and Urinal Screens.

1.2 QUALITY ASSURANCE

A. Source Quality Control:

1. Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same areas.
2. Stamped names or labels on exposed faces of units will not be permitted.
3. Provide locks with the same keying for each type of accessory units in the Project wherever possible. Furnish two keys for each lock.

B. Requirements of Regulatory Agencies:

1. Codes: Comply with applicable provisions of the State of Arizona Uniform Building Code and ANSI A117.1.

- C. Reference Standards: Comply with applicable provisions and recommendations, except where otherwise shown or specified.
1. ASTM A 167, Corrosive Resisting Chromium-Nickel; Steel Plate, Sheet and Strip.
 2. ASTM A 366 Specification for Cold Rolled Carbon Steel Commercial Quality.
 3. ASTM A 386 Specification for Zinc Coating (Hot-Dip) on Assembled Steel Products.
 4. ASTM B 456, Specification for Electro Deposited Coatings of Nickel Plus Chromium.
 5. Federal Specification, FS DD-G-451, Glass (Laboratory).
 6. Federal Specification, FS WW-P-541.
 7. FS WW-P-541, Plumbing Fixtures (Land Use).

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Copies of manufacturer's technical data and installation instructions for each toilet accessory.
 2. Setting Drawings, templates, instructions and directions for installation of anchorage devices in other work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel, ASTM A 167: Type 304L with polished No. 4 finish, unless otherwise specified.
- B. Brass, FS WW-P-541: Cast or forged quality alloy.
- C. Sheet Steel, ASTM A 366: Cold rolled, commercial quality. Surface preparation and metal pretreatment as required for applied finish.
- D. Chromium Plating, ASTM B 456: Nickel and chromium electro-deposited on metal, Type SC2.
- E. Mirror Glass, FS DD-G-451: Type I, Class 1, Quality q2, 1/4-inch thick, with silver coating, copper protective coating, and non-metallic paint coating.
- F. Galvanized Steel Mounting Devices, ASTM A 386: Hot-dip galvanized after fabrication.

2.2 RECESSED PAPER TOWEL DISPENSER/DISPOSAL

- A. Size to dispense not less than 600 c-fold towels with interchangeable paper drop. With cabinet and door not less than 22 gage stainless steel, No. 4 satin finish all welded construction without mitered corners. Hang doors with a concealed, full-length stainless steel piano hinge and install a tumbler-lockset.

- B. Product and Manufacturer: Provide one of the following:
1. No. 0467 by American Specialties Incorporated.
 2. Or equal.

2.3 TOILET TISSUE DISPENSERS

- A. General: Provide toilet tissue dispensers at each water closet.
- B. Multi-roll Toilet Tissue Dispenser and Ash Tray: Fabricate shelf of not less than 1/8-inch thick stainless steel, to store and dispense not less than two 4-1/2-inch by 4-1/2-inch core tissue rolls. Fabricate flange from a single piece, with seamless construction.
- C. Product and Manufacturer: Provide one of the following:
1. No. 0697GA by American Specialties Incorporated.
 2. Or equal.

2.4 MIRRORS

- A. General: Provide mirrors above each lavatory.
- B. Stainless Steel Mirror: Fabricate frame from 20 gage stainless steel, welded and groundsmooth, no shelf. Mirrors shall be 18-inches by 24-inches.
- C. Product and Manufacturer: Provide one of the following:
1. No. 0535A by American Specialties Incorporated.
 2. Or equal.

2.5 GRAB BARS

- A. General: Provide grab bars where shown. Provide custom specials where required or specified.
- B. Stainless Steel Grab Bars: Provide stainless steel knurled grab bars, 1-1/2-inch outside diameter, 16 gage.
1. Mounting: Concealed, with manufacturer's standard flanges and anchorages for type of installation.
- C. Product and Manufacturer: Provide one of the following:
1. Type 40 with 52-inch leg and 36-inch leg and Type 28 by American Specialties Incorporated.
 2. Or equal.

2.6 SOAP DISPENSERS

- A. General: Provide wall mounted shelf soap dispensers, one per lavatory.
1. Cover and container finish: Stainless steel.
 2. Liquid Soap Dispenser and Shelf: Fabricate units from 20 gage stainless steel to dispense lather in measured quantity by pump action with stainless steel pistons, springs, and internal parts.
 - a. Capacity: 80 fluid ounces.

- B. Product and Manufacturer: Provide one of the following:
1. No. 0315 by American Specialties Incorporated.
 2. Or equal.

2.7 SHOWER STALL SWING DOORS

- A. Provide shower stall doors custom cut, sized, and fit as shown, fabricated of 1-1/4-inch by 9/16-inch by 3/32-inch extruded architectural brass channels with polished chrome plate over nickel finish. Provide doors constructed with mitered corners, welded and ground smooth.
- B. Maintain 12-inch clear between top of door and head of masonry opening. Provide stainless steel piano hinges and double towel bar door pulls inside and outside door. Glaze doors with 1/4-inch thick, LEXGARD PLE-250 bronze, laminate, 2-ply prismatic polycarbonate glazing by General Electric Company.
- C. Product and Manufacturer: Provide one of the following:
1. Deluxe Construction Shower Doors, Frames and Glazing with double towel bar by Keystone Division of KSD Industries.
 2. Or equal.

2.8 ELECTRIC HAND AND HAIR DRYERS

- A. Provide automatic starting and stopping dryers incorporating an infra-red sensor.
- B. Provide units with 1/8 HP, 3000 RPM, instant starting brushless-type motors protected by built-in dual circuit breaker with fully enclosed contacts.
- C. Blower: Centrifugal type; 183 CFM at 5700 F/M.
- D. Heating Element: Industrial strength spiral wound element operating in the black heat range for increased life.
- E. Time Cycle:
1. Hand Dryers: 30 seconds.
 2. Hair Dryers: 3 minutes.
- F. Alloy die cast uni-body construction.
- G. Finish: Satin chrome.
- H. Product and Manufacturer: Provide one of the following:
1. 0122 Dryers by American Specialties Incorporated.
 2. Or equal.

2.9 MISCELLANEOUS ITEMS

- A. Combination shelf with utility hook and mop strip: Provide 18 gage stainless steel shelf with 3/4-inch lip, four 18 gage stainless steel hook strips and 3 mop holders. Shelf shall be 34-inches wide and 8-inches deep.

1. Product and Manufacturer: Provide one of the following:
 - a. No. 1308A by American Specialties Incorporated.
 - b. Or equal.
- B. Hose Bracket: 14 gage stainless steel.
 1. Product and Manufacturer: Provide one of the following:
 - a. No. 1305A by American Specialties Incorporated.
 - b. Or equal.
- C. Pail Hook: 12 gage stainless steel.
 1. Type 8 as shown.
 2. Product and Manufacturer: Provide one of the following:
 - a. No. 13017-A by American Specialties Incorporated.
 - b. Or equal.
- D. Towel and Robe Hooks:
 1. General: Provide two double concealed mounting hooks.
 2. Cast brass with polished chrome finish.
 3. Product and Manufacturer: Provide one of the following:
 - a. 0750 by American Specialties Incorporated.
 - b. Or equal.
- E. Recessed Heavy-Duty Stainless Steel Soap Dishes:
 1. 20 gauge stainless steel, No. 4 satin finish.
 2. Product and Manufacturer: Provide one of the following:
 - a. 0407 by American Specialties Incorporated.
 - b. Or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. CONTRACTOR and his installer must examine the areas and conditions under which toilet accessories are to be installed and notify ENGINEER in writing of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Install items for the handicapped in accordance with ANSI A117.1.
- B. Use concealed fastenings wherever possible.
- C. Provide anchors, bolts and other necessary anchorages, and attach accessories securely to walls and partitions in locations as shown.
- D. Install concealed mounting devices and fasteners fabricated of the same material as the accessories as recommended by manufacturer.
- E. Install exposed mounting devices and fasteners finished to match the accessories.

- F. Provide theft-resistant fasteners for all accessory mountings.
- G. Secure toilet room accessories in accordance with the manufacturer's instructions for each item and each type of substrate construction.
- H. Lock grab bars to concealed mounting plate installed in wall.

3.3 ADJUSTMENT AND CLEANING

- A. Adjust accessories for proper operation.
- B. After completion of installation, clean and polish all exposed surfaces.
- C. Deliver keys and instruction sheets to OWNER.

+ + END OF SECTION + +