

D. Backfilling Around Structures

1. General

- a. Remove debris from excavations before backfilling.
- b. Do not backfill against foundation walls until so directed by the Engineer nor until all indicated perimeter insulation and/or waterproofing is in place.
- c. Protect such insulation and/or waterproofing during filling operations.
- d. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
- e. Do not backfill against walls until all permanent construction is in place to furnish lateral support on both top and bottom of wall.
- f. Backfilling against walls is to take place after all the concrete in the affected members has attained the specified strengths.

2. Materials

- a. Backfill material placed against structures built or encountered during the work of this Section shall be suitable fill material.
- b. No broken concrete, bricks or similar materials will be permitted as backfill.

3.06 GRADING

A. General

1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of ± 0.15 foot.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other site features.

C. Treatment After Completion of Grading

1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.07 EXCESS WATER CONTROL

A. Regulations and Permits: Obtain all necessary soil erosion control permits in accordance with the Georgia Soil Erosion and Sedimentation Control Act and all pertinent rules, laws, and regulations of all applicable federal, state, county and municipal regulatory agencies.

- B. Unfavorable Weather
 - 1. Do not place, spread or roll any fill material during unfavorable weather conditions.
 - 2. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.
- C. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.
- D. Pumping and Drainage
 - 1. Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the work.
 - 2. Dewater by means which will insure dry excavations, preserve final lines and grades, do not disturb or displace adjacent soil.
 - 3. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances and regulations.
 - 4. Do not overload or obstruct existing drainage facilities.

3.08 SETTLEMENT

- A. The Contractor shall be responsible for all settlement of backfill, fills and embankments which may occur within one year after final acceptance of the Work by the Owner.
- B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Engineer or Owner.

3.09 CLEANING

Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer, and in conformance with the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 02225

TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 SCOPE

- A. The work under this Section consists of furnishing all labor, equipment and materials and performing all operations in connection with the trench excavation and backfill required to install the pipelines shown on the Drawings and as specified.
- B. Excavation shall include the removal of any trees, stumps, brush, debris or other obstacles which remain after the clearing and grubbing operations, which may obstruct the work, and the excavation and removal of all earth, rock or other materials to the extent necessary to install the pipe and appurtenances in conformance with the lines and grades shown on the Drawings and as specified.
- C. Backfill shall include the refilling and compaction of the fill in the trenches and excavations up to the surrounding ground surface or road grade at crossing.
- D. The pipe zone area of the trench is divided into five specific areas:
 - 1. Foundation: The area beneath the bedding, sometimes also referenced to as trench stabilization.
 - 2. Bedding: The area above the trench bottom (or foundation) and below the bottom of the barrel of the pipe.
 - 3. Haunching: The area above the bottom of the barrel of the pipe up to a specified height above the bottom of the barrel of the pipe.
 - 4. Initial Backfill: The area above the haunching material and below a plane 18-inches above the top of the barrel of the pipe.
 - 5. Final Backfill: The area above a plane 18-inches above the top of the barrel of the pipe.
- E. The choice of method, means, techniques and equipment rests with the Contractor. The Contractor shall select the method and equipment for trench excavation and backfill depending upon the type of material to be excavated and backfilled, the depth of excavation, the amount of space available for operation of equipment and storage of excavated material proximity of man-made improvements to be protected, available easement or right-of-way and prevailing practice in the area.

1.02 QUALITY ASSURANCE

- A. Density: All references to "maximum dry density" shall mean the maximum dry density defined by the "Maximum Density-Optimum Moisture Test", ASTM D 698. Determination of the density of backfill in place shall meet with the requirements of ASTM D 1556, "Density of Soil In Place by the Sand Core Method", ASTM D 2937, "Density of Soil In Place by the Drive-Cylinder Method" or ASTM D 2922, "Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)".
- B. Sources and Evaluation Testing: Testing of materials to certify conformance with the Specification requirements shall be performed by an independent testing laboratory at no cost to the Owner. The Contractor's testing laboratory shall perform tests, at no cost to the Owner, upon change of source and at sufficient intervals during the work to certify conformance of all select material furnished for use on this Project.

1.03 SAFETY

Perform all trench excavation and backfilling activities in accordance with the Occupational Safety and Health Act of 1970 (PL 91-596), as amended. The Contractor shall pay particular attention to the Safety and Health Regulations Part 1926, Subpart P "Excavation, Trenching & Shoring" as described in OSHA publication 2226.

PART 2 PRODUCTS

2.01 TRENCH FOUNDATION MATERIALS

Crushed stone shall be utilized for trench foundation (trench stabilization) and shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be between No. 57 and No. 4, inclusive.

2.02 BEDDING AND HAUNCHING MATERIALS

- A. Unless specified otherwise, bedding and haunching materials shall be crushed stone as specified below.
- B. Crushed stone utilized for bedding and haunching shall meet the requirements of the Georgia Department of Transportation Specification 800.01, Group I (limestone, marble or dolomite) or Group II (quartzite, granite or gneiss). Stone size shall be No. 57.
- C. Earth materials utilized for bedding and haunching shall be suitable materials selected from materials excavated from the trench. Suitable materials shall be clean and free of rock larger than 2-inches at its largest dimension, organics, cinders, stumps, limbs, frozen earth or mud, man-made wastes and other unsuitable materials. Should the material excavated from the trench be saturated, the saturated material may be used as earth material, provided it is allowed to dry properly and it is capable of meeting the specified compaction

requirements. When necessary, earth bedding and haunching materials shall be moistened to facilitate compaction by tamping. If materials excavated from the trench are not suitable for use as bedding or haunching material, provide select material conforming to the requirements of this Section at no additional cost to the Owner.

D. Filter Fabric

1. Filter fabric associated with bedding shall be a polypropylene woven fabric. The fabric shall be a high modulus type with good separation capabilities. The fabric shall be inert to biological degradation and naturally occurring chemicals, alkalies and acids.
2. The fabric shall have an equivalent opening size (EOS or AOS) of 20 to 45. The fabric shall also conform to the minimum property values listed in the following table:

<u>Fabric Property</u>	<u>Unit</u>	<u>Test Method</u>	<u>Minimum Value</u>
Grab Tensile Strength	lb	ASTM-D-4632	200
Grab Tensile Elongation	%	ASTM-D-4632	30 (max)
Mullen Burst Strength	psi	ASTM-D-3786	400
Trapezoid Tear Strength	lb	ASTM-D-4533	75
Puncture Strength	lb	ASTM-D-3787	75

3. If ordered by the Engineer, the filter fabric manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of 10 days during initial pipe installation.
4. Filter fabric shall be Mirafi 500X, Amoco 2002 or Exxon GTF-200.

2.03 INITIAL BACKFILL

Initial backfill material shall be crushed stone or earth materials as specified for bedding and haunching materials.

2.04 FINAL BACKFILL

Final backfill material shall be general excavated earth materials, shall not contain more than one-third broken rock, of which no stone or boulder shall weigh more than 50 pounds, cinders, stumps, limbs, man-made wastes and other unsuitable materials.

2.05 SELECT BACKFILL

Select material shall be provided where the materials excavated from the trench will not meet the requirements as specified for bedding, haunching, initial backfill or final backfill, including compaction requirements.

PART 3 EXECUTION

3.01 TRENCH EXCAVATION

- A. Topsoil and grass shall be stripped a minimum of 6-inches over the trench excavation site and stockpiled separately for replacement over the finished grading areas.
- B. Trenches shall be excavated to the lines and grades shown on the Drawings with the centerlines of the trenches on the centerlines of the pipes and to the dimensions which provide the proper support and protection of the pipe and other structures and accessories.
- C. Width
1. The sides of all trenches shall be vertical to a minimum of one foot above the top of the pipe. Unless otherwise indicated on the Drawings, the maximum trench width shall be equal to the sum of the outside diameter of the pipe plus two feet. The minimum trench width shall be that which allows the proper consolidation of the haunching and initial backfill material.
 2. Excavate the top portion of the trench to any width within the construction easement or right-of-way which will not cause unnecessary damage to adjoining structures, roadways, pavement, utilities, trees or private property. Where necessary to accomplish this, provide sheeting and shoring.
 3. Where rock is encountered in trenches, excavate to remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe or manhole. The maximum allowable width of rock excavation for payment shall be based on a trench width equal to the outside diameter of the pipe barrel plus 18-inches, but the total allowable rock excavation width for payment will not be less than 36-inches.
 4. Wherever the prescribed maximum trench width is exceeded, the Contractor shall use the next higher class (load factor) of bedding and haunching for the full trench width as actually cut, at no additional cost to the Owner. The excessive trench width may be due to unstable trench walls, inadequate or improperly placed bracing and sheeting which caused sloughing, accidental over-excavation, intentional over-excavation necessitated by the size of the Contractor's tamping and compaction equipment, intentional over-excavation due to the size of the Contractor's excavation equipment, or other reasons beyond the control of the Engineer or Owner.
- D. Depth
1. The trenches shall be excavated to the required depth or elevation which allow for the placement of the pipe and bedding to the thickness shown on the Drawings.

2. Water Mains and Force Mains

- a. Depth of Trenches: Excavate trenches to provide depths as shown on the Drawings. The depth of cover shall not exceed that as shown on the Drawings by more than two feet, without approval of the Engineer.
- b. Where not shown on the Drawings, excavate trenches to provide a minimum cover of four feet. Within the right-of-way of highways, streets or roadways, also excavate to place the top of the pipe a minimum of four feet below the nearest pavement edge.
- c. Increase the depth of cover where specifically shown on the Drawings and where necessary to avoid interference with underground utilities and obstructions.

3. Where rock is encountered in trenches, excavate to the minimum depth which will provide clearance below the pipe barrel of 8-inches for pipe 21-inches in diameter and smaller and 12-inches for larger pipe, valves and manholes. Remove boulders and stones to provide a minimum of 6-inches clearance between the rock and any part of the pipe, manhole or accessory.

E. Excavated Materials

1. Excavated materials shall be placed adjacent to the work to be used for backfilling as required. Top soil shall be carefully separated and lastly placed in its original location.
2. Excavated material shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and not cause any drainage problems. Excavated material shall be placed so as not to damage existing landscape features or man-made improvements.

3.02 SHEETING, BRACING AND SHORING

A. Sheeting, bracing and shoring shall be performed in the following instances:

1. Where sloping of the trench walls does not adequately protect persons within the trench from slides or cave-ins.
2. In caving ground.
3. In wet, saturated, flowing or otherwise unstable materials. The sides of all trenches and excavations shall be adequately sheeted and braced.
4. Where necessary to prevent damage to adjoining structures, roadways, pavement, utilities, trees or private properties which are required to remain.
5. Where necessary to maintain the top of the trench within the available construction easement or right-of-way.
6. Where shown on the Drawings, sheeting shall be steel sheeting.

- B. In all cases, excavation protection shall strictly conform to the requirements of the Occupational Safety and Health Act of 1970.
- C. Timber: Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good, serviceable condition. Size and spacing shall be in accordance with OSHA regulations.
- D. Steel Sheeting and Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from the surrounding area. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral movement at all times. The Contractor shall provide closure and sealing between sheet piling and existing facilities. Sheet piling within three feet of an existing structure or pipeline shall remain in place, unless otherwise directed by the Engineer.
- E. Trench Shield: A trench shield or box may be used to support the trench walls. The use of a trench shield does not necessarily preclude the additional use of bracing and sheeting. When trench shields are used, care must be taken to avoid disturbing the alignment and grade of the pipe or disrupting the haunching of the pipe as the shield is moved. When the bottom of the trench shield extends below the top of the pipe, the trench shield will be raised in 6-inch increments with specified backfilling occurring simultaneously. At no time shall the trench shield be "dragged" with the bottom of the shield extending below the top of the pipe.
- F. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the Engineer it cannot be safely removed. Cut off any sheeting left in place at least two feet below the surface.

3.03 TRENCH ROCK EXCAVATION

- A. Definition of Trench Rock: Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 18,300 pounds (equal to Caterpillar Model 215), and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.
- B. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.
- C. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

- D. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set.
- E. Following review by the Engineer regarding the proximity of permanent structures to the blasting site, the Engineer may direct the Contractor to employ an independent, qualified specialty subcontractor, approved by the Engineer, to monitor the blasting by use of seismograph, identify the areas where light charges must be used, conduct pre-blast and post-blast inspections of structures, including photographs or videos, and maintain a detailed written log.
- (1) F. No blasting shall be permitted within the DOT right-of-way of Roswell Road.

3.04 DEWATERING EXCAVATIONS

- A. Dewater excavation continuously to maintain a water level two feet below the bottom of the trench.
- B. Control drainage in the vicinity of excavation so the ground surface is properly pitched to prevent water running into the excavation.
- C. There shall be sufficient pumping equipment, in good working order, available at all times, to remove any water that accumulates in excavations. Where the pipe line crosses natural drainage channels, the work shall be conducted in such a manner that unnecessary damage or delays in the prosecution of the work will be prevented. Provision shall be made for the satisfactory disposal of surface water to prevent damage to public or private property.
- D. In all cases, accumulated water in the trench shall be removed before placing bedding or haunching, laying pipe, placing concrete or backfilling.
- E. Where dewatering is performed by pumping the water from a sump, crushed stone shall be used as the medium for conducting the water to the sump. Sump depth shall be at least two feet below the bottom of the trench. Pumping equipment shall be of sufficient quantity and/or capacity to maintain the water level in the sump two feet below the bottom of the trench. Pumps shall be a type such that intermittent flows can be discharged. A standby pump shall be required in the event the operating pump or pumps clog or otherwise stop operation.
- F. Dewater by use of a well point system when pumping from sumps does not lower the water level two feet below the trench bottom. Where soil conditions dictate, the Contractor shall construct well points cased in sand wicks. The casing, 6 to 10-inches in diameter, shall be jetted into the ground, followed by the installation of the well point, filling casing with sand and withdrawing the casing.

3.05 TRENCH FOUNDATION AND STABILIZATION

- A. The bottom of the trench shall provide a foundation to support the pipe and its specified bedding. The trench bottom shall be graded to support the pipe and bedding uniformly throughout its length and width.
- B. If, after dewatering as specified above, the trench bottom is spongy, or if the trench bottom does not provide firm, stable footing and the material at the bottom of the trench will still not adequately support the pipe, the trench will be determined to be unsuitable and the Engineer shall then authorize payment for trench stabilization.
- C. Should the undisturbed material encountered at the grade depth constitute, in the opinion of the Engineer, an unstable foundation for the pipe, the Contractor shall be required to remove such unstable material and fill the trench to the proper subgrade with crushed stone.
- D. Where the replacement of unsuitable material with crushed stone does not provide an adequate trench foundation, the trench bottom shall be excavated to a depth of at least two feet below the specified trench bottom. Place filter fabric in the bottom of the trench and support the fabric along the trench walls until the trench stabilization, bedding, haunching and pipe have been placed at the proper grade. The ends of the filter fabric shall be overlapped above the pipe.
- E. Where trench stabilization is provided, the trench stabilization material shall be compacted to at least 90 percent of the maximum dry density, unless shown or specified otherwise.

3.06 BEDDING AND HAUNCHING

- A. Bedding material shall be placed to provide uniform support along the bottom of the pipe and to place and maintain the pipe at the proper elevation. The initial layer of bedding placed to receive the pipe shall be brought to the grade and dimensions indicated on the Drawings, and the pipe shall be placed thereon and brought to grade by tamping the bedding material or by removal of the slight excess amount of the bedding material under the pipe. Adjustment to grade line shall be made by scraping away or filling with bedding material. Wedging or blocking up of pipe shall not be permitted. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted. Each pipe section shall have a uniform bearing on the bedding for the length of the pipe, except immediately at the joint. All bedding shall extend the full width of the trench bottom. Prior to placement of bedding material, the trench bottom shall be free of any water, loose rocks, boulders or large dirt clods.
- B. At each joint, excavate bell holes of ample depth and width to permit the joint to be assembled properly and to relieve the pipe bell of any load.

- C. After the pipe section is properly placed, add the haunching material to the specified depth. The haunching material shall be shovel sliced, tamped, vigorously chinked or otherwise consolidated to provide uniform support for the pipe barrel and to fill completely the voids under the pipe, including the bell hole. Prior to placement of the haunching material, the bedding shall be clean and free of any water, loose rocks, boulders or dirt clods.
- D. Gravity Sewers and Accessories: Lay all gravity (DIP or RCP) pipe with minimum Class "B" bedding unless otherwise shown on the Drawings.
 - 1. Class "A" (Bedding Factor - 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Lay pipe to line and grade on concrete block. Place concrete to the full width of the trench and to a height of one-fourth of the outside diameter of the pipe above the invert.
 - 2. Class "B" (Bedding Factor - 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.
 - 3. Class "C" (Bedding Factor - 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.
- E. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.
- F. Force Mains
 - 1. Ductile Iron Pipe
 - a. Unless otherwise shown on the Drawings or specified, utilize earth materials for bedding and haunching. Type 4 and 5 bedding shall be as detailed on the Drawings.
 - b. Unless specified or shown otherwise, bedding shall meet the requirements for Type 4 Pipe Bedding.
 - c. Where the depth of cover over the piping exceeds 20 feet, the pipe bedding shall meet the requirements of Type 5 Pipe Bedding.
 - d. Type 4 or Type 5 Pipe Bedding called for on the Drawings, specified or ordered by the Engineer, shall meet requirements for Type 4 or Type 5 Pipe Bedding, utilizing crushed stone bedding and haunching material.

- e. Where multiple pipes are to be installed in the same trench, use pipe bedding details shown on the Drawings.

2. Polyvinyl Chloride Pipe

- a. Unless shown otherwise on the Drawings, utilize earth materials for bedding and haunching.
- b. Unless shown otherwise on the Drawings, bedding and haunching shall meet the requirements for Type 2 Pipe Bedding, as detailed on the Drawings.

G. Excessive Width and Depth

- 1. Gravity Sewers: If the trench is excavated to excess width, provide the bedding class with the next higher bedding factor. Crushed stone haunching and initial backfill may be used in lieu of Class "A" bedding, where Class "A" bedding is necessitated by excessive trench width.
- 2. Force Mains: If the trench is excavated to excess width, provide Type 5 pipe bedding.
- 3. If the trench is excavated to excessive depth, provide crushed stone to place the bedding at the proper elevation or grade.

- H. Compaction: Bedding and haunching materials under pipe, manholes and accessories shall be compacted to a minimum of 90 percent of the maximum dry density, unless shown or specified otherwise.

3.07 INITIAL BACKFILL

- A. Initial backfill shall be placed to anchor the pipe, protect the pipe from damage by subsequent backfill and ensure the uniform distribution of the loads over the top of the pipe.
- B. Place initial backfill material carefully around the pipe in uniform layers to a depth of at least 18-inches above the pipe barrel. Layer depths shall be a maximum of 6-inches for pipe 18-inches in diameter and smaller and a maximum of 12-inches for pipe larger than 18-inches in diameter.
- C. Backfill on both sides of the pipe simultaneously to prevent side pressures.
- D. Compact each layer thoroughly with suitable hand tools or tamping equipment.
- E. Initial backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless shown or specified otherwise.

3.08 CONCRETE ENCASEMENT

Where concrete encasement is shown on the Drawings, excavate the trench to provide a minimum of 6-inches clearance from the bell of the pipe. Lay the pipe to line and grade on concrete blocks. In lieu of

bedding, haunching and initial backfill, place concrete to the full width of the trench and to a height of not less than 6-inches above the pipe bell. Do not backfill the trench for a period of at least 24 hours after concrete is placed.

3.09 FINAL BACKFILL

- A. Backfill carefully to restore the ground surface to its original condition.
- B. The top 6-inches shall be topsoil obtained as specified in "Trench Excavation" of this Section.
- C. Excavated material which is unsuitable for backfilling and excess material, shall be disposed of, at no additional cost to the Owner, in a manner approved by the Engineer. Surplus soil shall not be distributed and spread over the site in areas under Corps of Engineer jurisdiction. If such spreading is allowed, the site shall be left in a clean and sightly condition and shall not affect pre-construction drainage patterns. Surplus rock from the trenching operations shall be removed from the site.
- D. After initial backfill material has been placed and compacted, backfill with final backfill material. Place backfill material in uniform layers, compacting each layer thoroughly as follows:
 - 1. In 6-inch layers, if using light power tamping equipment, such as a "jumping jack"
 - 2. In 12-inch layers, if using heavy tamping equipment, such as hammer with tamping feet
 - 3. In 24-inch layers, if using a hydra-hammer
- E. Settlement: If trench settles, re-fill and grade the surface to conform to the adjacent surfaces.
- F. Final backfill shall be compacted to a minimum 90 percent of the maximum dry density, unless specified otherwise.

3.10 BACKFILL UNDER ROADS

Compact backfill underlying pavement and backfill under dirt and gravel roads to a minimum 95 percent of the maximum dry density. The top 12-inches shall be compacted to a minimum of 98 percent of the maximum dry density.

3.11 BACKFILL WITHIN GEORGIA DOT RIGHT-OF-WAY

Backfill within the Georgia DOT right-of-way shall meet the requirements stipulated in the "Utility Accommodation Policy and Standards", published by the Georgia Department of Transportation.

3.12 BACKFILL ALONG RESTRAINED JOINT PIPE

Backfill along restrained joint pipe shall be compacted to a minimum 90 percent of the maximum dry density.

3.13 TESTING AND INSPECTION

- A. The soil testing will be performed by an independent testing laboratory selected by the Owner. Payment for soil testing shall be made by the Contractor from the "SOILS TESTING" CASH ALLOWANCE.
- B. The soils testing laboratory is responsible for the following:
 - 1. Compaction tests in accordance with paragraph "Quality Assurance" of this Section.
 - 2. Field density tests for each 2 feet of lift, one test for each 500 feet of pipe installed or more frequently if ordered by the Engineer.
 - 3. Inspecting and testing stripped site, subgrades and proposed fill materials.
- C. The Contractor's duties relative to testing include:
 - 1. Notifying laboratory of conditions requiring testing.
 - 2. Coordinating with laboratory for field testing.
 - 3. Paying costs for additional testing performed beyond the scope of that required and for re-testing where initial tests reveal non-conformance with specified requirements.
 - 4. Providing excavation as necessary for laboratory personnel to conduct tests.
- D. Inspection
 - 1. Earthwork operations, acceptability of excavated materials for bedding or backfill, and placing and compaction of bedding and backfill is subject to inspection by the Engineer.
 - 2. Foundations and shallow spread footing foundations are required to be inspected by a geotechnical engineer, who shall verify suitable bearing and construction.
- E. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.

END OF SECTION

SECTION 02300

TUNNELS

PART 1 GENERAL

1.01 SCOPE

- A. This Section describes materials to be incorporated into the tunnel and requirements for tunnel installation and to properly complete pipeline construction as described herein and/or shown on the Drawings. Furnish all materials and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all materials and perform all work in accordance with applicable American Society for Testing and Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI) or other recognized standards. Latest revisions of all standards are applicable. If requested by the Engineer, submit evidence that manufacturer has consistently produced products of satisfactory quality and performance over a period of at least two years.

1.02 SUBMITTALS

- A. Submit shop drawings and engineering data in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Method Submittals: The Contractor shall provide for the Engineer's approval, a detailed plan for the methods proposed for the construction of the tunnel. These plans shall address the following:
 1. Groundwater Control: The Contractor shall control the groundwater throughout the construction of the tunnel. The groundwater shall be controlled by dewatering (well points, sumps, or deep wells), grouting, compressed air, freezing or other method approved by the Engineer. The Contractor shall prepare a written, detailed plan for controlling the groundwater, citing similar installation conditions and results. This plan is to be submitted to the Engineer and approved prior to any construction activity for the tunnel.
 2. Face Protection: The face of the excavation shall be protected from the collapse of the soil into the tunnel. This protection is to be provided by bulkheads, shields or other means approved by the Engineer.
 3. Tunnel Design: The liner plate gauge specified herein is the minimum allowable. Design of the temporary tunnel support and temporary shaft support systems is the responsibility of the Contractor. The temporary tunnel and shaft support shall be designed to accommodate the combined effects of effective earth

pressure, traffic loads, site surcharge loads, and hydrostatic loads. The excavation method selected shall be compatible with expected ground conditions and the support system. The lengths of the tunnel shown on the Drawings are the minimum lengths required. The length of the tunnel may be extended for the convenience of the Contractor, at no additional cost to the Owner.

4. Tunnel Method

- a. The Contractor has the option to select the tunnel method, including groundwater control, that will be used except as restricted herein.
- b. Submit working drawings, written procedure, and calculations describing in detail the proposed tunnel method and entire operation. This shall include, but not be limited to, tunnel shafts and support, groundwater control, ground stabilization if proposed, excavation procedures, control of tunnel alignment and grade, support of tunnel face and initial supports, grouting procedures, detection of surface movement, procedure for installing pipes and anchors, and placement of grout between pipe and liner plates. If, in the opinion of the Contractor, modifications to the methods are required during construction, working drawings shall be submitted delineating such modifications, including reasons for the modifications.

C. Material Submittals: The Contractor shall provide for the Engineer's approval, shop drawings, proposed construction drawings, and other pertinent specifications and product data as follows:

1. Shop drawings for tunnel liner plates showing sizes, shapes, methods of attachment and connection details including location and details of grout holes as well as design calculations.
2. Design mixes for concrete and grout.
3. Shop drawings on carrier pipes.

D. Experience Submittals

1. Tunnel construction is deemed to be specialty contractor work. If the Contractor elects to perform the work, the Contractor shall provide evidence as required by the General Conditions. A minimum of five continuous years of experience in tunnel construction is required of the tunnel installer. Evidence of this experience must be provided, citing projects of similar soil conditions, with the shop drawings for review by the Engineer.
2. The filling of the void between the tunnel liner plates and carrier pipe is deemed to be specialty contractor work. If the Contractor elects to perform this work, the Contractor shall provide evidence as required by the General Conditions.

- a. Such evidence shall include, as a minimum, the successful grouting of at least three tunnels, minimum 72-inches in diameter and minimum 100 feet long each, which was performed and supervised by the Contractor's own personnel. The experienced supervising personnel must be utilized to supervise this Project's grouting operation.
- b. Documentation of such evidence shall include tunnel diameter and length, carrier pipe diameter and material of construction, project name, project owner, project engineer, project date and name of grouting supervisor.

1.03 STORAGE AND PROTECTION

All materials shall be stored and protected in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Liner Plates

1. Tunnel liner plates shall be manufactured from steel meeting the chemical requirements of ASTM A 569 with the following mechanical properties before cold forming:
 - a. Minimum tensile strength: 42,000 psi
 - b. Minimum yield strength: 28,000 psi
 - c. Elongation, 2-inches: 30 percent
- (1) 2. Liner plates shall have the nominal neutral axis diameter shown on the Drawings. Minimum liner plate thickness shall be 5 gauge. The Contractor's design of the tunnel shall incorporate the combined effects of live and dead loads, hydrostatic loads, and loads, both temporary and permanent, caused by the Contractor's methods of construction. The design shall bear the seal of a professional engineer currently registered in the State of Georgia.
3. All plates shall be formed to provide circumferential flanged joints. Longitudinal joints may be flanged or offset lap seam type. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints. Bolt spacing in circumferential flanges shall be in accordance with the manufacturer's standard spacing and shall be a multiple of the plate length so that plates having the same curvature shall be inter-changeable and will permit staggering of the longitudinal seams. Bolt spacing at flanged longitudinal seams shall be in accordance with the manufacturer's standard spacing. For lapped longitudinal seams, bolt size and spacing shall be in accordance with the manufacturer's standard but not less than that required to meet the longitudinal seam strength requirements of Section 13 of AASHTO Standard Specifications for Highway Bridges.

4. All liner plates in the tunnel shall be the same type, and shall be interchangeable, with the exception that half plates may be used on certain tunnel diameters.
 5. Liner plates shall be hot-dip galvanized in accordance with ASTM A 123 and bituminous coated.
 6. Bolts shall conform to ASTM A 307 Grade A, and shall be hot-dip galvanized in accordance with ASTM A 153.
 7. Grout holes shall be 2-inch minimum diameter tapped couplings welded into place over holes cut in the liner plate. Provide a minimum of three grout holes every three rings (approximately 48-inches). Grout holes shall be provided with steel or iron plugs.
- B. Grout: Grout shall be used for filling the void between the liner plates and the soil and may be used for filling the void between the liner plates and the carrier pipe. Cement shall conform to ASTM C150, Type I or Type II; water shall be fresh, clean, and potable; sand shall conform to requirements of ASTM C404, Size No. 1. Grout shall have a minimum compressive strength of 1,000 psi attained within 24 hours. The grout shall be fluid enough to inject through the lining and to fill voids, however, it shall set promptly enough to keep grout flow under control.
- C. Concrete: Concrete for cradle and for filling void between liner plate and carrier pipe shall meet the following requirements:
1. Cement: All cement shall be one brand of Portland cement. All cement shall be Type I or Type II and shall meet the requirements of ASTM C 150. One bag of Portland cement shall be considered to weigh 94 pounds.
 2. Aggregates: Aggregates shall conform to requirements of ASTM C 33.
 3. Water: Mixing water for concrete shall be fresh, clean and potable.
 4. Admixtures: For each 94 pounds of cement the following amount of admixture shall be provided in accordance with the manufacturer's recommendations.
 - a. For air temperatures below 70 degrees F, provide 3-6 ounces of Master Builders Pozzoloth 344-N (or 122-N) or 2 ounces of Sika Chemical Company's Plastocrete-A.
 - b. For air temperatures above 70 degrees F, provide 3 ounces of Master Builders Pozzoloth 300-R or 3 ounces of Sika Chemical Company's Plastocrete-A.
 5. Concrete shall have a minimum compressive strength of 1,000 psi attained within 24 hours.

- D. Carrier Pipe: Carrier pipes shall meet requirements as specified in the section entitled "Sewers and Accessories" of these Specifications.
- E. Casing Spacers: Casing spacers shall be flanged, bolt-on style with a two-section stainless steel shell lined with a PVC liner, minimum 0.09-inch thick also having a hardness of 85-90 durometer. Runners shall be attached to stainless steel risers which shall be properly welded to the shell. The height of the runners and risers shall be manufactured such that the pipe does not float within the tunnel. Casing spacers shall be equal to Cascade Waterworks Manufacturing Company.
- F. Surface Settlement Markers: Surface settlement markers within pavement areas shall be P.K. nails. Surface settlement markers within non-paved areas shall be wooden hubs.

2.02 TUNNELING EQUIPMENT

- A. Tunneling equipment shall be of U.S. Bureau of Mines approved types. Power machinery and tools within the tunnel shall be operated by either electricity, compressed air, diesel with approved scrubber or other approved power. Electrical tools and equipment shall be grounded in accordance with the latest requirements of the National Electrical Code.
- B. Provide temporary electric lights to properly and safely illuminate all parts of the tunnel construction area including special illumination at the working face. Lighting circuits shall be thoroughly insulated and separated from power circuits, and lights shall be enclosed in wire cages. Secure electrical permits required for successful completion of this work.

PART 3 EXECUTION

3.01 GENERAL

- A. Interpretation of soil investigation reports and data, investigating the site and determination of the site soil conditions prior to bidding is the sole responsibility of the Contractor. Any subsurface investigation by the Bidder or Contractor must be approved by DOT. Rock and/or water, if encountered, shall not entitle the Contractor to additional compensation.
- B. When water is encountered, provide and maintain a dewatering system of sufficient capacity to remove water on a 24 hour basis keeping excavations free of water until the backfill operation is in progress. Dewatering shall be performed in such a manner that removal of soil particles is held to a minimum. Dewater into a sediment trap and comply with requirements specified in the section entitled "Temporary and Permanent Erosion and Sedimentation Control" of these Specifications.
- C. Methods of dewatering shall be at the option and responsibility of the Contractor. Maintain close observation to detect settlement or

displacement of surface facilities due to dewatering. Should settlement or displacement be detected, notify the Engineer immediately and take such action as necessary to maintain safe conditions and prevent damage.

- D. Tunnel construction shall be performed so as not to interfere with, interrupt or endanger roadway surface and activity thereon, and minimize subsidence of the surface, structures, and utilities above and in the vicinity of the tunnel. Support the ground continuously in a manner that will prevent loss of ground and keep the perimeters and face of the tunnel, passages and shafts stable. The Contractor shall be responsible for all settlement resulting from tunnel operations and shall repair and restore damaged property to its original or better condition at no cost to the Owner.
- E. Comply with applicable ordinances, codes, statutes, rules and regulations of the State of Georgia, applicable county building codes and DOT.
- F. Highway Crossings
 - 1. The Contractor shall be held responsible and accountable for the coordinating and scheduling of all construction work within the highway right-of-way.
 - 2. Work along or across the state highway department rights-of-way shall be under the supervision of the Engineer and state highway department.
 - 3. All installations shall be performed to leave free flows in drainage ditches, pipes, culverts or other surface drainage facilities of the highway, street or its connections.
 - 4. No excavated material or equipment shall be placed on the pavement or shoulders of the highway without the express approval of the state highway department.
 - 5. In no instance will the Contractor be permitted to leave equipment (trucks, backhoes, etc.) on the pavement or shoulder overnight. Construction materials to be installed, which are placed on the right-of-way in advance of construction, shall be placed in such a manner as not to interfere with the safe operation of the highway.
 - (1) 6. No blasting shall be permitted within the DOT right-of-way of Roswell Road.

3.02 SAFETY

- A. Provide all necessary bracing, bulkheads and shields to ensure complete safety to all traffic, persons and property at all times during the work. Perform the work in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it.

- B. Begin the tunneling operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. Observe all applicable requirements of DOT regulations. Conduct the operations in such a manner that all work will be performed below the level of the roadbed. Coordinate and schedule all work with DOT.
- C. If, in the opinion of the Engineer or DOT, the tunnel installation work is being conducted in an unsafe manner or in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to tunneling, the Contractor shall be required to submit a plan to repair the roadway. The plan must be acceptable to DOT and the Engineer.
- D. Perform all activities in accordance with the Occupational Safety and Health Act of 1970 (PL-596), as amended, applicable regulations of the Federal Government, OSHA 29CFR 1926 and applicable criteria of ANSI A10.16-81, "Safety Requirements for Construction of Tunnel Shafts and Cassions".

3.03 SURFACE SETTLEMENT MONITORING

- A. Provide surface settlement markers, placed as specified and as directed by the Engineer. The Contractor shall place settlement markers outside of pavement area and railroad ties, along the centerline of the tunnel at 10 foot intervals and offset 10 feet each way from the centerline of the tunnel. Markers shall also be placed at each shoulder of the roadway, at each edge of pavement and railroad ties, at the centerline of the pavement and railroad ties and at 10 and 25 feet in each direction from the centerline of the tunnel. Tie settlement markers to bench marks and indices sufficiently removed as not to be affected by the tunnel operations.
- B. Make observations of surface settlement markers, placed as required herein, at regular time intervals acceptable to the Engineer. In the event settlement or heave on any marker exceeds 1-inch, the Contractor shall immediately cease work and using a method approved by the Engineer and DOT, take immediate action to restore surface elevations to that existing prior to start of tunnel operations.
- C. Take readings and permanently record surface elevations prior to start of dewatering operations and/or shaft excavation. The following schedule shall be used for obtaining and recording elevation readings: all settlement markers, once a week; all settlement markers within 50 feet of the tunnel heading, at the beginning of each day; more frequently at the Engineer's direction if settlement is identified. Make all elevation measurements to the nearest 0.01 foot.
- D. The Contractor shall cooperate fully with jurisdictional personnel. Any settlement shall be corrected by, and at the expense of, the Contractor.
- E. Promptly report any settlement and horizontal movement immediately to the Engineer and take immediate remedial action, at no cost to the Owner.

3.04 SHAFT CONSTRUCTION

Design, construction, maintenance and removal, including any damage attributed to the shaft construction, is the responsibility of the Contractor. Tunnel shafts and the ingress and egress of the tunnel shall meet requirements of OSHA. Construct shafts in accordance with approved shop drawings. Perform excavation, backfill and grading in accordance with the section entitled "Trench Excavation and Backfill" of these Specifications and to the requirements specified herein.

3.05 VENTILATION AND AIR QUALITY

Provide, operate and maintain for duration of tunnel project a ventilation system to meet safety and OSHA requirements.

3.06 TUNNEL OPERATION

- A. Control the tunnel face against sloughing by using such support procedures as breasting boards, poling plates, face jacks, sliding tables, either singly or in combination, spaced as required.
- B. Excavate in such a manner that voids behind the liner plates are held to a minimum. During the tunnelling operation, care shall be exercised in trimming the surface of the excavated section in order that the steel liner plates fit snugly against undisturbed material. Excavation shall not be advanced ahead of the previously installed liner plates any more than is necessary for the installation of the succeeding liner plate.
- C. Whenever the tunnel operation is suspended, support the tunnel face by positive means and keep dewatering system operating. Have qualified personnel periodically check conditions that might threaten tunnel stability.
- E. Excavated soil and rock shall be removed from the site by the Contractor and disposed of properly at a location secured by the Contractor.

3.07 INSTALLATION OF TUNNEL LINER PLATES

- A. Install liner plates in a manner that will not damage the liner plates or coating. If damaged, replace liner plates; repair coating damage to the satisfaction of the Engineer.
- B. Clean foreign matter from the surfaces of flanges which will be in contact with each other, taking care not to damage the coating in the cleaning process. Such surfaces shall be free from material that could interfere with proper bearing and water tightness.
- C. Bolt liner plates in accordance with liner plate manufacturer's recommendations. Retighten or replace bolts as required.

3.08 GROUTING

- A. Grout couplings shall be placed as close as practical to the 12:00, 3:00 and 9:00 positions, alternating with each set of rings.

- B. Fill voids between the earth and the tunnel liner with grout.
- C. The grout pump and injection system shall be of a type that will deliver the grout in a smooth, even flow without surge. The grouting equipment shall be capable of developing uniform pressure at the grout hole connection sufficient to fill voids without disturbing the liner plates, adjacent utilities, structures or roadways. The equipment shall be equipped with hoses having a minimum inside diameter of 1-1/2-inches and have a minimum capacity of one-half cubic yard.
- D. Grouting between the liner plates and excavation shall follow as soon as practicable but at no time shall more than four feet be left ungrouted. At the end of a work shift or when work is interrupted for any reason, no ring shall be left ungrouted. Grouting shall follow progressively with each adjacent set of holes.
- E. In general, grouting shall proceed from the lowest grout hole of each ring and proceed progressively upward. When going from lower to higher grout holes, do not make connection to the higher holes until grout has completely filled the space below. Continue grouting until grout appears in the next set of grout holes which shall be kept open during grouting to permit escape of air and water.

3.09 FIELD QUALITY CONTROL

- A. Inside dimensions of the ring for tunnel liner plates measured along the diameter at any location, shall not vary more than three percent of the liner plate diameter.
- B. The Contractor shall check, verify, record and make corrective measures for the vertical and horizontal alignment of the tunnel. The minimum frequency of this procedure is at the beginning and end of each work shift and at least once every third ring (approximately 48-inches).
- C. Construct tunnel to the line and grade indicated on the Drawings, ensuring a minimum concrete cradle thickness of 4-inches as measured from the inside face of the flange or the inside of the corrugated metal. Ensure that the specified grade for sewers is provided toward the outlet ends with no ponding or pockets.

3.10 INSTALLATION OF PIPE

- A. After construction of the tunnel is complete, and has been accepted by the Engineer, install the pipelines in accordance with the Drawings and Specifications.
- B. Check the alignment and grade of the tunnel and submit a plan to the Engineer for approval to set the pipe at proper alignment, grade and elevation, without any sags or high spots.
- (1) C. The pipe shall be held down by the use of galvanized steel straps or rods with threaded ends. Attach one end of the strap to the liner plate with jaw and jaw turnbuckles; attach the other end of the strap

to the liner plate with a double clevis; attach one end of the rod to the liner plate with thread and jaw turnbuckle; attach the other end of the rod to the liner plate with a clevis. Spacing of straps and rods and the size of straps, rods, clevises and turnbuckles shall be determined by the Contractor and shall be such to withstand the buoyancy forces of an empty pipe when encapsulated with grout.

- D. The void between carrier pipe and the tunnel liner shall be grouted in place in two phases. The first phase shall grout the 36-inch gravity sewer in place. The second phase shall grout the 24 and 48-inch force mains in place. Measures shall be taken by the Contractor to prevent floatation and other movement of the pipe as the grout is filling the void. The Contractor shall submit a plan to the Engineer for approval. This plan shall address the proposed procedure, including methods of assuring all the voids are filled as well as standby equipment.
- E. Close the ends of the tunnel with 12-inch brick walls, plastered with Portland cement mortar and waterproofed with asphaltic roofing cement.

3.11 SHEETING REMOVAL

Remove sheeting used for shoring from the shaft and off the job site. The removal of sheeting, shoring and bracing shall be done in such a manner as not to endanger or damage either new or existing structures, private or public properties and also to avoid cave-ins or sliding in the banks.

END OF SECTION

SECTION 02510
ASPHALT CONCRETE PAVEMENT

PART 1 GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, materials, equipment and incidentals required to construct asphalt concrete pavements to the grades and cross-sections shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

- A. Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.
- B. Comply with applicable requirements of Georgia Department of Transportation, Standard Specifications for Construction of Roads and Bridges.

1.03 SUBMITTALS

- A. Certificates: Provide certificates stating that materials supplied comply with Specifications. Certificates shall be signed by the asphalt producer and the Contractor.
- B. Traffic paint manufacturer's application instructions and a description and other data relative to the Contractor's application equipment and methods shall be submitted to the Engineer for approval.

1.04 CONDITIONS

A. Weather Limitations

1. Apply bituminous prime and tack coats only when the ambient temperature in the shade has been at least 40 degrees F.
2. Do not conduct paving operations when surface is wet, frozen or contains excess of moisture which would prevent uniform distribution and required penetration.
3. Construct asphaltic courses only when atmospheric temperature in the shade is above 35 degrees F, when the underlying base is dry and when weather is not rainy.
4. Place base course when air temperature is above 35 degrees F and rising. No base course shall be placed on a frozen or muddy subgrade.

- B. Grade Control: Establish and maintain the required lines and grades for each course during construction operations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Graded Aggregate Base Course: Graded aggregate base course shall be of uniform quality throughout and shall meet the requirements of Section 815.01 of the Georgia Department of Transportation Standard Specifications.
- B. Binder Course: Binder course shall be of uniform quality throughout and shall conform to the requirements of Section 828, Type "B-Modified" of the Georgia Department of Transportation Standard Specifications.
- C. Surface Course: Surface course shall be of uniform quality throughout and shall conform to the requirements of Section 828, Type "E" of the Georgia Department of Transportation Standard Specifications.
- D. Tack coat shall conform to the requirements of Section 413 of the Georgia Department of Transportation Standard Specifications.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Graded Aggregate Base Course
 - 1. Check subgrade for conformity with elevations and section immediately before placing aggregate base material.
 - 2. Place aggregate base material in compacted layers not more than 6-inches thick, unless continuing tests indicate that the required results are being contained with thicker layers.
 - 3. In no case shall more than 8-inches of compacted base be placed in one lift.
 - 4. Spread, shape, and compact all aggregate base material deposited on the subgrade during the same day.
 - 5. The compacted base shall have sufficient stability to support construction traffic without pumping.
 - 6. If compacted base becomes unstable as a result of too much moisture, the base material and underlying subgrade, if necessary, shall be dried and reworked to a moisture content that can be recompacted.
- B. Loose and Foreign Material
 - 1. Remove loose and foreign material from surface immediately before application of paving.
 - 2. Use power brooms or blowers, and hand brooming as required.
 - 3. Do not displace surface material.

C. Tack Coat

1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or portland cement concrete and similar surfaces.
2. Apply at a rate of 0.05 to 0.15 gallon per square yard of surface.
3. Apply tack coat by brush to contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.
4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 EQUIPMENT

- A. Provide size and quantity of equipment to complete the work specified within project time schedule.
- B. Bituminous pavers shall be self-propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.
- C. Rolling equipment shall be self-propelled, steel-wheeled and pneumatic-tired rollers that can reverse direction without backlash.
- D. Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.03 ASPHALTIC CONCRETE PLACEMENT

- A. Place asphalt concrete mix on prepared surface, spread and strike-off using paving machine.
- B. Spread mixture at a minimum temperature of 225 degrees F.
- C. Inaccessible and small areas may be placed by hand.
- D. Place each course at a thickness such that when compacted it will conform to the indicated grade, cross-section, finish thickness, and density indicated.
- E. Paver Placing
 1. Unless otherwise directed, begin placing along centerline of areas to be paved on crowned section, and at high side of sections on one-way slope, and in direction of traffic flow.
 2. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
 3. Complete base courses for a section before placing surface courses.

4. Place mixture in as continuous an operation as practical.

F. Hand Placing

1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to Engineer.
2. Place mixture at a rate that will ensure handling and compaction before mixture becomes cooler than acceptable working temperature.

G. Joints

1. Carefully make joints between old and new pavements, or between successive days work, to ensure a continuous bond between adjoining work.
2. Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
4. Offset transverse joints in succeeding courses not less than 24-inches.
5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
6. Offset longitudinal joints in succeeding courses not less than 6-inches.
7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.04 ASPHALTIC CONCRETE COMPACTION

- A. Provide sufficient rollers to obtain the required pavement density.
- B. Begin rolling operations as soon after placing as the mixture will bear weight of roller without excessive displacement.
- C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.
- D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.
- F. Do not roll centers of sections first under any circumstances.

G. Breakdown Rolling

1. Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
2. Operate rollers as close as possible to paver without causing pavement displacement.
3. Check crown, grade, and smoothness after breakdown rolling.
4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.

H. Second Rolling

1. Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.
2. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling

1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
2. Continue rolling until roller marks are eliminated and course has attained specified density.

J. Patching

1. Remove and replace defective areas.
2. Cut-out and fill with fresh, hot asphalt concrete.
3. Compact by rolling to specified surface density and smoothness.
4. Remove deficient areas for full depth of course.
5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.
6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.05 CLEANING AND PROTECTION

A. After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Engineer.

B. Protection

1. After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case no sooner than 6 hours.

2. Provide barricades and warning devices as required to protect pavement and the general public.

C. Maintenance: The Contractor shall maintain the surfaces of pavements until the acceptance of the Project. Maintenance shall include replacement, overlay, milling and reshaping as necessary to prevent raveling of the road material, the preservation of smooth surfaces and the repair of damaged or unsatisfactory surfaces, to the satisfaction of the Engineer.

3.06 SUPERVISION AND APPROVAL

- A. Pavement shall meet the requirements of the regulatory agency responsible for the maintenance of pavement. Obtain agency approval of pavement before requesting final payment.
- B. Failure of Pavement: Should any pavement restoration or repairs fail or settle during the life of the Contract, including the bonded period, promptly restore or repair defects.

END OF SECTION

SECTION 02675

DISINFECTION OF POTABLE WATER FACILITIES

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section includes furnishing all labor, equipment, materials and chemicals required to disinfect all potable water facilities in accordance with the procedures specified herein.
- B. Upon completion of the construction and installation of equipment, the Contractor shall sterilize all piping, pumps, and connections thereto, all distribution system piping and any surfaces that shall be in contact with potable water.

1.02 STANDARDS

Procedures for disinfecting water mains and water storage facilities, unless otherwise modified herein, shall conform to the requirements of AWWA Standards C651, C652, C653 and C654.

PART 2 PRODUCTS

2.01 DISINFECTION AGENT

The disinfection agent shall be free chlorine or chlorine compound. The method of application and type of disinfecting agent shall both be acceptable to the Engineer.

PART 3 EXECUTION

3.01 DISINFECTION PROCEDURE

- A. Prior to disinfection, all surfaces shall be thoroughly flushed with clear water after all debris and dirt has been removed.
- B. Disinfection shall be accomplished by the application of clear water containing a minimum of 50 parts per million (ppm) of available chlorine: in new lines at least 25 ppm free chlorine shall be applied. The chlorine bearing water shall remain in contact with the surfaces being sterilized for a period of not less than 24 hours. At the end of the contact period the chlorine residual in all units and at extremities of pipe lines and other representative points shall be at least 25 ppm.
- C. In the process of chlorinating newly constructed units and newly installed pipe, all valves or other appurtenances shall be operated at least five times while the units and pipelines are filled with the disinfection agent.

- D. Upon completion of the disinfection procedure, reduce the chlorine residual of disinfection water to levels required for discharge per requirements of federal, state and local regulatory agencies. Treat water with sulfur dioxide or other reducing chemicals to neutralize chlorine residual. All units and piping shall be flushed with potable water until the chlorine residual remaining is one part per million or less and the replacement water throughout the units, upon suitable bacteriological tests, has proved to be of acceptable quality and in conformance with Georgia Department of Natural Resources, Environmental Protection Division Standards for municipal water supplies. This satisfactory quality of water shall continue for two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination.
- E. No portion of new work shall be placed in service until disinfection has been completed and approved by the Engineer. Should the initial treatment fail to result in acceptable water, the chlorination procedure shall be repeated until satisfactory results are obtained.

END OF SECTION

SECTION 02730

SEWERS AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

- A. This Section describes products to be incorporated into process piping, sewers and accessories and requirements for the installation and use of these items. Furnish all products and perform all labor necessary to fulfill the requirements of these Specifications.
- B. General: Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

1.02 QUALIFICATIONS

If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two years.

1.03 SUBMITTALS

Complete shop drawings and engineering data, including shop drawings, shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.04 TRANSPORTATION AND HANDLING

A. Handling Materials

- 1. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves and accessories. Make equipment available at all times for use in unloading. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.
- 2. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

1.05 STORAGE AND PROTECTION

A. Storage

- 1. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

2. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage by freezing.
3. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tier shall be kept off the ground on timbers, rails or concrete. Pipe in tiers shall be alternated: bell, plain end; bell, plain end. At least two rows of timbers shall be placed between tiers and chocks, affixed to each other in order to prevent movement. The timbers shall be large enough to prevent contact between the pipe in adjacent tiers.
4. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

1.06 QUALITY ASSURANCE

- A. Product manufacturers shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.
- B. If ordered by the Engineer, each pipe manufacturer shall furnish the services of a competent factory representative to supervise and/or inspect the installation of pipe. This service will be furnished for a minimum of five days during initial pipe installation.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

- A. Ductile Iron Pipe (DIP)
 1. Ductile iron pipe shall be utilized in station piping, force mains, stream crossings, highway crossings, and other applications as shown on the Drawings. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet.
 2. Ductile iron pipe shall conform to AWWA C 151 for force mains and for gravity sewers and shall be Class 51 unless otherwise specified or shown on the Drawings. Flanged pipe shall be minimum Class 53. Flanges shall be furnished by the pipe manufacturer. Sizes will be as shown on the Drawings.
 3. Pipe and fittings shall be cement lined in accordance with AWWA C 104. Exterior pipe and fittings shall be furnished with a bituminous outside coating. Interior pipe and fittings shall be coated in accordance with the section entitled "Painting" of these Specifications.
 4. Fittings shall be ductile iron and shall conform to AWWA C 110 with a minimum rated working pressure of 250 psi.

5. Joints: Unless shown or specified otherwise, joints shall be push-on or restrained joint type for pipe and standard mechanical, push-on or restrained joints for fittings. Joints shall conform to AWWA C 111. Flanged joints shall conform to AWWA C115. Restrained joints shall be equal to American "FLEX-RING" or "LOK-RING", Clow "SUPER-LOCK" or U.S. "TR-FLEX".
6. Provide the appropriate gaskets for joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.
7. Provide the necessary bolts for mechanical, restrained and flange connections. Bolts for flange connections shall be steel with American Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B 17.2. All bolts and nuts shall be threaded in accordance with ANSI B 1.1, Coarse Thread Series, Class 2A and 2B fit. Mechanical joint glands shall be ductile iron.
8. Wall Sleeves and Wall Pipes
 - a. Where piping passes through concrete structures, furnish and install wall sleeves unless wall pipes or other provisions are specifically shown on the Drawings. Wall sleeves shall be accurately located and securely fastened into position before concrete is poured.
 - b. For pipe sizes smaller than 3-inches, wall sleeves shall be steel oversized sleeves furnished with a full circle integral or continuously welded water stop collar. The sleeve seal shall be mechanically expanded, synthetic rubber type. Provide all associated bolts and nuts of stainless steel, seals and seal fittings, pressure clamps, or plates necessary to achieve a watertight installation. Sleeves shall extend the full thickness of the concrete. Seals shall be Link Seal, manufactured by Thunderline Corporation.
 - c. Wall sleeves shall be statically cast iron mechanical joint wall sleeves. Unless specified or shown otherwise for a specific situation, wall sleeves shall be MJ bell-plain end type with waterstop collar. Sleeves shall be installed with studs and gland on the air side of the concrete structure. Where the concrete structure is exposed to dirt on one side and is wet on the other side, install with studs and glands on the dirt side. Pipe passing through the sleeve shall extend no more than 3 feet beyond the structure without a piping joint. Wall sleeves shall be equal to American A-10771.
 - d. Wall pipes shall be either statically cast iron with integral waterstop collar or centrifugally cast ductile iron with a continuously welded waterstop collar. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside. Unless specified or shown otherwise for a specific situation, wall pipes shall be flange-flange type. Wall pipes and collars shall be designed to withstand a thrust force caused by 250 psi acting from either direction on that size pipe.

e. Wall pipes shall be cast and/or fabricated, and lined in one manufacturer's facilities and delivered to the job site ready for use.

9. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

B. Reinforced Concrete Pipe (RCP)

1. Pipe

- a. Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class IV pipe. Wall thickness design shall correspond to Wall C.
- b. In addition, the pipe and materials shall meet the following requirements:
 - (1) Concrete shall have a minimum compressive strength of 5,000 psi;
 - (2) Cement shall meet the requirements of ASTM C 150, Type II;
 - (3) Absorption shall not exceed 6 percent when tested in accordance with ASTM C 497.
- c. Reinforced concrete pipe shall be supplied in lengths of at least six feet.

2. Joints

- a. Pipe 24-inches and larger shall have steel end rings with rubber O-ring gasket type joints conforming to ASTM C 361.
- b. A rectangular groove shall be supplied in the spigot end to receive the rubber O-ring gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.
- c. The steel end ring, on both the spigot and the bell ends, shall be provided with a 4-inch wide skirt. The skirt shall be 14 gauge and shall be connected to the end ring by a continuous weld for the full circumference. The skirt shall be welded to the wall or joint reinforcing. The skirt shall be provided with a 1.00-inch impact collar/waterstop, 0.25-inch thick, perpendicular to the skirt and located at the center of the skirt. The impact collar/waterstop shall be continuously welded for the full circumference to the skirt. All steel surfaces not encased in concrete shall be galvanized.
- d. The steel and O-ring pipe joint shall also be provided with a butyl rubber sealant or a polyurethane foam sealant. Butyl rubber sealant shall have a minimum nominal diameter of 1-inch and shall be equal to Kent Seal No. 2 or Concrete Sealants CS-202. The polyurethane foam sealant shall have its pores filled with unhydrated Portland cement equal to

Flex-Protex Joint Filler. The sealant shall be installed on the shoulder of the spigot in such a manner that the sealant will be compressed by the jointing of the bell and spigot and fill the void between the bell and spigot.

3. Acceptance

- a. Acceptance of pipe shall be on the basis of plant load-bearing tests for the load to produce 0.01-inch crack and the ultimate strength of the pipe, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.
- b. Provide results of tests on pipe, pipe materials, joint material, and made-up joints performed by an independent testing laboratory approved by the Engineer. Include materials, absorption, crushing, and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications.
- c. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.
- d. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Do not accept or use pipe with repaired or patched gasket grooves or shoulders. Any pipe repaired or patched is subject to rejection if such repairs or patches, in the opinion of the Engineer or Owner, are not sound and properly finished.
- e. The Owner shall, at its own discretion, select another independent testing laboratory to confirm those tests performed by the manufacturer's testing laboratory. This testing laboratory shall observe the tests conducted by the laboratory selected by the manufacturer, or, as necessary, conduct its own tests. The manufacturer shall provide the necessary facilities for the performance of these tests at the plant site. These test specimens shall be provided in accordance with paragraph 11 of ASTM C 76. Costs for these tests shall be billed to the Contractor who will be reimbursed under the provisions of CASH ALLOWANCES.
- f. No pipe shall be shipped before it has been cured for a minimum of 14 days.

C. Reinforced Concrete Pipe (RCP) (Storm Drains)

1. Pipe: Pipe shall be bell and spigot reinforced concrete conforming to ASTM C 76 for Class III pipe. Wall thickness design shall correspond to Wall B. Reinforced concrete pipe shall be supplied in lengths of at least 6 feet.
2. Joints: Pipe shall have rubber gasket type joints conforming to ASTM C 443 or ASTM C 361. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

3. Acceptance

- a. Acceptance for pipe shall be on the basis of plant load-bearing tests, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1 of ASTM C 76.
 - b. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.
 - c. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Do not accept or use repaired or patched pipe or pipe with repaired or patched gasket grooves or shoulders.
- D. Detection Tape: Detection tape shall be composed of a solid aluminum foil encased in a protective plastic jacket. Tapes shall be color coded in accordance with APWA color codes with the following legends: Sanitary Sewerage Systems, Safety Green, "Caution: Sewer Line Buried Below". Colors may be solid or striped. Tape shall be permanently printed with no surface printing allowed. Tape width shall be minimum 2-inches when buried less than 10-inches below the surface. Tape width shall be minimum 3-inches when buried greater than 10-inches and less than 20-inches. Detection tape shall be equal to Lineguard Type III Detectable or Allen Systems Detectatape.
- E. Retainer Glands: Retainer glands shall be Megalug, Series 1100, as manufactured by EBBA Iron.
- F. Stainless Steel Pipe
1. Stainless steel pipe in sizes 10-inches and smaller shall be seamless stainless steel pipe conforming to the requirements of ASTM A 312, Type 304.
 2. Unless otherwise specified or shown, stainless steel pipe 1-1/2-inches and smaller shall be screwed, Schedule 40S. Steel pipe in sizes 2 through 10-inches shall be welded, Schedule 10S.
 3. Screwed fittings and unions 1-1/2-inches and smaller shall be 3,000 pound forged stainless steel conforming to ASTM A 182, Grade F304 and ANSI B16.11.
 4. Welded fittings shall be of the butt-welded type of wrought stainless steel conforming to ASTM A 403, Grade WP304 and ANSI B16.9. Reducing branch connections shall be made using threadolets or weldolets.

2.02 MANHOLES AND PRECAST CONCRETE PRODUCTS

- A. Provide manholes and other precast concrete products in accordance with the following:

1. Precast Concrete Sections

- a. Precast concrete sections shall meet the requirements of ASTM C 478. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
- b. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.
- c. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
- d. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.
- e. Precast sections shall be manufactured such that the spigot end is at the top of each section.

2. Brick and Mortar: Brick shall be whole and hardburned, conforming to ASTM C 32 Grade MS. Mortar shall be made of one part Portland cement and two parts clean sharp sand. Cement shall be Type 1 and shall conform to ASTM C 150. Sand shall meet ASTM C 53.

4. Iron Castings

- a. Cast iron manhole frames and covers shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth and free from blow holes, blisters, shrinkage, strains, cracks, cold shots and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
- b. Manhole frames and covers shall be equal to the following:

	<u>Type</u>	<u>Design Weight</u>	<u>Manufacturer's Reference</u>
(1)	Watertight	270#	Clow F-3370
	c.	All frames and covers shall have machined horizontal bearing surfaces.	
	d.	All manholes shall have watertight frames and covers.	
	e.	Watertight covers shall be bolt-down type and shall be equipped with four 1/2-inch stainless steel bolts and a 1/8-inch red rubber or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored	

through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

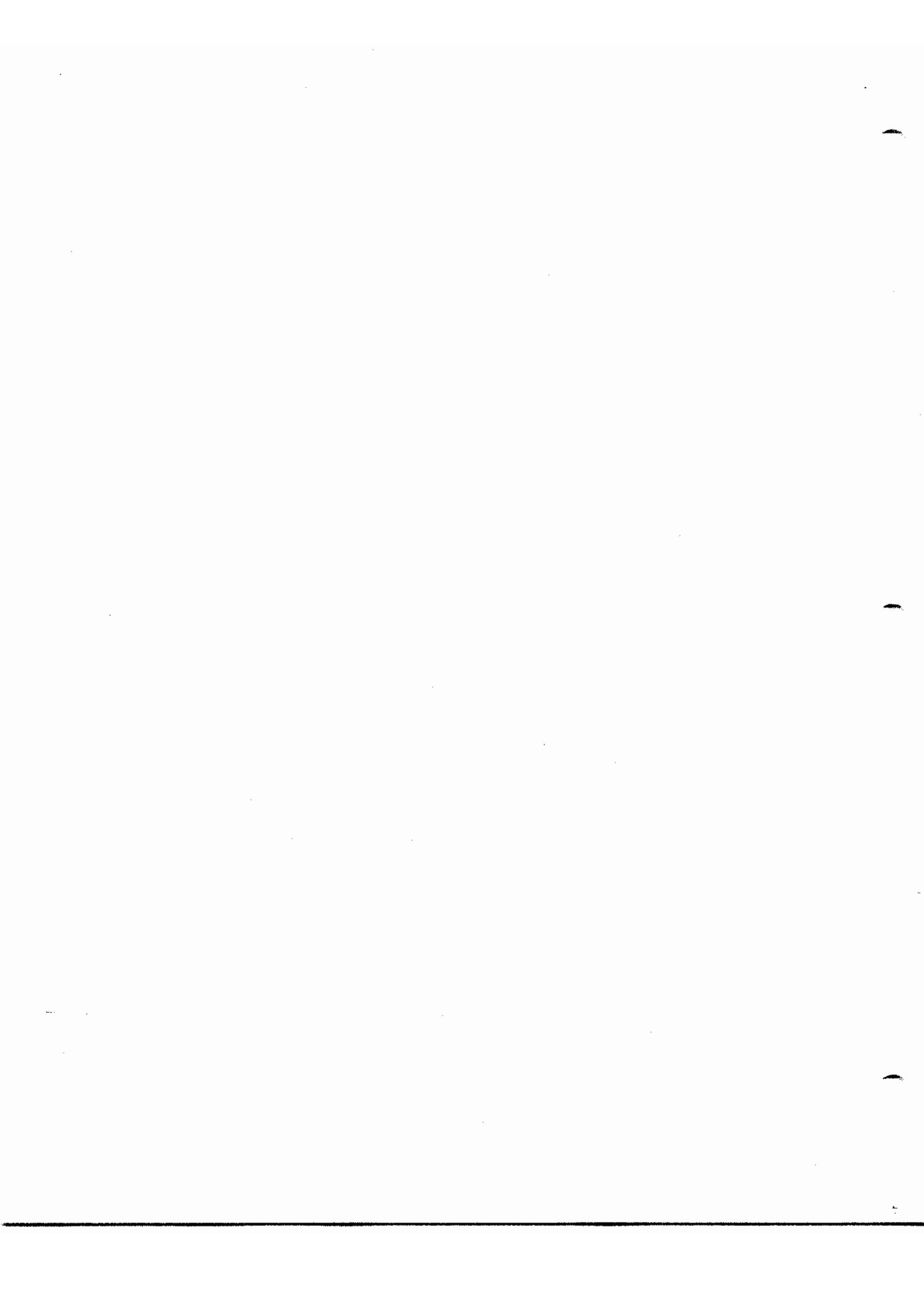
5. Plastic Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries may be used.
6. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.
7. Floor Door
 - a. Door shall be a single or double leaf type as shown on the Drawings built to withstand 150 pounds per square foot.
 - b. The frame shall be 1/4-inch extruded aluminum with built-in neoprene cushion and with strap anchors bolted to the exterior. Door leaf shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required. Stainless steel hinges shall be bolted to the underside and pivot on torsion bars that counterbalance the door for easy operation. The door shall open to 90 degrees and lock automatically in that position. A vinyl grip handle shall be provided to release the cover for closing. Doors shall be equipped with a snap lock and removable handle. Door shall also be equipped with hasp and padlock in addition to built-in locking mechanisms. Padlocks for all doors shall be keyed alike. Bituminous coating shall be applied to the exterior of the frame by the manufacturer. All parts shall be aluminum or stainless steel.
 - c. Door shall be Type KD, manufactured by The Bilco Company.

2.03 CONCRETE

Concrete shall have a compressive strength of not less than 3000 psi, with not less than 5.5 bags of cement per cubic yard and a slump between 3 and 5-inches. For job mixed concrete, submit the concrete mix design for approval by the Engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, Grade 60.

2.04 PLUG VALVES

- A. Valves shall be 90 degree turn, non-lubricated, eccentric type with resilient faced plugs. Design of the valve shall provide that contact between the seat and the plug shall only occur in the final degrees of plug movement. Valves shall be suitable for throttling service and service where valve operation is infrequent.
- B. Operating Requirements: Valves shall provide drip-tight shut-off up to the full pressure rating with pressure in either direction. Pressure ratings shall be established by hydrostatic tests conducted in accordance with ANSI B 16.1. Valves shall be rated at a minimum of 150 psi. Valves 20-inches and smaller shall have a port area equal to at least 80 percent of the full pipe area.



- C. Valve Body: Bodies shall be cast-iron conforming to ASTM A 126 Class B. All exposed nuts, bolts, springs, washers, etc. shall be zinc coated in accordance with ASTM A 153. Valves shall have flanged or mechanical joint ends as shown on the Drawings. Flanged valves shall have ANSI 125 pound standard flanges. Mechanical joint valves shall have bell ends conforming to applicable requirements of ANSI 21.11. Flanged valves with flange-to-MJ adaptors shall not be acceptable in lieu of MJ valves.
- D. Valve Seats: Valve seats shall be a raised welded-in overlay of not less than 90 percent pure nickel, machined to mate with the resilient faced plug. Overlay shall be minimum of 1/8-inch thick.
- E. Valve Plug: The plug shall be of semi-steel conforming to ASTM A 126 Class B. Plug facing shall be a synthetic rubber compound of approximately 70 durometer hardness bonded to the plug. Facing material shall be abrasion resistant and suitable for service in sewage and sludge applications.
- F. Shaft Bearings: Valves shall be furnished with replaceable sleeve-type bearings in the upper and lower journals. Bearings shall comply with applicable requirements of AWWA C 507. Bearing materials shall have a proven record of service of not less than five years.
- G. Shaft Seal: The valve body shall be fitted with a bolted bonnet incorporating a stuffing box and pull-down packing gland. Packing shall be the split chevron type. Design of exposed valves shall allow visible inspection of the shaft seal, adjustment of the packing, and replacement of the packing, all without disturbing the bonnet or valve operator. The shaft seal shall comply with the requirements of AWWA C 504.
- H. Manual Operation: Valves 8-inches and smaller in diameter shall be equipped with lever operators unless otherwise noted on the Drawings. Valves for buried service shall be provided with operating nut suitable for connection to extension stem where required and as specified in this Section. Provide one valve wrench for each exposed valve.
- I. Manufacturer: All plug valves shall be products of a single manufacturer who must submit evidence of five years satisfactory service in sewage applications of the same design and of the sizes required. Valves shall be manufactured by DeZurik or Keystone.

2.05 CHECK VALVES

- A. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valves shall be designed for 10 psi and shall not slam shut on pump shutdown. Valves shall be equipped with a 1/2-inch stop cock at the high point of the valve for bleeding air from the line.
- B. Valves shall be outside spring and lever type.

(1) C. Valve shall have globe body type design with ANSI/ASME B 16.1, Class 125 flanges.

D. Valves shall be G.A. Industries or APCO.

2.06 KNIFE GATE VALVES

A. The valve shall be a short body, round port, resilient seat valve. All parts in contact with the process material, including knife gate, valve body and packing chamber shall be of stainless steel construction. The knife gate shall be finish ground on both sides to prevent damage to the valve packing. The gate shall be held in position by gate guides designed to assure proper support for the moving gate and positive seating when closed.

(1) B. Flanges shall be in accordance with ANSI/ASME B 16.1, Class 125. The valves shall have a minimum pressure rating of 125 psi.

C. The packing chamber shall be equipped with multiple-ring packing, corrosion resistant packing gland, and stainless steel packing gland bolts and nuts. Packing gland bolts shall be easily accessible.

D. The valve stem shall be stainless steel and shall be supported by a bronze sleeve mounted in an extended yoke. The valve shall be equipped with a handwheel actuator designed for rapid manual actuation of the valve. All bolts, nuts and other connections and fittings shall be stainless steel

E. The valve shall be manufactured by DeZurik, Hilton or Rovalve.

2.07 VACUUM RELIEF CHECK VALVES

A. Check valves shall be hinged disc type with cast iron body and bronze or bronze-fitted disc. Valve shall be designed to open at 12 psia and close at 5 psig.

B. Valves shall be outside counterweight and lever type.

(1) C. Valve shall have globe body type design with ANSI/ASME B 16.1, Class 125 flanges. Valve shall not be equipped with standard hooded vent.

D. Valves shall be G.A. Industries (Figure 991).

2.08 TAPPING SADDLES

Tapping saddles shall be ductile iron body type with O-ring gasket and alloy steel straps. Connection shall be flanged or mechanical joint as detailed on the Drawings. Tapping saddles shall be equal to ACIPCO A-30920 (FL) or A-10920 (MJ).

2.09 AIR VALVES

A. Air Release Valves: Valves shall be automatic air release valves designed to allow escape of air under pressure and close water-tight

when liquid enters the valve. Valve shall have a 3-inch NPT inlet and a maximum orifice diameter of 7/32-inch. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.

- B. Air/Vacuum Valves: Valves shall be automatic air and vacuum valves designed to allow escape of air, close water-tight when liquid enters the valve, and allow air to enter in the event of a vacuum. The valve body shall be cast iron, designed to facilitate disassembly for cleaning and maintenance. The float shall be stainless steel; the valve seat and all working parts shall be of corrosion-resistant materials. Valves shall be equipped with the necessary attachments, including valves, quick disconnect couplings and hose, to permit back flushing after installation without dismantling the valve.
- C. Combination air valve shall consist of an air release valve tapped into the body of an air and vacuum valve.
- D. Single Body Valve: In lieu of 3. above, a single body, double orifice, sewage combination valve may be used. Materials of construction, orifice size, venting capacity and accessories shall meet the requirements of A and B above.
- E. Valves shall be recommended by the manufacturer for wastewater service and shall be APCO Valve Corporation or Val-Matic.

2.10 FLANGE ADAPTOR

- (1) The flange adaptor shall permit the connection of unthreaded, ungrooved, open-ended ductile iron pipe to ANSI/ASME B 16.1, Class 125 flanges. The adaptor shall be a ductile iron casting incorporating a flange with extended throat, set screws and gasket. The gasket shall provide a compression seal between the adaptor, the pipe and the adjacent flange. Install only in locations specifically shown on the Drawings and in accordance with the manufacturer's recommendations. The flange adaptor shall be equal to Uni-Flange or Kwik-Flange.

2.11 SURGE RELIEF VALVES (SRV-V-1, 2)

- A. Surge relief valves shall be angle type, APCO Series 3000.
- (1) B. Flanges shall be in accordance with ANSI/ASME B 16.1, Class 125.
- C. Valves shall be set to open at 100 psi. The opening set point shall be adjustable to 175 psi.

2.12 TRUE UNION BALL CHECK VALVES

Ball check valves shall be non-shock thermoplastic type of Type 1, Grade 1 PVC with O-ring ball seal. The valve shall have a true union

connection for easy removal. The valve shall operate in the vertical or horizontal position. Valve shall be Hayward "True Check" or Chemtrol BC Series.

2.13 TRUE UNION BALL VALVES

Ball valves shall be non-shock thermoplastic of Type 1, Grade 1 PVC with O-ring stem seal and teflon ball seat. Valves shall withstand 150 psi pressure. Valves shall have union connections at each end. Valves shall be Hayward "Safe Block" or Chemtrol TU Series.

2.14 VALVE BOXES (VB) AND EXTENSION STEMS

- A. All valves shall be equipped with valve boxes where shown on the Drawings. The valve boxes shall be cast iron, two piece screw type with drop covers. Valve boxes shall have a 5.25-inch inside diameter. Valve box covers shall weigh a minimum of 13 pounds. The valve boxes shall be adjustable to 6-inches up or down from the nominal required cover over the pipe. Valve boxes shall have sufficient length that the bottom flange of the lower belled portion of the box is below the valve operating nut. Ductile or cast iron extensions shall be provided as necessary. Valve boxes shall be manufactured in the United States.
- B. All valves shall be furnished with extension stems, as necessary, to bring the operating nut to within 30-inches of the top of the valve box. Connection to the valve shall be with a wrench nut coupling and set screw to secure the coupling to the valve's operating nut. The coupling and square wrench nut shall be welded to the extension stem. Extension stems shall be equal to Mueller A-26441 or M & H Valve Style 3801.

2.15 PRESSURE GAUGES

Pressure gauges shall have bronze or stainless steel bourdon tube elements. Lens shall be heavy glass, with oil-resistant gasket seal. The dial shall be a minimum of 4.5-inches in diameter, with white coated metal lithographed with black metal graduations and numerals. The mounting as required. Connection shall be 1/4-inch NPT with square wrench surface. Provide cartridge snubber and polished brass gauge cock. Range shall be as shown on the Drawings. Accuracy shall be ± 0.5 percent. Acceptable manufacturers shall be Ashcroft and U.S. Gauge.

PART 3 EXECUTION

3.01 EXISTING UNDERGROUND UTILITIES AND OBSTRUCTIONS

- A. The Drawings indicate underground utilities or obstructions that are known to exist according to the best information available to the Owner. The Contractor shall call the Utilities Protection Center (UPC) (325-5000 or 1-800-282-7411) as required by Georgia law (Code Section 25-9-1 through 25-9-13) and all utilities, agencies or departments that own and/or operate utilities in the vicinity of the construction work site, at least 72 hours (three business days) prior to construction, to verify the location of the existing utilities.

- B. Existing Utility Location: The following steps shall be exercised to avoid interruption of existing utility service.
1. Provide the required notice to the utility owners and allow them to locate their facilities according to the Georgia law. Field utility locations are valid for only ten days after original notice. The Contractor shall ensure, at the time of any excavation, that a valid utility location exists at the point of excavation.
 2. Expose the facility to verify its true location and grade for a distance of at least 200 feet in advance of pipeline construction to verify its true location and grade. Repair, or have repaired, any damage to utilities resulting from locating or exposing their true location.
 3. Avoid utility damage and interruption by protecting it with means or methods recommended by the utility owner.
 4. Maintain a log identifying when phone calls were made, who was called, area for which utility relocation was requested and work order number issued, if any. The Contractor shall provide the Engineer an updated copy of the log bi-weekly, or more frequently if required.

C. Conflict with Existing Utilities

1. Horizontal Conflict: Horizontal conflict shall be defined as when the actual horizontal separation between a utility, main, or service and the proposed water main does not permit safe installation of the sewer by the use of sheeting, shoring, tying-back, supporting, or temporarily suspending service of the parallel or crossing facility. The Contractor may change the proposed alignment of the sewer to avoid horizontal conflicts if the new alignment remains within the available right-of-way or easement and complies with regulatory agency requirements after a written request to and subsequent approval by the Engineer. Where such relocation of the sewer is not approved by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.
2. Vertical Conflict: Vertical conflict shall be defined as when the actual vertical separation between a utility, main, or service and the proposed sewer does not permit the crossing without immediate or potential future damage to the utility, main, service, or the sewer. The Contractor may change the proposed grade of the sewer to avoid vertical conflicts if the changed grade provides minimum required capacity, maintains adequate cover and complies with regulatory agencies requirements, after written request to and subsequent approval by the Engineer. Where such relocation of the sewer is not approved by the Engineer, the Contractor shall arrange to have the utility, main, or service relocated.

- D. Electronic Locator: Have available at all times an electronic pipe locator and a magnetic locator, in good working order, to aid in locating existing pipe lines or other obstructions.
- E. Water and Sewer Separation
 - 1. Sewers should maintain a minimum 10 foot edge-to-edge separation from water mains. Where the sewer crosses a water main, an 18-inch vertical separation shall be maintained where possible. Where possible, a full joint of sewer pipe shall be centered over the water main. Any deviation shall be requested in writing to the Engineer.
 - 2. No water main shall be permitted to pass through or come in contact with any part of a manhole.

3.02 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

- A. Install pipe lines and appurtenances along highways, streets and roadways in accordance with the applicable regulations of, and permits issued by, the Georgia Department of Transportation, Fulton County, and the City of Roswell with reference to construction operations, safety, traffic control, road maintenance and repair.
- B. Traffic Control
 - 1. The Contractor shall: provide, erect and maintain all necessary barricades; suitable and sufficient lights and other traffic control devices; provide qualified flagmen where necessary to direct traffic; take all necessary precautions for the protection of the work and the safety of the public.
 - 2. Construction traffic control devices and their installation shall be in accordance with the current Manual On Uniform Traffic Control Devices for Streets and Highways.
 - 3. Placement and removal of construction traffic control devices shall be coordinated with the Georgia Department of Transportation, Fulton County and the City of Roswell a minimum of 48 hours in advance of the activity.
 - 4. Placement of construction traffic control devices shall be scheduled ahead of associated construction activities. Construction time in street right-of-way shall be conducted to minimize the length of time traffic is disrupted. Construction traffic control devices shall be removed immediately following their useful purpose. Traffic control devices used intermittently, such as "Flagmen Ahead", shall be removed and replaced when needed.
 - 5. Existing traffic control devices within the construction work zone shall be protected from damage. Traffic control devices requiring temporary relocation shall be located as near as possible to their original vertical and horizontal locations. Original locations shall be measured from reference points and

recorded in a log prior to relocation. Temporary locations shall provide the same visibility to affected traffic as the original location. Relocated traffic control devices shall be reinstalled in their original locations as soon as practical following construction.

6. Construction traffic control devices shall be maintained in good repair, and shall be clean and visible to affected traffic for daytime and nighttime operation. Traffic control devices affected by the construction work zone shall be inspected daily.
7. Construction warning signs shall be black legend on an orange background. Regulatory signs shall be black legend on a white background. Construction sign panels shall meet the minimum reflective requirements of the Georgia Department of Transportation, Fulton County and the City of Roswell. Sign panels shall be of durable materials capable of maintaining their color, reflective character and legibility during the period of construction.
8. Channelization devices shall be positioned preceding an obstruction at a taper length as required by the current Manual On Uniform Traffic Control Devices for Streets and Highways, as appropriate for the speed limit at that location. Channelization devices shall be patrolled to insure that they are maintained in the proper position throughout their period of use.

C. Construction Operations

1. Perform all work along highways, streets and roadways to minimize interference with traffic.
 2. Trenching, Laying and Backfilling: Do not open the trench any further ahead of pipe laying operations than is necessary. Backfill and remove excess material immediately behind laying operations. Complete excavation and backfill for any portion of the trench in the same day.
 3. Shaping: Reshape damaged slopes, side ditches, and ditch lines immediately after completing backfilling operations. Replace topsoil, sod and any other materials removed from shoulders.
- D. Excavated Materials: Do not place excavated material along highways, streets and roadways in a manner which obstructs traffic. Sweep all scattered excavated material off the pavement in a timely manner.
- E. Drainage Structures: Keep all side ditches, culverts, cross drains, and other drainage structures clear of excavated material. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.
- F. Landscaping Features: Landscaping features shall include, but are not necessarily limited to: fences; property corners; cultivated trees and shrubbery; manmade improvements; subdivision and other signs within the right-of-way and easement. The Contractor shall take

extreme care in moving landscape features and promptly re-establishing these features.

G. Maintaining Highways, Streets, Roadways and Driveways

1. Maintain streets, highways, roadways and driveways in suitable condition for movement of traffic until completion and final acceptance of the work.
2. During the time period between pavement removal and completing permanent pavement replacement, maintain highways, streets and roadways by the use of steel running plates. The edges of running plates shall have asphalt placed around their periphery to minimize vehicular impact. The backfill above the pipe shall be compacted, as specified elsewhere up to the existing pavement surface to provide support for the steel running plates.
3. Furnish a road grader or front-end loader for maintaining highways, streets, and roadways. Make the grader or front-end loader available at all times.
4. Immediately repair all driveways that are cut or damaged. Maintain them in a suitable condition for use until completion and final acceptance of the work.

3.03 PIPE DISTRIBUTION

- A. Pipe shall be distributed and placed in such a manner that will not interfere with traffic.
- B. No pipe shall be strung further along the route than 500 feet beyond the area in which the Contractor is actually working without written permission from the Owner. The Owner reserves the right to reduce this distance to a maximum distance of 200 feet in residential and commercial areas based on the effects of the distribution to the adjacent property owners.
- C. No street or roadway may be closed for unloading of pipe without first obtaining permission from the proper authorities. The Contractor shall furnish and maintain proper warning signs and obstruction lights for the protection of traffic along highways, streets and roadways upon which pipe is distributed.
- D. No distributed pipe shall be placed inside drainage ditches.
- E. Distributed pipe shall be placed as far as possible from the roadway pavement, but no closer than five feet from the roadway pavement, as measured edge-to-edge.

3.04 LOCATION AND GRADE

- A. The Drawings show the alignment and grade of the sewer, force mains, and the position of manholes and other appurtenances. The slope shown on the profile is the slope of the invert of the pipe.

- B. Prior to clearing and grubbing, the Engineer will provide a temporary bench mark along the sewer route and a hub at the center line of each manhole and at all other locations where the alignment of the sewer changes.
- C. Reference Points
1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points, in order to protect and preserve the centerline or baseline established by the Engineer.
 2. Reference points shall be placed, at or no more than three feet, from the outside of the construction easement or right-of-way. The location of the reference points shall be recorded in a log with a copy provided to the Engineer for use prior to his verifying reference point locations. Distances between reference points and the manhole centerlines shall be accurately measured to the nearest 0.01 foot.
 3. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations must be verified by the Engineer prior to commencing clearing and grubbing operations.
- D. After the Engineer locates and marks the manhole centerlines or baselines of the sewer, the Contractor shall perform clearing and grubbing.
- E. Cut Sheets
1. Cut sheets shall be utilized for confirming that the profile is as shown on the Drawings.
 2. Prior to beginning installation of any section of the gravity sewer, prepare cut sheets from field run ground elevations and submit them to the Engineer for approval.
 3. The survey, from which cut sheets are prepared, may be performed prior to or after clearing and grubbing operations. The surveyor shall obtain an elevation on each bench mark shown on the Drawings and provide this information to the Engineer.
 4. No installation of the sewer shall commence prior to approval of the cut sheets.
 5. Submittal of cut sheets shall be in accordance with the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
 6. Cut sheets shall provide the station (to the nearest 1 foot) and the elevation (to the nearest 0.1 foot) at maximum 100 foot intervals, plus at each change in slope of the ground and at each manhole centerline. The cut sheet shall also show the invert elevation of the sewer at the corresponding sewer station. From

a straight line interpolation of the data, the Contractor shall calculate and record the station of each point where there is a change in the cut brackets indicated on the Bid form. The Contractor shall calculate and record the length of the sewer between each change in cut bracket. The Contractor shall also indicate the pipe material and class as well as the type of bedding. The slope of the sewer shall also be indicated between manholes. At least one offset hub or temporary bench mark shall be provided at each manhole. Its elevation and the resulting cut from the hub to the manhole invert shall also be shown on the cut sheets.

- F. Construction shall begin at the low end of the sewer and proceed upstream without interruption. Multiple construction sites shall not be permitted without written authorization from the Engineer for each site. As a minimum, cut sheets between construction sites shall be submitted and approved before multiple construction sites will be permitted.
- G. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines and temporary bench marks as a result of the operations.
- H. Survey Cash Allowance: The survey cash allowance is solely for the use of the Engineer for verification of the Contractor's reference points, centerlines and work performed and is not to be used by the Contractor to provide cut sheets. The presence of this cash allowance in no way relieves the Contractor of the responsibility of installing reference points, centerlines, temporary bench marks or verifying that the work has been performed accurately.

3.05 LAYING AND JOINTING PIPE AND ACCESSORIES

- A. Lay all pipe and fittings to accurately conform to the lines and grades established by the Engineer.
- B. Pipe Installation
 - 1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes or other suitable tools or equipment in such a manner as to prevent damage to sewer materials and protective coatings and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.
 - 2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.

3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
6. It is common practice to lay pipe with the bells facing the direction in which work is progressing, however, it is not mandatory.
7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.

C. Alignment and Gradient

1. Lay pipe straight in alignment and gradient or follow true curves, where shown on the Drawings, as nearly as practicable. Do not deflect any joint more than the maximum deflection recommended by the manufacturer.
2. Maintain a transit, level and accessories on the job to lay out angles and ensure that deflection allowances are not exceeded.
3. The Contractor shall check the invert elevation at each manhole and the pipe invert elevation at least three times daily, start, mid-day and end of day. Elevations shall be checked more frequently if more than 100 feet of pipe is installed in a day or if the pipe is being constructed at minimum slope.
4. The Contractor shall check the horizontal alignment of the sewer at the same schedule as for invert elevations.

- D. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug, either push-on, mechanical joint, restrained joint or as approved by the Engineer.

E. Joint Assembly

1. Push-on, mechanical, flange and restrained type joints shall be assembled in accordance with the manufacturer's recommendations.

2. Each restrained joint shall be inspected by the Contractor to ensure that it has been "homed" 100 percent.
3. The Contractor shall internally inspect each pipe joint to insure proper assembly for pipe 24-inches in diameter and larger after the pipe has been brought to final alignment.

F. Cutting Pipe

1. Cut ductile iron pipe using an abrasive wheel saw.
2. Remove all burrs and smooth the end before jointing.
3. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories and closure pieces in the correct location. Only push-on or mechanical joint pipe shall be cut.

G. Valve and Fitting Installation

1. Prior to installation, valves shall be inspected for direction of opening, number of turns to open, freedom of operation, tightness of pressure-containing bolting and test plugs, cleanliness of valve ports and especially seating surfaces, handling damage and cracks. Defective valves shall be corrected or held for inspection by the Engineer. Valves shall be closed before being installed.
2. Valves, fittings, plugs and caps shall be set and joined to the pipe in the manner specified in this Section for cleaning, laying and joining pipe.
3. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

H. Air Valve Vaults

1. Construct the vault or manhole as detailed on the Drawings.
2. The floor door shall be cast into the top slab.
3. Where vent pipes are not shown on the Drawings, the frame and cover or floor door shall be provided with 1-inch holes to provide equivalent opening as in air valve, but not less than two. The quantity for each valve size is as follows: 2-inch, 4; 3-inch, 9; 4-inch, 16; 6-inch, 36; 8-inch, 64.

3.06 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

- A. Construct manholes as shown on the Drawings.
- B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent

uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

- C. Brick: Bed the bottom and sides of every brick in mortar. Apply a smooth coat of mortar, 3/4-inch thick, on the inside and outside.
- D. Pipe Connections: All pipes shall be connected to precast concrete manholes by a rubber boot provided in a cored or precast hole of the proper diameter.
 - 1. Pipe 36-Inch Diameter and Less: Connect pipe to manhole utilizing rubber boots.
 - 2. Pipe 42-Inch Diameter and Larger: Construct manhole collars as shown on the Drawings after the pipe has been sealed into the manhole. Forms may be used in lieu of brick sidewalls upon written approval of the Engineer.
 - 3. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting.
- E. Inverts: Form channels as shown on the Drawings, rounded, and troweled smooth. Maintain consistent grade through the invert.
- F. Top Elevations: Build manholes outside of paved areas to 18-inches above finished grade unless otherwise shown on the Drawings or directed by the Engineer.
- G. Frames and Covers: Unless frame and cover is at grade, the frame shall be cast into the cone section.
- H. Seal all manhole joints and lift holes, both inside and out, with grout. Between precast sections, this is in addition to joint sealant.
- I. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the precast concrete manhole or for the invert of the precast concrete fitting associated with the pipe tee manhole. Prior to setting the laser or other vertical alignment control system for the sewer upstream of the manhole, the Contractor shall verify the elevation of the sewer installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:
 - 1. If the sewer is laid at negative grade, the Contractor shall remove and reinstall the sewer at the correct grade at no additional cost to the Owner.
 - 2. If the sewer is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the sewer shall be removed and relaid at the correct grade at no additional cost to the Owner.

3. If the sewer is laid at a grade greater than that shown on the Drawings, the Contractor shall remove and relay that portion of the sewer laid at the improper grade at no additional cost to the Owner.

J. Manholes shall be constructed such that their walls are plumb.

3.07 THRUST RESTRAINT

A. Provide restraint at all points where hydraulic thrust may develop.

B. Retainer Glands: Provide retainer glands where shown on the Drawings and all associated fittings, valves and related piping. Retainer glands shall be installed in accordance with the manufacturer's recommendations, particularly, the required torque of the set screws. The Contractor shall furnish a torque wrench to verify the torque on all set screws which do not have inherent torque indicators.

C. Harnessing: Provide harness rods only where specifically shown on the Drawings or directed by the Engineer. Harness rods shall be manufactured in accordance with ASTM A 449 and shall have an allowable tensile stress of no less than 39,600 psi. Harness rods shall be hot dip galvanized. Where possible, harness rods shall be installed through the mechanical joint bolt holes. Where it is not possible, provide 90 degree bend eye bolts. Eye bolts shall be of the same diameter as specified in AWWA C111 for that pipe size. The eye shall be welded closed. Where eye bolts are used in conjunction with harness rods, an appropriate size washer shall be utilized with a nut on each end of the harness rod. Eye bolts shall be of the same material and coating as the harness rods.

3.08 CONCRETE COLLARS

Construct collars as shown on the Drawings.

3.09 PROTECTION AND RESTORATION OF WORK AREA

A. General: Return all items and all areas disturbed, directly or indirectly by work under these Specifications, to their original condition or better, as quickly as possible after work is started.

1. The Contractor shall plan, coordinate, and prosecute the work such that disruption to personal property and business is held to a practical minimum.

2. All construction areas abutting lawns and yards of residential or commercial property shall be restored promptly. Backfilling of underground facilities, ditches, and disturbed areas shall be accomplished on a daily basis as work is completed. Finishing, dressing, and grassing shall be accomplished immediately thereafter, as a continuous operation within each area being constructed and with emphasis placed on completing each individual yard or business frontage. Care shall be taken to provide positive drainage to avoid ponding or concentration of runoff.

3. Handwork, including raking and smoothing, shall be required to ensure that the removal of roots, sticks, rocks, and other debris is removed in order to provide a neat and pleasing appearance.
 4. The Department of Transportation's engineer shall be authorized to stop all work by the Contractor when restoration and cleanup are unsatisfactory and to require appropriate remedial measures.
- B. Man-Made Improvements: Protect, or remove and replace with the Engineer's approval, all fences, walkways, mail boxes, pipe lines, drain culverts, power and telephone lines and cables, property pins and other improvements that may be encountered in the work.
- C. Cultivated Growth: Do not disturb cultivated trees or shrubbery unless approved by the Engineer. Any such trees or shrubbery which must be removed shall be heeled in and replanted under the direction of an experienced nurseryman.
- D. Cutting of Trees: Do not cut trees for the performance of the work except as absolutely necessary. Protect trees that remain in the vicinity of the work from damage from equipment. Do not store spoil from excavation against the trunks. Remove excavated material stored over the root system of trees within 30 days to allow proper natural watering of the root system. Repair any damaged tree over 3-inches in diameter, not to be removed, under the direction of an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the Contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
- E. Disposal of Rubbish: Dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate county, state and federal regulatory agencies.
- F. Swamps and Other Wetlands
1. The Contractor shall not construct permanent roadbeds, berms, drainage structures or any other structures which alter the original topographic features within the easement.
 2. All temporary construction or alterations to the original topography will incorporate measures to prevent erosion into the surrounding swamp or wetland. All areas within the easement shall be returned to their original topographic condition as soon as possible after work is completed in the area. All materials of construction and other non-native materials shall be disposed by the Contractor.
 3. The Contractor shall provide temporary culverts or other drainage structures, as necessary, to permit the free migration of water between portions of a swamp, wetland or stream which may be temporarily divided by construction.

4. The Contractor shall not spread, discharge or dump any fuel oil, gasoline, pesticide, or any other pollutant to adjacent swamps or wetlands.

END OF SECTION

SECTION 02831

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish all labor, materials, equipment and miscellaneous items as necessary for the installation of a complete chain link fence system. Fencing shall be installed in the location as shown on the Drawings in complete conformity with the manufacturer's written recommendations and as specified herein.
- B. Security fencing for the Contractor is at Contractor's option and is not included as part of the work specified.

1.02 SUBMITTALS

Product data shall be submitted in complete conformance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.03 DELIVERY AND HANDLING

- A. Deliver materials with the manufacturer's tags and labels intact.
- B. Handle and store materials in such a manner that will avoid damage.

1.04 STORAGE AND PROTECTION

Provide storage and protection in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.05 QUALITY ASSURANCE

- A. Standards of manufacturer shall comply with the standards of the Chain Link Manufacturers Institute and these Specifications.
- B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings and fasteners.

PART 2 PRODUCTS

2.01 GENERAL

- A. Overall height for new fencing shall be seven feet including three strands of barbed wire on malleable iron post tops. Posts shall be set at no more than 10 foot centers, a full three feet deep in concrete footings, poured the full size of the holes as excavated. Corner posts shall have the necessary strut and tie bracing. Gates shall be provided of the size and at the locations indicated on the Drawings.

- B. Where fencing crosses ditches, steep grades, and other unusual conditions, make special provisions to insure that the security, appearance, maintainability and permanence of the standard fencing are equalled or exceeded.

2.02 MATERIALS AND CONSTRUCTION

A. Materials shall conform to the following:

1. Fence Mesh: 9 gauge wire, woven to 2-inch squares, galvanized after weaving, 6 foot wide roll. Continuous tension wire shall be provided at the lower edge of the mesh.
2. Line Post: 2-1/2-inch O.D. Galvanized Pipe (3.65 #/ft.)
3. Corner Post: 3-inch O.D. Galvanized Pipe (5.79 #/ft.)
4. Gate Post: 4-inch O.D. Galvanized Pipe (9.11 #/ft.)
5. Top Rail: 1-5/8-inch O.D. Galvanized Pipe (2.27 #/ft.) with extra long pressed steel sleeves
6. Gates shall be supplied with heavy-duty latches, keepers and heavy duty hardened bronze padlocks with duplicate keys.
7. Gate Frames: 2-inch O.D. Galvanized Pipe Frame (2.72 #/ft.)
8. Barbed wire shall consist of three strands of 12 gauge wire, with 4-point pattern barbs, galvanized after weaving.
9. Concrete shall be furnished in accordance with the requirements of the section entitled "Cast-In-Place Concrete" of these Specifications.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Fence installation shall not be started before the final grading is completed, with finish grade elevations established, unless otherwise permitted.

B. Excavation

Drill holes of diameters and spacings shown, for post footings in firm, undisturbed or compacted soil.

1. If not shown on the Drawings, excavate holes to the minimum diameters as recommended by fence manufacturer.
2. Unless otherwise indicated, excavate hole depths shall be approximately 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.

3. If 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 for the post to be placed. If solid rock is below soil overburden, drill to full depth required. 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 of 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 days after placement or cure with membrane curing materials or other acceptable curing methods.
 5. Grout-in posts set into sleeved holes, concrete constructions or rock excavations with non-shrink Portland cement grout or other acceptable grouting material.
- D. Concrete Strength: Allow concrete to attain at least 75 percent of its minimum 28 day compressive strength, but in no case sooner than seven 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.
- E. 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.
- F. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.
- G. Tension Wire: Install tension wires by weaving through the fabric and tying to each post with not less than 6 gauge galvanized wire or by securing the wire to the fabric.
- H. Fabric: Pull fabric taut and tie to posts, rails and tension wires. Install fabric on security side of fence and anchor to framework so that fabric remains in tension after pulling force is released.

- I. Repair damaged coatings in the shop or during field erection by recoating with manufacturer's recommended repair compound, applied per manufacturer's directions.
- 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. Barbed Wire: Install three parallel wires on each extension arm; on security side of fence, unless otherwise indicated. Pull wire taut and fasten securely to each extension arm.
- L. Tie Wires: Use U-shaped wire appropriate for the diameter of pipe. Attach pipe and fabric firmly with tie wire ends twisted at least two full turns. Bend ends of wire to minimize hazard to persons or clothing.
- M. 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.

3.02 CLEANING

Perform cleaning during installation of the work and upon completion of the work. Remove from site all debris and equipment. Repair all damage resulting from chain link fence system installation. Cleaning shall be in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 02921

TOPSOIL

PART 1 GENERAL

1.01 SCOPE

- A. Topsoil for planting shall consist of a rich, friable soil conforming to the requirements and provisions set out in these Specifications, or as approved by the Engineer and obtained from locations indicated on the Drawings, or as approved by the Engineer. Topsoil shall be placed at the locations indicated on the Drawings, set out in the Specifications or as directed by the Engineer and in conformity with the provisions and requirements set out in the Specifications or as required by the Engineer.
- B. Suitable topsoil which has been stripped off of excavation and embankment areas of roadway construction projects shall be stockpiled as directed by the Engineer and later used before additional topsoil is hauled to the site. Unsuitable material shall not be included in these stockpiles and shall be wasted as directed by the Engineer. The amount of stockpiled topsoil obtained from the site shall be measured by the Engineer using the cross-section method and this material shall be excluded from that quantity of material paid for under the appropriate subsection of the section entitled "Earthwork" of these Specifications.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Topsoil for planting shall be a rich, friable loam containing a large amount of humus and shall be original surface sandy loam, topsoil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.
- B. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classified as a loam, silt loam, clay loam or a combination thereof. Topsoil shall contain not less than five percent nor more than 20 percent, by weight, of organic matter as determined by loss or ignition of oven-dried samples. The ignition test shall be performed on samples which have been thoroughly oven-dried to constant weight at a temperature of 221 degrees F.
- C. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil

shall not be removed to a depth in excess of the depth approved by the Engineer.

- D. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed in commercial quantities, the product will be homogeneous in nature and will conform to the requirements of these Specifications, or as required by the Engineer.
- E. Topsoil may be secured, if approved by the Engineer, from areas which are, or have been, in cultivation within the past five years, which are producing or have produced fair or good yields of staple farm or truck crops without unusual fertilization, or topsoil may be secured from areas supplied with good normal drainage which is arable or suitable for cultivation.

PART 3 EXECUTION

3.01 EQUIPMENT

All equipment necessary for the proper removal, transportation, protection and maintenance of topsoil must be available, when required, in first class working condition and shall have been approved by the Engineer before construction will be permitted to begin.

3.02 REQUIREMENTS

- A. Topsoil, except that reserved within excavation areas on the Project, shall not be stored for use but shall be excavated and placed directly into its final position.
- B. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, lime, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.
- C. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Engineer, the pit shall be abandoned.
- D. Before placing or depositing topsoil upon any areas, all improvements within the area shall be completed, unless otherwise approved by the Engineer.
- E. The areas or pits into which topsoil is to be placed or incorporated, shall be prepared before securing topsoil for use.
- F. The depth to which topsoil is excavated in any pit, shall be subject to the direction of and be approved by the Engineer, and if during the excavation of the pit, the Engineer decides to make changes in the depth in order to secure more satisfactory material, the Contractor shall follow instructions as may be issued by the Engineer.

- G. Topsoil shall be transported in vehicles which will not lose or scatter the topsoil during transportation.
- H. Topsoil shall be placed upon or incorporated into prepared areas or pits in accordance with the provisions and requirements set out in the sections of these Specifications covering the particular type or kind of planting or seeding for which topsoil is required.
- I. Rock slopes and other rock areas which are to be seeded shall be capped with 9-inches of suitable material before topsoil is used.

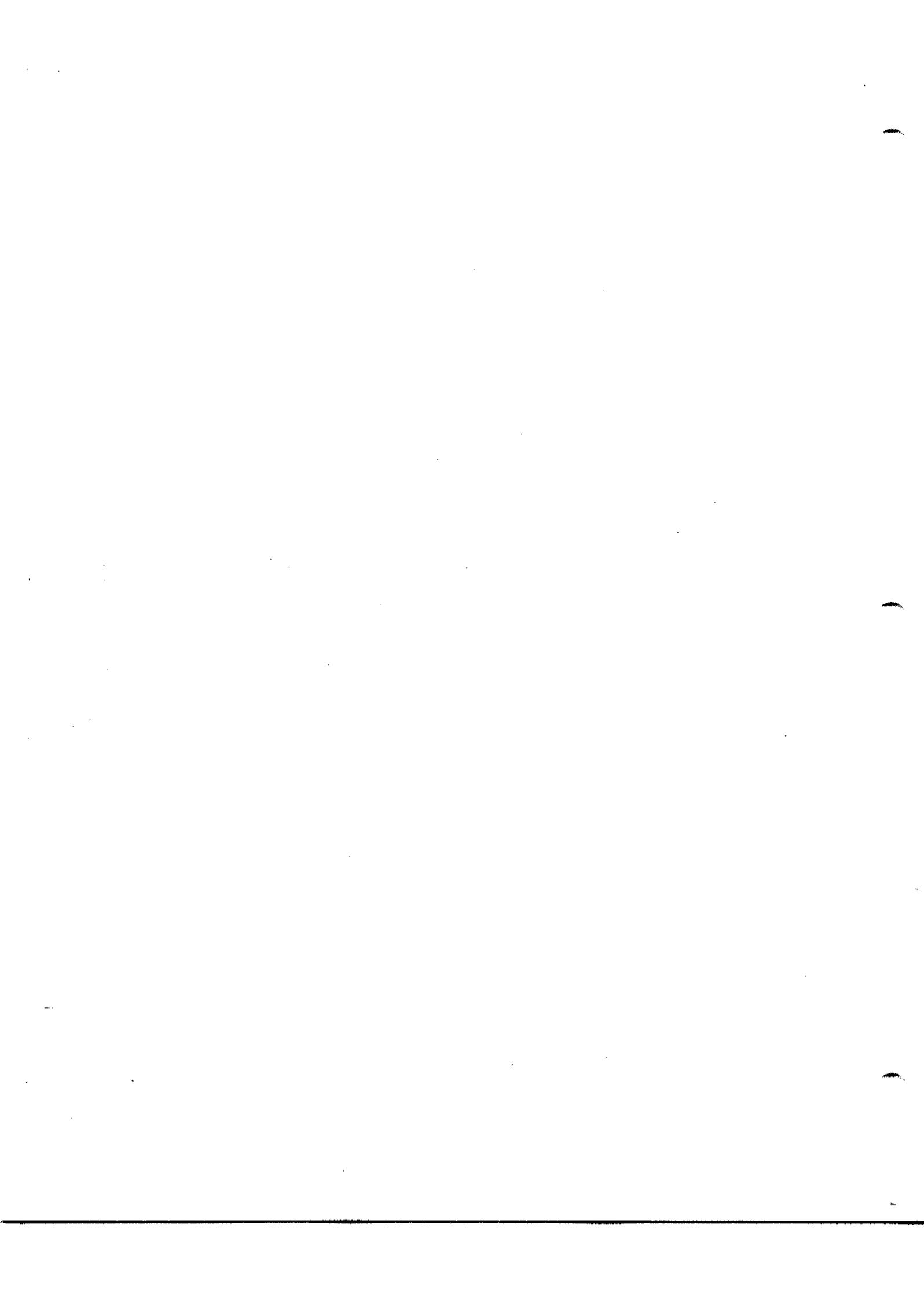
3.03 MAINTENANCE

The Contractor shall maintain topsoil, at Contractor's own expense, in connection with any seeding or planting, or otherwise, until final completion of the Project. Maintenance shall consist of preserving, protecting, replacing and such other work as may be necessary to keep the Project in a satisfactory condition.

3.04 CLEANING

- A. Final cleaning shall consist of completely cleaning the area of all equipment, rubbish, excess material and unused materials which will mar the appearance of the Project and disposing of the same satisfactorily.
- B. All pavements and structures shall be swept clean of all dirt or rubbish which may have become deposited upon them during construction.
- C. In addition, final cleaning up shall be performed in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION



SECTION 02933

SEEDING

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section consists of furnishing all labor, equipment and material required to place topsoil, seed, commercial fertilizer, agricultural limestone and mulch material, including seedbed preparation, harrowing, compacting and other placement operations on graded earthen areas as described herein and/or shown on the Drawings. In general, seeding operations shall be conducted on all newly graded earthen areas not covered by structures, pavement or sidewalks; all cleared or grubbed areas which are to remain as finish grade surfaces; and on all existing turf areas which are disturbed by construction operations and which are to remain as finish grade surfaces. Areas disturbed by borrow activities shall also be seeded according to these Specifications.
- B. The work shall include temporary seeding operations to stabilize earthen surfaces during construction or inclement weather and to minimize stream siltation and erosion. Temporary seeding shall be performed at the times and locations as directed by the Engineer.

1.02 QUALITY ASSURANCE

- A. Prior to seeding operations, the Contractor shall furnish to the Engineer labels or certified laboratory reports from an accredited commercial seed laboratory or a state seed laboratory showing the analysis and germination of the seed to be furnished. Acceptance of the seed test reports shall not relieve the Contractor of any responsibility or liability for furnishing seed meeting the requirements of this Section.
- B. Prior to topsoil operations, the Contractor shall obtain representative samples and furnish soil test certificates including textural, pH, and organic analysis from the State University Agricultural Extension Services or other certified testing laboratory.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. All materials shall conform to the requirements and standards of this Section.
- B. Wood-cellulose fiber mulch shall be manufactured by Weyerhaeuser Company or Conway Corporation.

2.02 MATERIALS AND CONSTRUCTION

A. Topsoil

1. Utilizing designated stockpiles or borrow areas on site, the Contractor shall place a minimum of 4-inches of topsoil over all graded earthen areas and over any other areas to be seeded. Sources of topsoil shall be approved by the Engineer prior to disturbance. Importing topsoil from offsite sources shall be at the discretion of the Engineer and shall be justification for additional compensation to the Contractor. A change order properly authorized by the Owner shall be agreed upon prior to importing offsite topsoil. No additional compensation will be allowed for spreading of topsoil.
2. Topsoil shall be a friable loam containing a large amount of humus and shall be original surface soil of good, rich, uniform quality, free from any material such as hard clods, stiff clay, hardpan, partially disintegrated stone, pebbles larger than 1/2-inch in diameter, lime, cement, bricks, ashes, cinders, slag, concrete, bitumen or its residue, boards, sticks, chips or other undesirable material harmful or unnecessary to plant growth. Topsoil shall be reasonably free from perennial weeds and shall not contain objectionable plant material, toxic amounts of either acid or alkaline elements or vegetable debris undesirable or harmful to plant life.
3. Topsoil shall be natural topsoil without admixture of subsoil material, and shall be classifiable as loam, silt loam, clay loam, sandy loam or a combination thereof. The pH shall range from 5.5 to 7.0. Topsoil shall contain not less than five percent nor more than 20 percent, by weight, of organic matter as determined by loss on ignition of oven-dried samples to 65 degrees C.

B. Seed

1. Seed shall be delivered in new bags or bags that are sound and labeled in accordance with the U.S. Department of Agriculture Federal Seed Act.
2. All seed shall be from the last crop available at time of purchase and shall not be moldy, wet or otherwise damaged in transit or storage.
3. Seed shall bear the growers analysis testing to 98 percent for purity and 90 percent for germination. At the discretion of the Engineer, samples of seed may be taken for verification against the grower's analysis.
4. Species, rate of seeding, fertilization and other requirements shall be as shown on the approved erosion control plan.

C. Fertilizer and Liming Materials

1. Fertilizer and liming materials shall comply with applicable state, local and federal laws concerned with their production and use.
2. Commercial fertilizer shall be a ready mixed material equivalent to the grade or grades specified in the Grassing Schedule shown on the approved plans. Container bags shall have the name and address of the manufacturer, the brand name, net weight and chemical composition.
3. Agricultural limestone shall be a pulverized dolomitic limestone having a calcium carbonate content of not less than 85 percent by weight. Agricultural limestone shall be crushed so that at least 85 percent of the material will pass a No. 10 mesh screen and 50 percent will pass a No. 40 mesh screen.

D. Mulch Material

1. All mulch materials shall be air dried and reasonably free of noxious weeds and weed seeds or other materials detrimental to plant growth.
2. Mulch shall be composed of wood cellulose fiber, straw or stalks, as specified herein. Mulch shall be suitable for spreading with standard mulch blowing equipment.
3. Straw mulch shall be partially decomposed stalks of wheat, rye, oats or other approved grain crops.
4. Stalks shall be the partially decomposed, shredded residue of corn, cane, sorghum or other approved standing field crops.

E. Mulch Binder

1. Mulch on slopes exceeding 3 to 1 ratio shall be held in place by the use of an approved mulch binder. The mulch binder shall be non-toxic to plant life and shall be acceptable to the Engineer.
2. Emulsified asphalt binder shall be Grade SS-1, ASTM D 977. Cutback asphalt binder shall be Grade RC 70 or RC 250.

F. Inoculants for Legumes: All leguminous seed shall be inoculated prior to seeding with a standard culture of nitrogen-fixing bacteria that is adapted to the particular seed involved.

G. Water: Water shall be clean, clear water free from any objectionable or harmful chemical qualities or organisms and shall be furnished by the Contractor.

PART 3 EXECUTION

3.01 SECURING AND PLACING TOPSOIL

- A. Topsoil shall be secured from areas from which topsoil has not been previously removed, either by erosion or mechanical methods. Topsoil shall not be removed to a depth in excess of the depth approved by the Engineer.
- B. The area or areas from which topsoil is secured shall possess such uniformity of soil depth, color, texture, drainage and other characteristics as to offer assurance that, when removed the product will be homogeneous in nature and will conform to the requirements of these Specifications.
- C. All areas from which topsoil is to be secured, shall be cleaned of all sticks, boards, stones, cement, ashes, cinders, slag, concrete, bitumen or its residue and any other refuse which will hinder or prevent growth.
- D. In securing topsoil from a designated pit, or elsewhere, should strata or seams of material occur which do not come under the requirements for topsoil, such material shall be removed from the topsoil or if required by the Engineer, the pit shall be abandoned.
- E. Before placing or depositing topsoil upon any areas, all improvement within the area shall be completed, unless otherwise approved by the Engineer.
- F. The areas in which topsoil is to be placed or incorporated shall be prepared before securing topsoil for use.

3.02 SEEDBED PREPARATION

- A. Before fertilizing and seeding, the topsoil surfaces shall be trimmed and worked to true line from unsightly variation, bumps, ridges and depressions and all detrimental material, roots and stones larger than 3-inches in any dimension shall be removed from the soil.
- B. Not earlier than 24 hours before the seed is to be sown, the soil surface to be seeded shall be thoroughly cultivated to a depth of not less than 4-inches with a weighted disc, tiller, pulvimixer or other equipment, until the surface is smooth and in a condition acceptable to the Engineer.
- C. If the prepared surface becomes eroded as a result of rain or for any other reason, or becomes crusted before the seed is sown, the surface shall again be placed in a condition suitable for seeding.
- D. Ground preparation operations shall be performed only when the ground is in a tillable and workable condition, as determined by the Engineer.

3.03 FERTILIZATION AND LIMING

- A. Following seedbed preparation, fertilizer shall be applied to all areas to be seeded so as to achieve the application rates shown in the Grassing Schedule of the approved plans.
- B. Fertilizer shall be spread evenly over the seedbed and shall be lightly harrowed, raked, or otherwise incorporated into the soil for a depth of 1-inch.
- C. Fertilizer need not be incorporated in the soil as specified above when mixed with seed in water and applied with power sprayer equipment. The seed shall not remain in water containing fertilizer for more than 30 minutes when a hydraulic seeder is used.
- D. Agricultural limestone shall be thoroughly mixed into the soil according to the rates in Table 1. The specified rate of application of limestone may be reduced by the Engineer if pH tests indicate this to be desirable. It is the responsibility of the Contractor to obtain such tests and submit the results to the Engineer for adjustment in rates.
- E. It is the responsibility of the Contractor to make one application of a maintenance fertilizer according to the recommendations listed in Grassing Schedule of the approved plans.

3.04 SEEDING

- A. Seed of the specified group shall be sown as soon as preparation of the seedbed has been completed. No seed shall be sown during high winds, nor until the surface is suitable for working and is in a proper condition. Seeding shall be performed during the dates shown in Table 1 unless otherwise approved by the Engineer. Seed mixtures may be sown together provided they are kept in a thoroughly mixed condition during the seeding operation.
- B. Seed shall be uniformly sown by any approved mechanical method suitable for the slope and size of the areas to be seeded, preferably with a broadcast type seeder, windmill hand seeder or approved mechanical power drawn seed drills. Hydro-seeding and hydro-mulching may be used on steep embankments, provided full coverage is obtained. Care shall be taken to adjust the seeder for seedings at the proper rate before seeding operations are started and to maintain their adjustment during seeding. Seed in hoppers shall be agitated to prevent segregation of the various seeds in a seeding mixture.
- C. Immediately after sowing, the seeds shall be covered and compacted to a depth of 1/8 to 3/8-inch by a cultipacker or suitable roller.
- D. Leguminous seeds shall be inoculated prior to seeding with an approved and compatible nitrogen-fixing inoculant in accordance with the manufacturer's mixing instructions.

3.05 MULCHING

- A. All seeded areas shall be uniformly mulched in a continuous blanket immediately after seeding. The mulch shall be applied evenly so as to permit sunlight to penetrate and the air to circulate and at the same time shade the ground, reduce erosion and conserve soil moisture. Approximately 45 percent of the ground shall be visible through the mulch blanket.
- B. One of the following mulches shall be spread evenly over the seeded areas at the following application rates:
 - 1. Wood Cellulose Fiber: 1,400 pounds/acre
 - 2. Straw: 4,000 pounds/acre
 - 3. Stalks: 4,000 pounds/acre
 - 4. These rates may be adjusted at the discretion of the Engineer at no additional cost to the Owner, depending on the texture and condition of the mulch material and the characteristics of the seeded area.
- C. Mulch on slopes greater than 3 to 1 ratio shall be held in place by the use of an approved mulch binder. Binder shall be thoroughly mixed and applied with the mulch. Emulsified asphalt or cutback asphalt shall be applied at the approximate rate of five gallons per 1,000 square feet as required to hold the mulch in place.
- D. The Contractor shall cover structures, poles, fences and appurtenances if the mulch binder is applied in such a way that it would come in contact with or discolor the structures.
- E. Mulch and binder shall be applied by suitable blowing equipment at closely controlled application rates in a manner acceptable to the Engineer.

3.06 WATERING

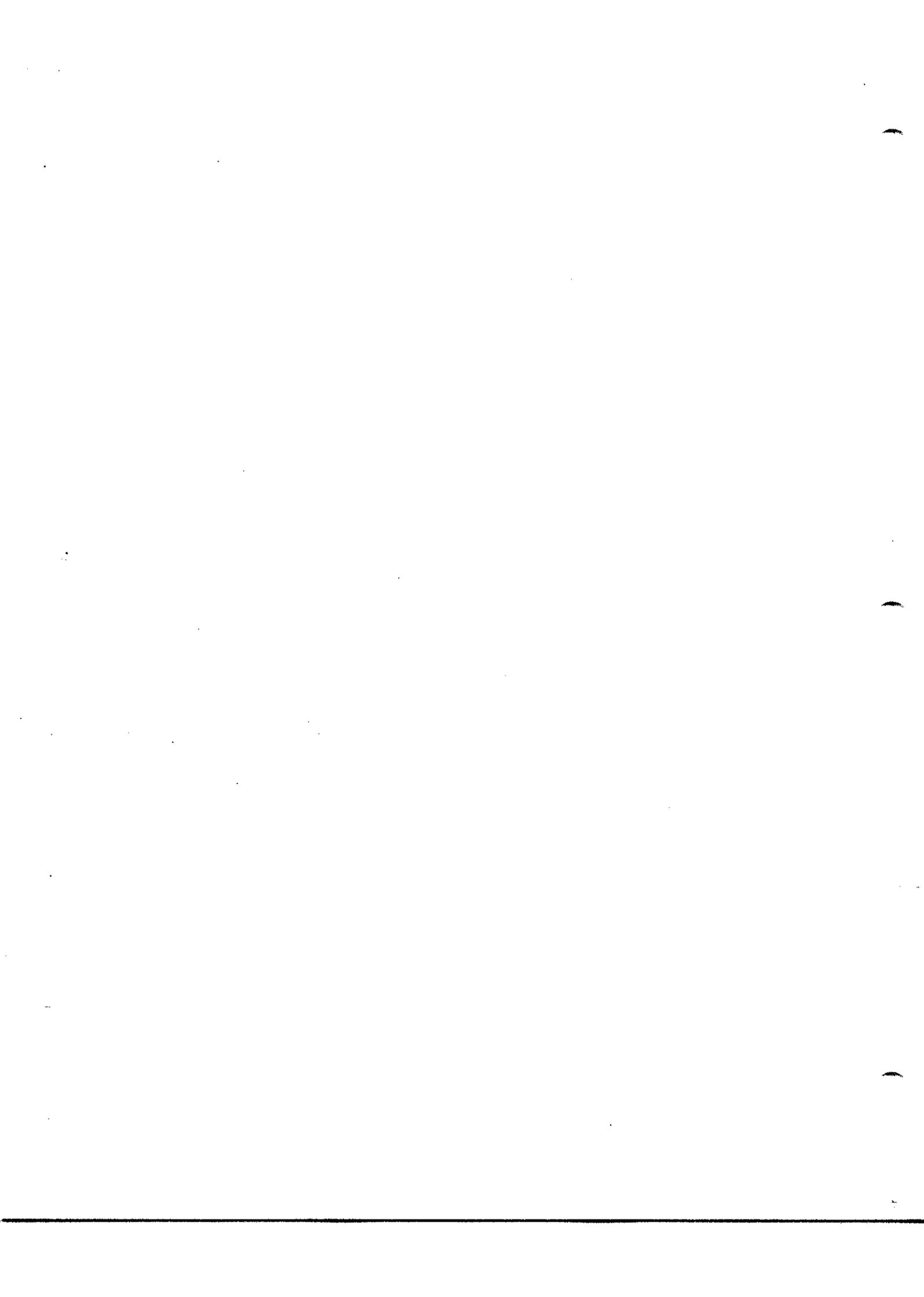
- A. The Contractor shall be responsible for maintaining the proper moisture content of the soil to insure adequate plant growth until a satisfactory stand is obtained. If necessary, watering shall be performed to maintain an adequate water content in the soil.
- B. Watering shall be accomplished by hoses, tank truck or sprinklers in such a way to prevent erosion, excessive runoff and overwatered spots.

3.07 MAINTENANCE

- A. Upon completion of seeding operations, the Contractor shall clear the area of all equipment, debris and excess material and the premises shall be left in a neat and orderly condition.
- B. The Contractor shall maintain all seeded areas without additional payment until final acceptance of the work by the Owner, and any

regrading, refertilizing, reliming, reseeding or remulching shall be done at Contractor's own expense. Seeding work shall be repeated on defective areas until a satisfactory uniform stand is accomplished. Damage resulting from erosion, gulleys, washouts or other causes shall be repaired by filling with topsoil, compacting and repeating the seeding work at Contractor's expense.

END OF SECTION



SECTION 03100
CONCRETE FORMWORK

PART 1 GENERAL

1.01 WORK INCLUDED

Furnish and install the concrete formwork as required by the concrete outlines shown and indicated on the Drawings and specified in this Section, complete.

1.02 REFERENCED PUBLICATIONS

A. The latest edition of the publications listed below are included as a part of these Specifications.

1. ACI 318 Building Code Requirements for Reinforced Concrete
2. ACI 347 Recommended Practice for Concrete Formwork
3. U.S. Department of Commerce Product Standard (PS)
PS 1 Construction and Industrial Plywood

1.03 FORM DESIGN

The design of the forms and their performance as required by this Section is the Contractor's responsibility. Formwork shall comply with ANSI A10.9 and OSHA Construction Standards, Part 1926, Subpart Q, Concrete, Concrete Forms, and Shoring.

PART 2 PRODUCTS

2.01 FORM MATERIAL

Formwork for all concrete, unless otherwise specified, shall not be less than 5/8-inch, 5-ply Douglas fir plywood of exterior structural grade especially processed to resist moisture and conforming to PS I, B-B Concrete Form Panels. Patented forms may be used, subject to approval by the Engineer, provided they are in new, or like new condition so as to produce a smooth, even surface; this approval is for the finish these forms will leave on the contact surfaces and will not relieve the Contractor of the responsibility for the design and structural soundness of the forms.

2.02 ACCESSORIES

A. Form tie assemblies shall be form clamps with smooth tie rods, with a waterstop at the center, permitting tightening of the forms and be of such type as to leave no metal or other material within 1-1/2-inch of the surface after use. The assembly should provide cone-shaped depressions at the forms, at the surface at least 1-inch in diameter and 1-1/2-inch deep to allow filling and patching.

- B. Form releasing agent shall be a non-staining form coating compound such as "Cast-Off" by Sonneborn Products Division (Contech, Inc.), or an equal product as approved by the Engineer.

PART 3 EXECUTION

3.01 FORM CONSTRUCTION

- A. Formwork shall be in accordance with ACI 347 and as follows:
 - 1. Forms shall conform to shape, lines and dimensions of members indicated and shall be sufficiently rigid and tight to prevent leakage of mortar. Forms shall be properly braced or tied together so as to maintain position and shape. Construct forms so that they can be removed readily without hammering or prying against the concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and lines. If required by the Engineer, cambers in beams and slabs will be noted on the Drawings.
 - 2. Wood forms shall be made of plywood. Joints shall be butted tight on solid bearings. Arrangements of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Forms shall be chamfered for external corners of concrete, including top of walls, which will be exposed in the finished work.
 - 3. The Contractor shall be fully responsible for adequacy of formwork in its entirety. Forms shall support loads they will be required to sustain and shall maintain their dimensional and surface correctness to produce members required by Drawings.
 - 4. Box out for slots, chases, recesses or other openings as shown on Drawings or as needed for the work of any other trades.
 - 5. Install all the inserts to be supported by the formwork as required by the work of this and other trades as indicated and/or shown on the Drawings.
 - 6. Provide cleanout doors at the base of wall and column forms.
 - 7. No holes or sleeves shall be placed vertically in spandrell beams or other beams 16-inches or less in width.
 - 8. Steel pipe sleeves 4-inches and less in diameter may be placed in beams over 16-inches in width.
 - 9. Where holes or sleeves 4-inches and over in diameter are required through beams, the beam shall be either widened by the amount the sleeve exceeds 4-inches, or the Contractor shall give the Engineer location and size of such openings and request written permission and instructions for providing such openings.

3.02 TOLERANCES FOR FORMED SURFACES

A. Variation from Plumb

1. In the lines and surfaces of columns, piers, walls and in arises:
 - a. In any 10 feet of length: 1/4-inch
 - b. Maximum for the entire length: 1-inch
2. For exposed corner columns, control-joint grooves and other conspicuous lines:
 - a. In any 20 foot length: 1/4-inch
 - b. Maximum for the entire length: 1/2-inch

B. Variation from the Level or from the Grades Specified in the Contract Documents

1. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores:
 - a. In any 10 foot length: 1/4-inch
 - b. In any bay or in any 20 foot length: 3/8-inch
 - c. Maximum for the entire length: 3/4-inch
2. In exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
 - a. In any bay or in any 20 foot length: 1/4-inch
 - b. Maximum for the entire length: 1/2-inch

C. Variation of the Linear Building Lines from Established Position in Plan and Related Position of Columns, Walls and Partitions

1. In any bay: 1/2-inch
2. In any 20 foot length: 1/2-inch
3. Maximum for the entire length: 1-inch

D. Variation in the Sizes and Location of Sleeves, Floor Openings and Wall Openings: \pm 1/4-inch

E. Variation in Cross-Sectional Dimensions of Columns and Beams and in the Thickness of Slabs and Walls: - 1/4-inch, + 1/2-inch

F. Footings*

1. Variations in Dimensions in Plan: - 1/2-inch, + 2-inches
2. Misplacement or Eccentricity: Two percent of the footing width in the direction of misplacement but not more than: 2-inches
3. Thickness: Decrease in specified thickness - 5 percent; Increase in specified thickness 25 percent unless otherwise approved by the Engineer

G. Variation in Steps

1. In a flight of stairs:
 - a. Rise: $\pm 1/8$ -inch
 - b. Tread: $\pm 1/4$ -inch
2. In consecutive steps:
 - a. Rise: $\pm 1/16$ -inch
 - b. Tread: $\pm 1/8$ -inch

* Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels or embedded items.

3.03 INSPECTION

Give the Engineer at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the Engineer has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the Contractor to minimize errors and in no case will they serve to relieve the Contractor of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.04 APPLICATION OF FORM COATING

Immediately before the placing of reinforcing, faces of all forms in contact with the concrete shall receive a thorough coating of the liquid form-releasing agent specified, applied in compliance with the manufacturer's instructions.

3.05 REMOVAL OF FORMS

- A. The Contractor shall assume full responsibility for removal of formwork and forms shall be removed in such a manner as to insure complete integrity and safety of the structure. The forms and reshoring shall remain in place for the following minimum periods of time after casting the concrete.

	<u>Form Removal</u>	<u>Reshoring</u>
Beams (sides)	2 days	0 days
Beams and slabs (soffits)	7 days	14 days
Walls and Columns	2 days	0 days

- B. Wood forms shall be completely removed from all the work to avoid termite infestation.

END OF SECTION

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 WORK INCLUDED

Furnish and install the concrete reinforcement as shown and indicated on the Drawings and specified in this Section, complete in place.

1.02 REFERENCED PUBLICATIONS

A. The latest edition of the publications listed below are included as a part of these Specifications.

1. ACI 318 Building Code Requirements for Reinforced Concrete
2. ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures
3. ASTM A 82 Specification for Cold Drawn Steel Wire for Concrete Reinforcement
4. ASTM A 185 Specification for Welded Steel Wire Fabric for Concrete Reinforcement
5. ASTM A 496 Deformed Steel Wire for Concrete Reinforcement
6. ASTM A 497 Welded Deformed Steel Wire Fabric for Concrete Reinforcement
7. ASTM A 615 Specification for Billet-Steel Bars for Concrete Reinforcement

1.03 SUBMITTALS

A. Shop Drawings: Reproductions of the Drawings are not permitted. Shop drawings shall show placing plans, bending details and bar lists. All details and notes appearing on the Drawings and giving information for the placing of reinforcing steel, shall be shown on the shop drawings. Shop drawings will not be reviewed without such information. Wall reinforcing shall be shown in elevation. Location and arrangement of accessories shall be clearly indicated. Placing drawings, detail drawings and bar list shall be checked by the fabricator and Contractor before being submitted to the Engineer for review.

B. Mill tests of reinforcing steel shall be submitted prior to use for each 15 tons or less shipped to the site. Tests shall be conducted in conformance with ASTM A 615, and methods prescribed therein.

1. Cost of tests shall be borne by Contractor.

2. Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the Engineer.
3. Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the reinforcement supplier by experienced, competent personnel using adequate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the Engineer may require the Contractor to furnish, at no additional cost to the Owner, test results from an independent testing laboratory acceptable to the Engineer on mill samples or delivered steel reinforcement.

PART 2 PRODUCTS

2.01 REINFORCING BARS

Bar reinforcement shall be deformed-type bars conforming to ASTM A 615. Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60, yield strength 60,000 psi minimum.

2.02 WELDED WIRE FABRIC

Welded wire fabric shall be in flat sheets conforming to ASTM A 185 (A 497), with wire conforming to ASTM A 82 (A 496).

2.03 ACCESSORIES

- A. All chairs and bolsters shall have plastic-covered or galvanized steel legs.
- B. For slabs on grade, all reinforcing shall be supported on chairs and/or bolsters as required to properly position the bars. The chairs and/or bolsters shall be supported on precast concrete pads bearing on the subgrade. The concrete pads shall be at least 6-inch x 6-inch and no more than 1-inch thick. Pads shall be cast from Class "A" concrete or from mortar made up of one part cement and two parts sand, with tie wires embedded.

PART 3 EXECUTION

3.01 STORAGE OF MATERIALS

Reinforcing steel delivered to the site, not immediately placed in forms, shall be protected from mud and excessive rust-producing conditions by storing in a well-drained area and supported off the ground.

3.02 INSPECTION OF STEEL PLACEMENT

- A. Give the Engineer at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the Engineer has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of

assisting the Contractor to minimize errors and in no case will they serve to relieve the Contractor of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.03 TOLERANCES

- A. Allowable tolerances for fabricating steel reinforcement shall be as follows:

<u>Item</u>	<u>Maximum Tolerance</u>	
Sheared length of bars	+ 1-inch	- 1-inch
Depth of truss bars	+ 0.0-inch	- 1/2-inch
Outside dimensions of stirrups, ties and spirals	+ 1/2-inch	- 1/2-inch
Location of bends	+ 1-inch	- 1-inch

- B. Allowable tolerances for placing steel reinforcement shall be as follows:

<u>Item</u>	<u>Maximum Tolerance</u>	
Concrete cover from outside of bar to finished surface	+ 1/4-inch	- 0.0-inch
Lateral spacing of bars in plane of reinforcement in beams and joists	+ 1/4-inch	- 0.0-inch
Lateral spacing of bars in plane of reinforcement in slabs and walls	+ 1-inch	- 1-inch
Spacing of stirrups, ties and spirals along longitudinal axis of member	+ 1/2-inch	- 1/4-inch
Height of bottom bars in slabs, beams and joists	+ 1/4-inch	- 1/4-inch
Height of top bars in slabs, beams and joists		
Depth 8-inches and less	+ 1/4-inch	- 1/4-inch
Depth 9 - 24-inches	+ 1/2-inch	- 1/2-inch
Depth 25-inches and greater	+ 1-inch	- 1-inch

3.04 SHOP FABRICATION

- A. Reinforcing steel shall be fabricated to shapes and dimensions indicated on the Drawings and in compliance with applicable provisions of ACI 315 and ACI 318.
- B. Bars shall be bent cold. Bars shall be pre-fabricated to detail and delivered on the job plainly tagged and ready to set.

3.05 FIELD FABRICATION

Field fabrication of reinforcing steel will not be permitted without the approval of the Engineer.

3.06 PLACEMENT AND ANCHORAGE

- A. Space metal chairs, bolsters, spacers and hangers in accordance with ACI 315.
- B. Reinforcement, at the time concrete is placed, shall be free from rust scale or other coatings that will destroy or reduce bond. Bars with kinks or bends not shown on the plans shall not be used. A thin coating of firmly attached rust shall not be cause for rejection.
- C. Reinforcement shall be accurately placed in accordance with the Drawings and shall be adequately secured in position with not less than 16-gauge annealed wire or suitable clips at intersections. Reinforcement shall be held securely at the required distance from the forms. Nails shall not be driven into outside forms to support reinforcement.
- D. Install welded wire fabric reinforcement for concrete slabs on ground and as otherwise indicated. Lap all joints 6-inches and wire securely. Extend mesh to within 2-inches of sides and ends of slabs. Sheets that do not lay flat when in their intended position will be rejected. Tags designating the wire size and spacing shall be left on each sheet until ready for use. Tuck ends of welded mesh well down into edge of beams or walls. Do not leave unreinforced border strips. Welded wire fabric shall not contain loose rust.
- E. Conduits: Where conduits are permitted in slabs, low conduit shall be wired to the upper side of bottom reinforcing and top conduit shall be wired to lower side of top steel. Where parallel conduits occur, they shall be separated by at least 2-inches clear.

3.07 CONCRETE COVER

- A. Concrete covering for reinforcing steel shall be as follows:
 - 1. Slabs and Joints
 - a. #5 Bars and Smaller: 1-1/2-inch
 - b. #6 through #18 Bars: 2-inches
 - 2. Beams and Columns
 - a. Stirrups and Ties: 2-inches
 - b. Principal Reinforcement: 2-1/2-inches
 - 3. Walls - Footing and Base Slabs
 - a. At Formed Surfaces and Bottom Bearing on Concrete Work Mat: 2-inches

- b. At Unformed Surfaces and Bottoms in Contact with Earth:
3-inches
- c. Top of Footing, Same as Slabs Over Top of Piles: 2-inches

3.08 SPLICING

- A. Splicing of reinforcement shall be as shown and indicated in the Contract Documents. Splices not shown on the Drawings shall be Class "B" splice minimum. Any changes to the location and type of splices desired by the contractor must be specifically request and must meet the approval of the Engineer before they can be used.
- B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.
- C. Mechanical splices may be used instead of lap splices provided that their location and type meets with the approval of the Engineer.

END OF SECTION

SECTION 03250
CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

The work under this Section includes, but is not necessarily limited to, furnishing and installing all concrete accessories as indicated on the Drawings, herein specified, and as necessary for the progress and complete performance of this work.

1.02 SUBMITTALS

The waterstop manufacturer shall submit documented test results demonstrating that the waterstop will not permit water leakage when subjected to pressure and joint movement.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Waterstops for expansion joints shall be Wirestop Waterstop Type No. CR-9380 as manufactured by Paul Murphey Plastics Company, Rossville, Michigan.
- B. Waterstops for construction joints shall be Wirestop Waterstop Type No. FR-9380 as manufactured by Paul Murphey Plastics Company, Rossville, Michigan.
- C. Concrete stair nosings shall be Wooster Type 101 with cast on anchors.

2.02 MATERIALS AND CONSTRUCTION

A. Waterstops

- 1. Waterstops shall be of the highest grade polyvinyl chloride meeting U.S. Army Corp of Engineers Specification CRD-C572-74 and shall incorporate looped galvanized steel wire along both edges to mechanically bond to the concrete.
- 2. Waterstops for expansion joints shall be heavy duty, 9-inches wide, ribbed with centerbulb.
- 3. Waterstops for construction joints shall be heavy duty, 9-inches wide, ribbed.

B. Dovetail Slots

- 1. No. 22 gauge, galvanized steel, 1-inch wide back
- 2. Crimped anchors shall be furnished by other trades whose work abuts concrete.

- C. Inserts for General Trades
 - 1. Maleable iron, strength as required
 - 2. Include bolts, nuts, and washers
- D. Expansion Joint Filler
 - 1. Asphalt impregnated fiberboard, ASTM D 1751, for interior work
 - 2. Self-expanding corkboard, ASTM D 1752, for exterior work
- E. Construction Joint Form for Building Floor Slabs on Grade: 16 gauge, tongue and groove galvanized metal
- F. Control Joint Form for Building Floor Slabs on Grade
 - 1. 20 gauge galvanized steel
 - 2. Depth shall be 1/4 the slab thickness or more
- G. Flashing Reglet: 26 gauge galvanized steel. Coordinate with waterproofing subcontractor.
- H. Concrete Stair Nosings: Abrasive cast aluminum 4-inches wide, 6-inches shorter than tread, with cast on anchors.

2.03 OTHER MATERIALS

All other materials not specifically described, but required for a complete and proper installation of concrete accessories, shall be as selected by the Contractor subject to the approval of the Engineer.

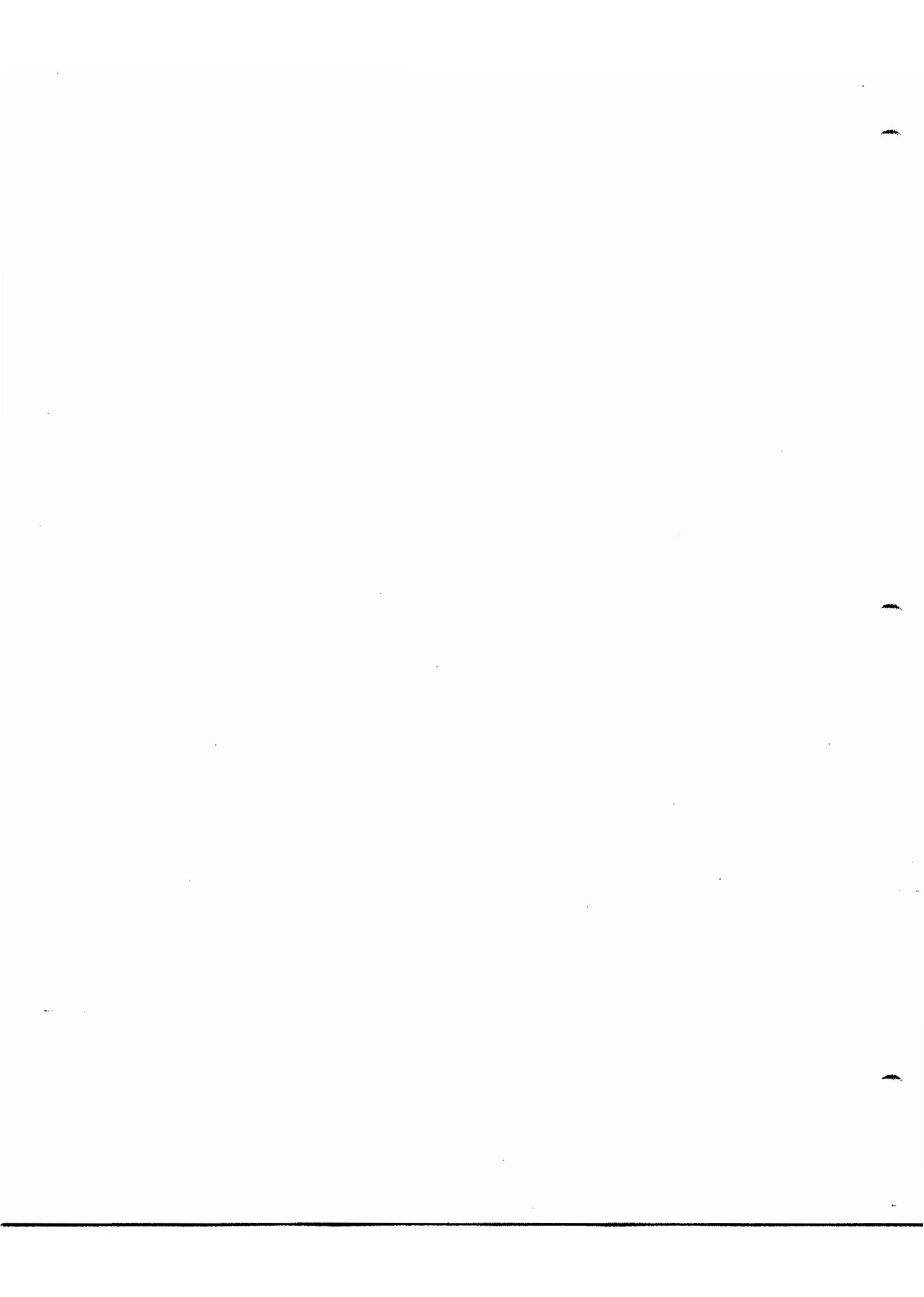
PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Install concrete accessories as indicated on the Drawings, specified in various other Sections and as necessary for the proper and complete performance of this work.
- B. Waterstops
 - 1. Waterstops shall be installed in all construction joints in walls and slabs which are to hold water and also where shown on the Drawings. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's recommendations.
 - 2. Waterstops for all joints shall be continuous around all corners and intersections. Provide factory formed corners and intersections where angle intersections occur. Only straight splices shall be made in the field. Splices shall be made by heat welding in accordance with the manufacturer's recommendations and shall be subject to the approval of the Engineer.

3. No holes will be permitted in waterstops.
 4. Waterstops shall be securely fastened to formwork or reinforcing steel every 12-inches or less on both edges as required to concrete placement.
- C. Dovetail Slots: Install dovetail slots at 24-inches on center where masonry adjoins concrete.
- D. Piping, Mechanical and Electrical Equipment Support
1. Inserts for hangers will be supplied by the trade whose work is supported.
 2. Locations of the inserts shall be given to the Contractor by the various trades.
 3. Installation of the cast-in-place inserts shall be by the Contractor.

END OF SECTION



Section 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 WORK INCLUDED

Furnish and install the cast-in-place concrete as shown and indicated on the Drawings and as specified in this Section, complete.

1.02 REFERENCED PUBLICATIONS

A. The latest edition of the publications listed below form a part of these Specifications:

1. American Concrete Institute (ACI) Publications

211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

211.2 Standard Practice for Selecting Proportions for Structural Lightweight Concrete

301 Specifications for Structural Concrete for Buildings

302.1R Guide for Concrete Floor and Slab Construction

304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete

305R Hot Weather Concreting

2. American Association of State Highway and Transportation Officials (AASHTO) Publication

M 182 Burlap Cloth Made From Jute or Kenaf

3. American Society for Testing and Materials (ASTM) Publications

C 31 Making and Curing Concrete Test Specimens in the Field

C 33 Concrete Aggregates

C 39 Compressive Strength of Cylindrical Concrete Specimens

C 42 Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

C 94 Ready-Mixed Concrete

306R	Cold Weather Concreting
318	Building Code Requirements for Reinforced Concrete
C 143	Slump of Portland Cement Concrete
C 150	Portland Cement
C 171	Sheet Materials for Curing Concrete
C 172	Sampling Freshly Mixed Concrete
C 173	Air Content of Freshly Mixed Concrete by the Volumetric Method
C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Air-Entraining Admixtures for Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 330	Lightweight Aggregates for Structural Concrete
C 494	Chemical Admixtures for Concrete
C 567	Unit Weight of Structural Lightweight Concrete
C 595	Blended Hydraulic Cements
C 618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
C 881	Epoxy-Resin-Base Bonding Systems for Concrete
D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)

PART 2 PRODUCTS

2.01 CEMENT

- (1) Cement shall be standard Portland cement of American manufacture, conforming to ASTM C-150, Type I. Only one brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used. Each bag shall weight approximately 94 pounds and contain one cubic foot.

2.02 CONCRETE AGGREGATES

- A. Fine aggregate shall be sand having clean, hard, durable, uncoated grains and free from deleterious substances and shall conform to ASTM C-33.
- B. Coarse aggregate shall be crushed stone having clean, hard, durable, uncoated particles conforming to ASTM C-33. Aggregate for lightweight concrete shall conform to ASTM C 330.

2.03 WATER

Water used in mixing concrete shall be clean, potable and free from deleterious amounts of acids, alkalies or organic materials.

2.04 EXPANSION JOINT FILLER MATERIAL

Expansion joint material shall be asphalt-impregnated fiber strips, 1/2-inch thick, unless otherwise shown or noted on the Drawings, conforming to ASTM 1751.

2.05 WATERSTOPS

Where shown on the Drawings in expansion joints and construction joints, waterstops shall be polyvinyl chloride (PVC) and shall incorporate a galvanized steel wire along both edges which shall be used to secure the waterstop in position, by tying to reinforcement, during concrete placement. The waterstop shall be of the size noted on the Drawings. The waterstop shall be equal to Wirestop CR-9380 or Burke. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's instructions.

2.06 VAPOR BARRIER

- (1) Vapor barrier shall be polyethylene sheeting, minimum 6 mil thickness, conforming to ASTM C 171.

2.07 NON-SHRINK GROUT

Non-shrink grout shall be a ready-to-use non-metallic aggregate product requiring only the addition of water at the jobsite, and shall conform to COE CRD-C-621.

2.08 ADMIXTURES

- A. Water reducing admixture shall conform to ASTM C-494, Type A.
- B. Water reducing, retarding admixture shall conform to ASTM C-494, Type D.
- C. Non-Corrosive, Non-Chloride Accelerator: The admixture shall conform to ASTM C-494, Type C.
- D. Air entraining admixture shall conform to ASTM C-260.

- E. High range water reducer (HRWR) shall conform to ASTM C494, Type F or G.
- F. Calcium Chloride: Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

2.09 CURING AND SEALING COMPOUNDS

- A. Curing compound shall be acrylic based, conforming to ASTM C-309.
- B. Sealing-hardener compound shall conform to ASTM C-309.

2.10 BONDING COMPOUNDS

Bonding Compound shall conform to ASTM 881.

PART 3 EXECUTION

(1) 3.01 CONCRETE QUALITY

- A. All mix designs shall be proportioned in accordance with ACI 211.1. The proportioning shall be based on the requirements of a well-graded high density plastic and workable mix within the slump range and strengths required. The following classes of concrete are required:

<u>Class of Concrete</u>	<u>Compressive Strength @ 28 Days</u>	<u>Slump Range</u>
A	4000	1 to 2-inch
B	3000	1 to 2-inch

The maximum water-cement ratio for the above concretes is 0.40. The slump range in the above table is required prior to adding the High Range Water Reducer (HRWR). The HRWR shall conform to ASTM C494, Type F or G. The HRWR shall be added to the concrete at the batch plant. Dosage and introduction will be the responsibility of the concrete producer. HRWR shall be capable of maintaining 7 to 10-inch slump in excess of 60 minutes of continuous mixing at 4 to 6 rpm in a truck mixer and workability up to 90 minutes. After introduction of HRWR, concrete temperature shall be maintained within 3 degrees F for 90 minutes when concrete temperatures are in excess of 90 degrees F. No other ASTM C494 Type A, B or D admixture may be used in conjunction with the HRWR. Upon 72 hours notice, the HRWR manufacturer shall supply jobsite technical service to the Contractor. The manufacturer shall be consulted for mix proportions and dosage rates. No added chlorides shall be used. The initial set shall not be in excess of 6 hours at temperatures above 50 degrees F. Rheobuild 1000 (80 degrees F and below) and 716 (80 degrees F and above) manufactured by Master Builders are acceptable products. Other products can only be used if approved by the Engineer.

- 1. Air Content: All concrete shall have an air content of 5.0 percent to 7.0 percent."

3.02 MIX DESIGNS

- A. The testing laboratory shall be paid for by the Owner.
- B. The Contractor shall submit samples, in adequate quantities for each mix design and verification, of all concrete materials to be used on the project to the designated testing laboratory. The Contractor shall not use any concrete in this work without acceptance and verification of design mix by the testing laboratory and the approval of the Engineer.
- C. If trial batches are used, the testing laboratory shall make strength tests from trial batches in the laboratory using materials and mix designs proposed for use by the Contractor. The testing laboratory shall prepare trial batches in accordance with ACI 211.1.
- D. If field experience method is selected, the proposed mix design must be accompanied by complete standard deviation analysis and at least 30 consecutive strength test that represent the proposed mix.
- E. The proposed mix design and supporting data must be submitted, in triplicate, to the testing laboratory for their review and comments at least 21 days prior to the expected start of concreting operations. The testing laboratory will forward two copies of the submittal to the Engineer with their comments. The Engineer will review the submittal and return one copy to the Contractor with the Engineer's comments.
- F. Compression test specimens made to verify the mixes shall be made in accordance with ASTM C-192. Aggregates shall be tested in accordance with ASTM C-33. All compression test specimens shall be tested in accordance with ASTM C-39.

3.03 PLANT MIXING

- A. Proportioning Concrete
 - 1. Proportions shall be in compliance with approved design mix for each class of concrete.
 - 2. The mixing plant shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete.
 - 3. Concrete materials shall be measured by weight except that admixtures shall be measured by volume.
- B. Batching
 - 1. The Contractor shall provide all necessary equipment to accurately determine and control actual amount of materials entering into the concrete mix. Individual ingredients shall be weighted separately for each batch. Accumulative weighing will be allowed if equipment is in acceptable working order as determined by the testing laboratory and approved by the Engineer. Accuracy of all weighing devices shall be such that

successive quantities can be measured to within one percent of the desired amount.

2. Completely discharge contents of the mixer before each new batch is loaded. Use of retempered concrete is not permitted.
3. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C-94 and to the following:
 - a. A separate water metering device (not truck tank) shall be used for measuring water added to the original batch.
 - b. Use of wash water as a portion of the mixing water is not permitted. Wash water added to empty drums after discharging shall be dumped before a new batch is received.
 - c. Centrally mixed concrete shall be mixed for the length of time specified herein, not "shrink-mixed".
 - d. Mixing drums shall be watertight.
 - e. Concrete shall be discharged within one hour from the time concrete was mixed, if centrally mixed, or from time the original water was added, if transit-mixed.
 - f. Furnish delivery ticket with each load of concrete delivered under these Specifications. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, water per cubic yard, the slump ordered, quantities of all admixtures, and the date and time of departure from the batching plant.

3.04 CONVEYING EQUIPMENT

- A. If concrete is to be transported in carts or buggies, the carts or buggies shall be equipped with pneumatic tires.
- B. Equipment for chuting or other methods of conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at delivery without segregation of materials.

3.05 CONVEYING

- A. Concrete shall be conveyed from mixer to place of final deposit by methods which will prevent separation or loss of the material.
- B. Runway supports shall not bear upon reinforcing steel or fresh concrete.
- C. All conveying equipment shall be thoroughly cleaned before each run of concrete is begun.

3.06 DELIVERY AND PROTECTION OF MATERIALS

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C-94.

3.07 SEVERE-WEATHER PROVISIONS

A. Hot-Weather Concreting

1. Provide adequate methods of lowering temperature of concrete ingredients so that the temperature of concrete when placed does not exceed 90 degrees F.
3. Subgrade and forms shall be wetted with water before placing of concrete. All excess water shall be removed before concrete is placed.
4. Curing shall start as soon as practicable to prevent evaporation of water. Flat work shall be protected from dry winds, direct sun and high temperatures.

B. Cold-Weather Concreting

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials, or materials containing ice, shall be used.
2. All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come into contact shall be free from frost.
3. Whenever the temperature of the surrounding air is below 40 degrees F and falling, all concrete placed in the forms shall have a temperature of between 70 and 80 degrees F, and adequate means shall be provided for maintaining a temperature of not less than 70 degrees F for three days, or 50 degrees F for five days, or for as much more time as is necessary to insure proper curing of the concrete. If high early strength concrete is used, the requirement for maintenance of 50 degrees F can be reduced to three days.
4. Use only the specified non-chloride accelerator. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.
5. Housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heat is discontinued.

3.08 CONSTRUCTION JOINTS AND EXPANSION JOINTS

- A. Construction Joints: Early in the construction program, the Contractor shall review with the Engineer any construction joints proposed for use which are not indicated on the Drawings. The Contractor shall not use any construction joints which are not approved by the Engineer. In all cases, construction joints shall occur at sections of minimum shear. Where construction joint is to be made, surface of the concrete shall be roughened (construction joints detailed with key ways in slabs and walls, are not required to be roughened) and thoroughly cleaned of foreign matter and laitance. In

addition to the foregoing, joints shall be dampened with water and the specified bonding compound applied, or slushed with a coat of neat cement grout. Additional construction joints that are requested by the Contractor and approved by the Engineer shall be of the type shown and/or noted on the Drawings for the specific element(s) being considered (i.e., wall slabs, etc.).

- B. Expansion joints shall be installed as indicated.

3.09 WATERSTOPS

Waterstops shall be installed as indicated and noted on Drawings and shall be made continuous by fusion welds.

3.10 INSPECTION OF WORK BEFORE PLACING

- A. The Contractor shall inspect the forms to receive concrete for any deficiencies which would prevent proper placing of concrete. Do not proceed with placing concrete until such deficiencies are corrected.
- B. Give the Engineer at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the Engineer has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the Contractor to minimize errors and in no case will they serve to relieve the Contractor of the responsibility to provide the materials and workmanship required by the Contract Documents.
- C. Do not place concrete on earth until the fill or excavation has been prepared as set forth under applicable Sections of the Specifications for that work.
- D. The Contractor shall not place in the concrete any item that is not authorized to be placed by the Drawings and Specifications. The Contractor shall insert all the items as required by the other trades and properly position and secure them in their intended location. Openings other than those which are facilitated by sleeves shall be properly formed and positioned as required by the other trades.
- E. Do not place concrete in forms until all foreign matter has been removed from forms and the reinforcing steel is in proper condition for placement of concrete.
- F. Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.

3.11 PLACING

- A. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not deposit concrete on work that has partially hardened or been contaminated by foreign material, and do not use retempered concrete. In no case shall Group II concrete be cast when the elapsed time after addition of water and cement to batch exceeds one hour. For Group I concretes,

this elapsed time may be extended if sufficient data from this construction indicates a time extension is permissible and if approved by the Engineer.

- B. Concrete shall be placed to avoid the displacement of reinforcing, and coating or spattering the reinforcing steel. The placing of concrete within form work shall be regulated so that the pressure within form work does not exceed the design pressure. In placing concrete each layer shall be placed following the preceding layer to prevent lines of separation or "cold joints" in the work. After the concrete reaches its initial set, jarring the formwork or placing strain or vibration on the ends of projecting reinforcing bars shall be carefully avoided.
- C. Concrete shall not be dropped more than four feet. For greater distances of drop, concrete shall be handled with metal chutes or tremie pipes. Greater drops shall be permitted only if approved by the Engineer.
- D. Once concreting is started, it shall be carried on as a continuous operation until placing of the concrete between construction joints is completed. The top surface will be finished to the required alignment.
- E. Concrete shall be placed in layers not over 12-inches deep and each layer shall be compacted with the aid of mechanical internal-vibrating equipment supplemented by hand spading. Vibrators shall in no case be used to transport concrete. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one spare vibrator shall be maintained as a relief. Duration of vibrator use shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Vibrator shall not be lowered into courses that have begun to set. Apply vibrator at uniformly spaced points not further apart than the visible effectiveness of the machine.
- F. Install vapor barrier over prepared sub-base for all concrete floor slabs on grade. Use largest sheets practicable to reduce number of joints. Lap joints a minimum of 24-inches. Remove torn and punctured sheets and replace with new sheets prior to placing concrete. Placing of concrete shall be done in a manner that will not damage the vapor barrier material. The sub-base material shall be as shown and/or noted on the Drawings.
- G. Type and use of vibrators shall be in accordance with ACI 301.

3.12 PROTECTION

Protect freshly placed concrete from damage or injury due to water, falling objects, persons or anything that may mar or injure finish surface on concrete. Only light use of the floor shall be permitted for the first seven days after placing of concrete.

3.13 CURING

- A. All Slabs. After placement and finishing, concrete shall be maintained in a moist condition for at least seven successive days during which the temperature of the concrete is 50 degrees F or above. For temperatures of 50 degrees F and below, curing period shall be 14 successive days.
1. Concrete shall be kept moist by any one, or combination, of the following methods:
 - a. Ponding or Immersion: Continually immerse the concrete in water throughout the curing period. Water shall not be more than 20 degrees F less than the temperature of the concrete.
 - b. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.
 - c. Pervious Sheeting: Completely cover surface and edges of the concrete with two thicknesses of wet sheeting. Overlap sheeting 6-inches over adjacent sheeting. Sheeting shall be at least as long as the width of the surface to be cured. During application, do not drag the sheeting over the finished concrete nor over sheeting already placed. Wet sheeting thoroughly and keep continuously wet throughout the curing period.
 - d. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Inspect surface of concrete daily for wetness. The surface shall be kept continuously wet during the curing period.
- B. All Other Concrete: After placement, concrete shall be maintained in a moist condition for the same periods as specified above.
1. Concrete in Formed Surfaces - Slabs, Beams, Columns and Building Walls: Keep forms and exposed surfaces wet with water during the curing period. If forms are removed before the end of the curing period, apply a curing compound within one hour after form removal.
 2. Concrete in Formed Surfaces - Containment Vessel Walls: Keep forms wet with water during the curing period. If forms are removed before the end of the curing period, continue the moist curing in accordance with subsection 3.13 A. 1.

3.14 PATCHING

- A. Any concrete which is not formed as shown on the Drawings, or for any reason is out of alignment or level or shows a defective surface, or shows defects which reduce the structural adequacy of a member or members, as determined by the Engineer, shall be considered as not

conforming with these Specifications and shall be removed from the Project by the Contractor at Contractor's own expense, unless the Engineer grants permission to patch the defective area, which shall be done in accordance with the following procedure:

1. Permission to patch any such area shall not be considered a waiver of the Engineer's right to require complete removal of the defective work if the patching does not, in the Engineer's opinion, satisfactorily restore the quality and appearance of the surface or the structural adequacy of the member or members.
- B. After removing the forms, all concrete surfaces shall be inspected and any joints, voids, stone pockets or defective areas permitted by the Engineer to be patched and all tie holes, shall be patched. Defective areas shall be chipped away to a depth not less than 1-inch with the edges perpendicular to the surface. Remove defective areas to sound concrete with clean, square cuts. Dampen concrete surfaces to be in contact with patching concrete and apply the specified bonding compound. Place patching concrete over the bonding compound as specified by the manufacturer. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete. Before patching mix is applied, the prepared surface shall first be approved by the Engineer.
- C. Patching concrete mix (or mortar) shall be subject to the approval of the Engineer. The patching concrete shall be compacted into place and screeded off so as to leave the patch higher than the surrounding surface. It shall then be left undisturbed for a period of one to two hours to permit initial shrinkage before being finished. The patch shall be finished to match the adjoining surface. All patches shall be cured as specified for the original concrete.
- D. Tie holes left by withdrawal of rods or the holes left by removal of ends of wall ties shall be filled solid with mortar after first being wetted. For holes passing through the wall, a plunger-type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing through the walls shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

3.15 FINISHES ON FORMED SURFACES

- A. Upon completion of patching, surfaces of concrete shall be finished as follows:
 1. Rubbed stone finish, where noted on the Drawings
 - a. Stone rubbed finish shall be produced by casting concrete against plywood forms and by rubbing the surfaces with carborundum stone and water, after patching of tie holes and depressions, to a true, even and smooth finish of uniform color and texture. No slush coat of cement grout or cement wash will be permitted at any state of the finishing.

- b. Areas to be rubbed shall be finished as soon as forms can be stripped. Strip only those forms on areas which can be finished in the same day as the forms are stripped.
2. Common finish shall be produced by filling all tie holes, honeycomb and depressions, and knocking off and evening up burrs and form marks.
 - a. All concrete surfaces not receiving a stone rubbed or rough finish shall receive a common finish.
3. Rough finish shall be produced by filling all tie holes and honeycomb and in other respects leaving the surface as formed.
 - a. All concrete surfaces which will be covered by earth and which will not be visible in the completed structure, shall receive a rough finish.

3.16 STEEL TROWELED FINISH - FLOOR SLABS

- A. Steel troweled finish shall be applied to the surface of all concrete floor slabs and interior equipment pads and slabs shown on the Drawings or specified to receive a steel troweled finish.
- B. Concrete shall be placed, consolidated, struck-off and leveled to the proper elevation. After the surface has stiffened sufficiently to permit the operation and the water sheen has disappeared, the surface shall be wood floated, by hand or power floated, at least twice, to a uniform sandy texture. Floors shall be leveled such that depressions between high spots do not exceed 1/4-inch under a 10 foot straightedge except where drains occur, in which case the floors shall be pitched to the drains as indicated on the Drawings.
- C. After the concrete has received a float finish, it shall be troweled at least twice to a smooth dense finish. The drying of the surface moisture before floating or troweling shall not be hastened by the dusting on of dry sand or cement. Both power and hand troweling shall be required. The first troweling shall be done by a power trowel and shall produce a smooth surface relatively free of defects. Additional troweling shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when a ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be free of any trowel marks or other imperfections; shall be uniform in texture and appearance, and shall be in true plane within the tolerance specified. Any deviation from this condition which remains after the troweling is completed shall be corrected by grinding.
- (1) D. Apply sealing-hardener compound after concrete has cured, a minimum of 28 days. Re-apply sealing-hardener compound to any area showing wear following construction activities.

3.17 BROOM FINISH

- A. Broom finish shall be applied to all exterior side walks, walkways, platforms and all steps and landings both interior or exterior.
- B. The surface shall be given a floated finish as specified above, then finished with a flexible bristle broom or burlap belt drawn across the surface. Surface must be hardened sufficiently to retain the scoring or ridges. Scores or ridges shall be transverse to traffic or at right angles to the slope of the slab.

3.18 TOPPING

- A. Finish grout topping shall be applied to surfaces noted on the Drawings.
- B. The surface shall be given a floated finish as specified above and moist cured. After the curing period, the finish grout shall be applied as indicated and noted on the Drawings.

3.19 TESTING LABORATORY

- A. The testing laboratory shall be paid by the Owner. The laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed and tested. Duties shall include, but not necessarily be limited to the following:
 - 1. Make, store, transport, cure and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C-39. Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen and slump test results air content of pour from which the specimen was made. One copy each of all tests shall be sent to the Contractor and two copies each to the Engineer.
 - 2. For each class of concrete, take four standard test cylinders from each 100 cubic yards or fraction thereof of concrete placed, nor less than four cylinders for each 5,000 square feet of surface area placed in any single day. Two of these cylinders shall be designated for the 28 day test and shall comprise a test under the definition of these Specifications. One cylinder will be broken at seven days and will be used as an aid in determining the early strength of the concrete and the 28 day strength, and one cylinder retained in reserve for later testing if required.
- B. Periodically inspect the batching plant and file a report with the Engineer stating whether the supplier's equipment and methods meet the requirements of these Specifications.
- C. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity and starting and finishing time of placement for

all concrete work. Copy distribution shall be as specified above for test reports.

3.20 EVALUATION OF COMPRESSION TESTS

- A. Evaluation of compression test results shall be as follows:
 - 1. For each class of concrete, compression-strength tests for laboratory-cured cylinders shall be considered satisfactory if the averages of the results of all sets of three consecutive compression-strength tests equal or exceed the 28 day design compression-strength specified; and, no individual cylinder strength test falls below the required compression strength by more than 500 psi. Strength tests of specimens cured under field conditions may be required by the Engineer to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality-control laboratory at the same time and from the same samples as the laboratory-cured specimens.
- B. Faulty Concrete: Failure to measure up to any of the specified conditions constitute faulty concrete. Unless otherwise directed by the Engineer, faulty concrete shall be removed and replaced with concrete as specified, at no expense to the Owner.
- C. Additional Test: If permitted by the Engineer, shall be subject to the approval of the Engineer and at no expense to the Owner. Load test, if permitted by the Engineer shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the Engineer.
- D. Neither the results of laboratory verification tests nor any provision in the Contract Documents shall relieve the Contractor of the obligation to furnish concrete of the class and strength specified.

3.21 NON-SHRINK GROUT

All column base plates, equipment bases and other locations noted on the structural Drawings shall be grouted with the specified non-shrink, non-metallic grout.

END OF SECTION

SECTION 03602

NONMETALLIC GROUTING

PART 1 GENERAL

1.01 SCOPE

This Section describes nonmetallic grout and grouting methods to be used in the setting of motors, compressors, pumps, aerators, vessels, tanks, pipe supports, structures and other miscellaneous items of equipment that require grout between their baseplate, bedplate or soleplate and the top of the concrete surface to which they are to be anchored.

1.02 GENERAL

- A. The Contractor shall furnish all labor, grouting materials, water, equipment, forms and other items necessary or convenient to the Contractor for the proper preparation, placement and curing of grout.
- B. Nonshrink, epoxy and sand-cement grouts shall be stored, mixed, handled and placed in accordance with the recommendations of the grout manufacturer and the American Concrete Institute, as applicable.
- C. No grout shall be placed until the place of grouting has been inspected and approved by the Engineer.

1.03 SUBMITTALS

- A. Prior to placement of any nonshrink or epoxy grout, the Contractor shall submit to the Engineer complete engineering and product data on the grout, including manufacturer's recommendations for mixing, placement and curing.
- B. The Contractor shall also submit to the Engineer written evidence that the grout, cement and aggregate is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the grout, cement and/or aggregate supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM or Corps of Engineers testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of grout, cement and/or aggregate.

1.04 SAFETY

Proper precautions shall be taken to protect workers during handling of epoxy resins and hardeners. All mixing and placement of epoxy grouts shall be done in well-ventilated areas. The specific safety recommendations of the manufacturer shall be strictly adhered to.

PART 2 PRODUCTS

2.01 NONSHRINK GROUT

All pumps, compressors, motors and other heavy equipment items shall be grouted in place with a nonmetallic, noncorrosive, nongaseous, nonshrink grout requiring no cutback or protective coating. Nonshrink grout shall show zero shrinkage from the placement volume or initial expansion volume as determined by ASTM C 827, and shall have an initial set time at 70 degrees F of not less than 45 minutes as determined by ASTM C 191. When tested in accordance with ASTM C 109, nonshrink grout shall have a 1-day compressive strength of not less than 2,000 psi and a 28-day compressive strength of not less than 9,000 psi at a flow of not less than 100 percent determined in accordance with Corps of Engineers Specification CRD-C-621. The grout shall contain no corrosive ions, calcium chloride, oxidizing catalysts, gas-forming agents, harmful aluminums or corrosive chemicals and shall be resistant to oil, water and sewage. The grout shall be premixed and shall require only the addition of water prior to placement. The grout shall be delivered to the job site in unopened, plastic-lined bags and shall have the manufacturer's mixing instructions printed on the back of each bag. Nonshrink grout shall be EUCO N-S Grout as manufactured by the Euclid Chemical Company, Masterflow 713 Grout as manufactured by Master Builders Company, or Upcon High Flow Grout as manufactured by UPCO Division of Emhart Chemical Company.

2.02 SAND-CEMENT GROUT

- A. Column baseplates, pipe support baseplates, tanks and miscellaneous small items of equipment shall be grouted in place using a sand-cement grout consisting of one part Portland cement, two parts fine aggregate and a maximum of 4.5 gallons of water per sack (cubic foot) of cement. Portland cement shall be Type III conforming to ASTM C 150. Fine aggregate shall be natural siliceous sand, consisting of hard, clean, sharp, dense, durable and uncoated particles.
- B. Fine aggregate shall be free from organic material and injurious amounts of deleterious substances and shall be graded as follows:

<u>Sieve Size No.</u>	<u>Percent (By Weight) Passing</u>
4	100
8	95 to 100
16	60 to 100
30	35 to 70
50	15 to 35
100	2 to 15

- C. Except as modified herein, fine aggregate shall conform to the requirements of ASTM C 144.
- D. Fine aggregate to be used with epoxy binders shall be dried prior to use to remove any free moisture.

2.03 EPOXY GROUT

Epoxy grout shall be used in special equipment grouting applications requiring high bonding or tensile strength where shown on the Drawings or directed by the Engineer. Epoxy grout shall be made from a two-component, 100 percent solids, polyamide epoxy binder and fine aggregate conforming to the requirements specified herein for sand-cement grout. Epoxy grout shall consist of not less than one part nor more than two parts, by weight, fine aggregate to one part epoxy binder. When cured at a temperature of 73 degrees F, neat epoxy binder shall have a one day compressive strength of not less than 5,000 psi and a 28 day compressive strength of not less than 12,000 psi when tested in accordance with ASTM D 695, and shall have a 14 day tensile strength of not less than 3,000 psi when tested in accordance with ASTM D 638. Polyamide epoxy binders shall be Sika "Sikadur Hi-Mod", Adhesive Engineering "Concessive 1001 LPL or 1001 Regular".

2.04 WATER

Water used in the preparation of nonshrink and sand-cement grout shall be clean, potable water, free from oil, alkali, acid, organic matter and other deleterious substances.

PART 3 EXECUTION

3.01 STORAGE

All grout shall be stored above ground and shall be protected at all times from moisture, high humidity, oil and extremes of temperature. Grout or cement which has been resacked or has become caked or lumpy shall not be used.

3.02 FOUNDATION PREPARATION

- A. Prior to setting equipment or placing grout, the foundation to receive grout shall be chipped or sandblasted so as to expose the coarse aggregate and create a roughened condition. All surfaces to be in contact with the grout, including the bottom of the baseplates or sole plates, shall be thoroughly cleaned until free of all oil, grease, laitance, dust, curing compounds and other foreign substances. If the surface is to receive nonshrink or sand-cement grout, the roughened surface shall be washed with liberal amounts of clean water and shall be soaked for a least 24 hours immediately preceding grouting. Prior to placement, all free water shall be removed using an air hose or other suitable method.
- B. Surfaces to receive an epoxy grout shall be completely dry and free from all visible moisture. Where it is impractical to obtain a moisture-free surface, the Engineer may authorize the use of epoxy grout on damp surfaces provided the epoxy formulation is moisture-compatible. When applying grouts to damp surfaces all free water shall be removed and the epoxy formulation shall be carefully selected so that localized boiling of entrapped moisture due to excessive exotherm does not occur.

3.03 MIXING

- A. The specific recommendations and instructions of the grout manufacturer shall be strictly adhered to in all proportioning, mixing and placing of grout. The grout shall be mixed as close to the point of use as is practical. A mechanical mortar mixer may be used for mixing large quantities of nonshrink or sand-cement grout. No more grout shall be mixed than can be placed in the time preceding initial set. Grout that has stiffened prior to placement shall be discarded. Only that amount of water required to produce the necessary degree of flowability shall be used. The grout mixture shall not be retempered by adding water.
- B. Components of epoxy grout systems shall be accurately proportioned and thoroughly mixed so as to produce a uniform and homogeneous mixture. Accuracy of proportioning of epoxy compounds shall be ± 5 percent of the manufacturer's specified mixing ratio. Mixing of small quantities (up to one quart) of epoxy grout may be accomplished by hand using spatulas, palette knives, or similar devices. For larger volumes, mechanically driven tumbling or paddle type mixers shall be used. Paddle type mixers shall be driven by a low speed (400-600 rpm) motor to prevent introduction of excessive amounts of entrained air into the mixture. Mixing shall continue until the mixture is uniform and homogeneous, but in no case less than three minutes. The manufacturer's recommended temperature range for mixing the epoxy grout shall be followed in all field mixing.
- C. After mixing, epoxy grout shall be allowed to stand for approximately five minutes to allow initial air release.

3.04 PLACEMENT

- A. Grout shall be carefully placed by troweling, ramming, or pouring, as is most suited to the application, so that all voids and cavities between the foundation and equipment baseplate or bedplate are filled. Air-relief holes shall be provided, if necessary, to eliminate entrapped air. If a pourable or flowable grout is required, suitable forms shall be provided for containing the grout. Forms shall be securely anchored and caulked to prevent leakage of grout. Grout shall be placed from one side only. Forms shall be of sufficient height to allow at least 6-inches of head on the grout above the bottom of the baseplate on the side where the grout is to be placed. Grout shall be placed until it protrudes from the entire perimeter area. Baseplates shall be located so as to provide a minimum clearance of 1-inch between the foundation and the bottom of the baseplate. The temperature of the foundation and baseplate or soleplate shall be maintained above 45 degrees F during placement and for at least 24 hours thereafter. Heating of foundation and baseplate surfaces shall be accomplished using heated enclosures, heat lamps or radiant heaters so as to achieve uniform heating. Use of direct flame shall be prohibited. Concrete structures shall be heated a minimum of four hours prior to grouting to ensure proper heating of the concrete mass. Temperature of heated surfaces shall not exceed 100 degrees F at the time of placement. When placing nonshrink or sand-cement grout under unusually hot or cold weather conditions, grouting practices shall comply with the requirements of ACI 305 and 306, respectively.

- B. Epoxy grout formulations shall possess exotherm properties compatible with the anticipated substrate and placement conditions. Where large masses of epoxy are involved or if ambient or substrate temperatures are high, relatively low exotherm formulations shall be used. Conversely, where very small quantities or thin films of epoxy are involved or if ambient or substrate temperatures are low, a high exotherm formulation shall be used.
- C. When placing epoxy grouts by pouring, care shall be taken to ensure that segregation of aggregate and epoxy binder or entrapment of entrained air does not occur prior to initial set. To prevent this condition, epoxy grout shall be placed in successive lifts under the baseplate or bedplate not to exceed one inch in thickness.

3.05 FINISHING AND CURING

- A. Forms shall be left in place until the grout is hardened enough so that it cannot flow. Unconfined edges of grout shall be cut off flush or beveled and shall be trowelled to produce a smooth finish. Wedges and shims used in levelling rotating, vibrating or other heavy items of equipment shall be removed after the grout has hardened three days. All voids shall be regrouted using the same grouting material. Removal of shims and wedges from column baseplates and pipe support baseplates is optional. Anchor bolts shall not be pulled up to final torques until shims and wedges have been removed and the grout is hard enough to permit equipment operation.
- B. After placement, exposed edges of water-cured grout shall be wet cured by covering with wet burlap, wet sand, or polyethylene film for at least seven days. During cold weather grout shall be maintained at a temperature for a period of time following placement that will ensure proper hardening and curing.

END OF SECTION



SECTION 04100

MASONRY MORTAR

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor, equipment and material required to ensure the proper proportioning of materials for masonry mortar and related work as described herein and or shown on the Drawings.

1.02 STORAGE AND PROTECTION

- A. Cementitious materials shall be delivered to the site in unbroken bags or other approved containers, plainly marked and labeled with the manufacturer's name and brand.
- B. Cementitious materials shall be handled in a manner which will prevent the inclusion of foreign materials and damage by water or dampness.

1.03 QUALITY ASSURANCE

- A. Materials shall conform to the current editions of the following standards:
 - 1. Masonry Cement - ASTM C91
 - 2. Aggregate for Masonry Mortar - ASTM C 144
 - 3. Portland Cement - ASTM 150, Type I
 - 4. Hydrated Lime for Masonry Purposes - ASTM C 207, Type S
 - 5. Mortar for Unit Masonry - ASTM C 270.
- B. The Contractor shall submit to the Engineer written evidence that the cement, lime and aggregate is in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the cement, lime and/or aggregate supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on samples of cement, lime and/or aggregate.
- C. In addition to these submittals, the Contractor shall submit to the Engineer test results in compliance with ASTM C 270, Section 9 for each type of mortar to be used in the work. The test report shall also include the average compressive strength of three 2-inch cubes of laboratory prepared mortar. Mortar mix ingredients and proportions

shall not be changed during the course of the work without the Engineer's approval. Extreme care shall be taken to assure that the same proportion of each ingredient is used in each batch. Mortar color shall be proportioned by weight in individual containers prior to mixing. Measuring mortar color by volume during mixing shall not be allowed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Masonry Cement

1. Masonry cement shall be a mixture of Portland cement and Type S hydrated lime. The mix shall not contain inert or noncementitious mineral fillers. If package mix is used, other hydraulic cements may be substituted for a part of the Portland cement. However, the Portland cement shall not be less than 30 percent of the total. Packaged mixes shall conform to the requirements of ASTM C 91.
 2. The composition of the masonry cement shall be printed on each bag in terms that show compliance with these requirements.
 3. If a packaged mix is not used, the Portland cement shall conform to ASTM C 150, Portland Cement, Type I and hydrated lime shall conform to ASTM C 207, Type S. The hydrated lime may be used in dry or paste form.
- (1) 4. Mortar color shall be selected by the Engineer from the manufacturer's standard colors.
- B. Sand: Aggregate for use in masonry mortar shall be clean, free from salt or other deleterious materials and conform to ASTM C 144, Aggregate for Masonry Mortar.
- C. Water: Water for mixing shall be potable, clean and free from oil, acids, salts and other deleterious matter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Mixing and Placing

1. All mortar materials shall be accurately measured by volume and thoroughly mixed until they are evenly distributed throughout the batch. Mix mortar as follows: first, add approximately 3/4 of required water, 1/2 the sand and all the cement and lime; mix and add remainder of sand. Mix briefly; then add remainder of water in small quantities until workability of batch is satisfactory to masons. Mortar color when used shall be added to the 3/4 of required water prior to adding sand. After all materials have been added, mix for a minimum of five minutes. Completely empty drum before recharging for next batch.

2. All mortar shall be mixed in a powered, batch-type mechanical mixer. This requirement will not be waived except for minor jobs and then only upon the approval of the Engineer.
 3. Mortars mixed for more than one hour shall not be used. A mortar which shows a tendency to become dry before this time shall have water added to it and shall be re-mixed. The use of a continuous mixer or retempered mortar shall not be permitted.
 4. Mortar for pointing shall have integral waterproofing added in accordance with the manufacturer's instructions.
- B. Mix Proportions: All mortar shall conform to the requirements of ASTM C 270. Mix proportions by volume. Allowable error is 2 percent.

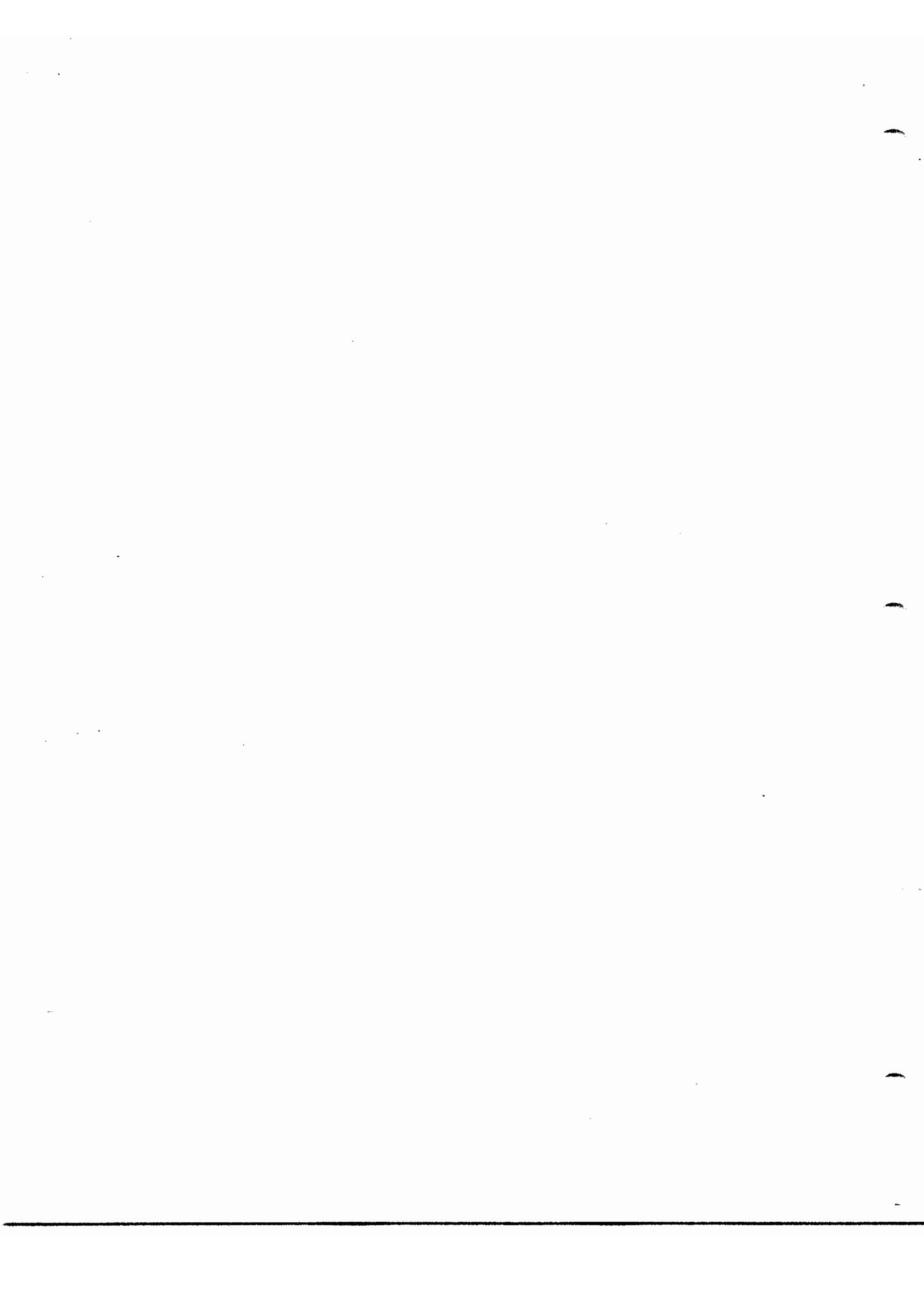
1. Mortar Mixes

Types	Description	Mix by Parts	
		A	or B
M	Portland Cement	1	1
	Masonry Cement	0	1
	Hydrate Lime	1/4	0
	Damp Loose Aggregate	3 to 3-1/2	4-1/2 to 6
N	Portland Cement	1	0
	Masonry Cement	0	1
	Hydrated Lime	1	0
	Damp Loose Aggregate	4-1/2 to 6	2-1/4 to 3
S	Portland Cement	1	1/2
	Masonry Cement	0	1
	Hydrated Lime	1/2	0
	Damp Loose Aggregate	4-1/2	4-1/2

2. Mortar Uses

- a. Use Type M for all load bearing masonry and in foundation walls where masonry materials occur
- b. Use Type N for all interior non-load bearing masonry
- c. Use Type S for all face brick work, backup and parging
- d. Type M may be used in lieu of Type N or S
- e. Type S may be used in lieu of Type N

END OF SECTION



SECTION 04210

BRICK MASONRY

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor equipment and materials required for the placement of all brickwork and related work as described herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Certificate: Submit two copies of the brick manufacturer's specifications and other data for each type of brick required, including certification that each type complies with the specified requirements.
- B. Samples: Submit three samples of each type of exposed brick required. Include in each set 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 all other requirements is the exclusive responsibility of the Contractor.

1.03 SAMPLE PANELS

- A. After approval of masonry units, mortar and color of mortar used in unpainted masonry exposed to view, construct a sample panel facing south of each type of masonry work required. Masonry sample panel shall be 48 x 48-inches; return ends 16-inches long x 48-inches high. Sample panel shall be typical of work as it will appear in the completed Project.
- B. Protect approved sample panel with suitable covering from damage or deterioration by weather and construction traffic, until late in the Project when approval to destroy and remove the sample panel is given. Destroy and remove debris resulting from rejected sample panels at once.

1.04 STORAGE AND PROTECTION

- A. Store brick off ground on level platforms to prevent contamination by mud, dust or materials likely to cause staining or other defects. Allow air circulation under stacked units. Cover materials as necessary to protect from elements. Protect anchors, ties and reinforcement from weather with suitable coverings.
- B. Handle units on pallets or flat bed borrows. Do not permit free discharge from conveyor units or transporting in mortar trays.

1.05 PROTECTION REQUIREMENTS

- A. Cover top of walls with nonstaining, waterproof coverings at end of each day or shutdown. Cover partially completed walls with nonstaining, waterproof membrane when work is not in progress. Provide a minimum two foot overhang of securely anchored protective covering each side of wall.
- B. Protect masonry construction from direct exposure to wind and sun when erected in an ambient air temperature of 99 degrees F (37 degrees C) in the shade with relative humidity of less than 50 percent.
- C. Do not apply uniform floor or roof loading for at least 12 hours after completing masonry columns or walls.
- D. Do not apply concentrated loads for at least three days after completing masonry columns or walls.

PART 2 PRODUCTS

2.01 BRICK

- A. Obtain from a single manufacturer, brick of uniform texture and color or uniform blend in the variation thereof, for each continuous area and for visually related area.
 - B. Size: Unless otherwise shown or specified, provide modular size brick (7-5/8-inches long x 2-1/4-inches high x 3-5/8-inches wide) for exposed vertical brickwork.
 - C. Coring: Provide solid brick where indicated and cored brick for vertical brickwork. Do not use cored brick with net cross-sectional area less than 75 percent of gross area in the same plane or with core holes less than 3/4-inch from any edge.
 - D. Face brick units shall be made of clay or shale material, conforming to the latest specification of ASTM C 216, shall be grade SW, type FBS (normal variations) as established therein.
 - E. Color and texture of brick units used shall be selected by the Owner from sample panels submitted by the Contractor from the proposed supplier. Samples submitted shall be of the price range of \$235.00/thousand.
- (1)

2.02 WEEPHOLE MATERIAL

PVC, rubber tube or sash cord

2.03 JOINT REINFORCEMENT

Joint reinforcement shall comply with "Specification for Cold-Drawn Steel Wire for Concrete Reinforcement," ASTM A82 and shall be galvanized steel of trussed design with nine gauge cross rods welded to 3/16-inch deformed side rods. Reinforcement shall be 2-inches less in width than nominal wall thickness.

Rev. (1)/09-06-91

05-16-91 JWR01

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2.04 DOVETAIL ANCHORS

Dovetail anchors shall be 26 gauge galvanized steel. Lengths, spacings and locations as per standard construction practice where required.

2.05 CLEANING AGENT

As recommended by brick manufacturer

PART 3 EXECUTION

3.01 SCAFFOLDING

Scaffolding shall be provided as required. Scaffolding shall not be overloaded and shall be inspected regularly by the Contractor to verify that it is amply strong, well braced and securely positioned. The Contractor shall be unconditionally responsible for the safety of the scaffolding at all times.

3.02 INSPECTION

- A. Inspect foundations to assure surfaces to support brickwork are to proper grades and elevations, free of dirt and other deleterious material. Surfaces not properly prepared shall be satisfactory corrected.
- B. Verify initial absorption rate of brick is within acceptable limits.

3.03 PREPARATION

Reduce initial absorption of brick by thoroughly wetting brick with clean water 24 hours prior to placement. Remove all dirt, loose rust and scale from anchors, ties and reinforcement prior to installation.

3.04 ALLOWABLE TOLERANCES

Maximum variation from plumb in lines and surfaces shall not exceed 3/8-inch in any story or 20 foot maximum or 1/2-inch in 40 feet.

3.05 INSTALLATION

- A. General: Masonry shall not be laid when temperature is below 40 degrees F. Do not install cracked, broken or chipped brick units exceeding ASTM allowance. Use masonry saws to cut and fit exposed units. In no case shall less than 1/2 brick be present at jambs and at exterior and interior corners. Adjust shelf angles to keep work level and at proper elevation.
 - (1)
- B. Protection: Protect sills, ledges and offsets from mortar drippings and face materials against staining.

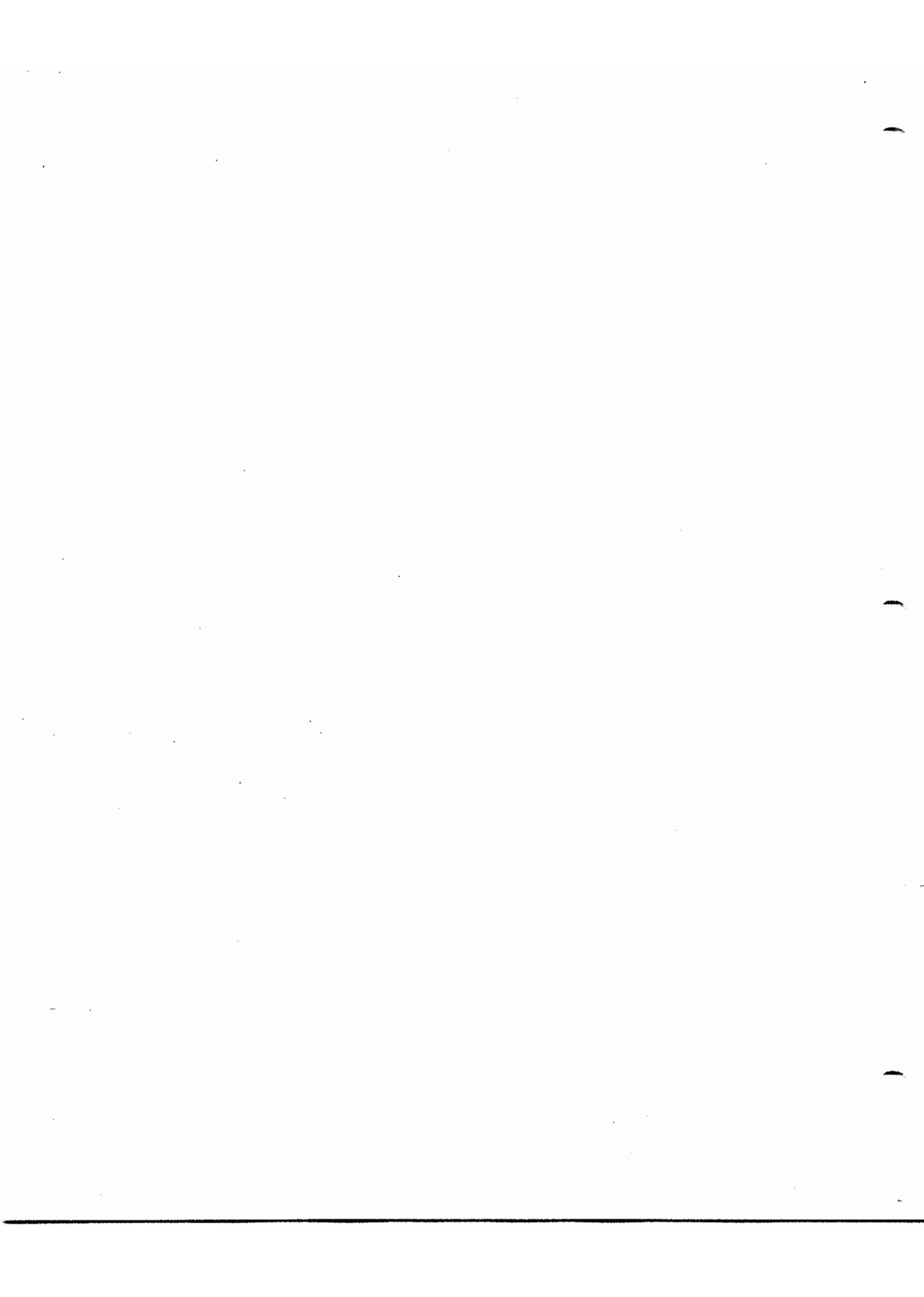
- C. Mortar Beds: Brick units shall be laid in running bond unless noted otherwise, with full mortar coverage on horizontal and vertical joints in all courses.
- D. Joints: Unless shown or specified otherwise, all joints shall be 3/8-inch nominal thickness. Exterior or exposed joints shall be finished with smooth concave contour. Interior joints shall be tooled flush. Trowel point exterior joints below grade. Fill horizontal joints between top of masonry partition and underside of concrete beams with mortar. Where ties, anchors and bolts occur within the cells of the units, such cells shall be filled with mortar or grout as the work progresses.
- E. Tuck Point Joints: Rake mortar joints to a depth of 1/2 to 3/4-inch, saturate exposed joints with clear water, fill joints solidly with pointing mortar and tool to match existing work.
- F. Flashings: Clean surface of masonry smooth and free from projections which might puncture or otherwise damage flashing material. Place through wall flashing on bed of mortar. Cover flashing with mortar.
- G. Weepholes: Provide weepholes in head joints in first course immediately above all flashing. Space weepholes 24-inches on center, unless shown otherwise.
- H. Sealant Joints: Retain sealant joints around outside perimeters of exterior doors, window frames and other wall openings. Uniform depth shall be 1/2-inch and 1/4-inch width.
- I. Anchoring: Anchor exterior brick walls facing or abutting concrete or steel members with dovetail, flatbar or wire anchors inserted in slots built into the member. Maximum anchor spacing shall be 24-inches vertically and 32-inches horizontally. Maintain a space of not less than 1/2-inch wide between mason wall and concrete members to permit differential movement.
- J. Brick Veneer Anchoring: Attach brick veneer to backing with metal ties. Maximum spacing shall be 24-inches vertically and 24-inches horizontally. Imbed ties at least 2-inches in horizontal joint of facing.
- K. Wall Reinforcement: Place wall reinforcement in first masonry bed joint above finished floor and in alternate bed joints (16-inch on centers) thereafter. Place wall reinforcement in first and second bed joints (8-inch on centers) above and below openings. Lap splices 6-inch minimum, or per supplier's recommendation. Corner reinforcement detail shall be in accordance with manufacturer's recommendations.

3.06 POINTING AND CLEANING

- A. Cut out any defective joints and holes in exposed masonry and repoint with mortar.

- B. Dry brush masonry surface after mortar has set at end of each day's work and after final pointing.
- C. If necessary, exposed masonry surfaces shall be scrubbed with warm water and soap and fiber brush and thoroughly rinsed with clear water. Work which may be damaged, discolored or stained shall be protected during the cleaning process. The use of sapolio or wire brushes or acid for washing down walls shall not be permitted.
- D. Protect all finished work against freezing for a period of not less than 48 hours by means of enclosures, temporary heat or such other protective methods as may be required and directed by the Engineer.

END OF SECTION



SECTION 04220
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section consists of furnishing all labor, equipment and material required for the correct placement and construction of concrete masonry units and related work as described herein and/or shown on the Drawings.
- B. Work for Other Trades: Bolts, anchors and shelf angles shall be the responsibility of the Contractor. However, the subcontractors requiring such work are responsible for furnishing complete information to the Contractor.
- C. Furnish and install all precast concrete sills, lintels and parking bumpers as described herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Samples: Submit two full-size concrete masonry units of each type required, including special shapes, to show range of colors, texture, finishes and dimensions.
- B. Certification: Furnish manufacturer's written certification accompanied by suitable laboratory or mill test reports that masonry units furnished meet or exceed the requirements of these Specifications.
- C. Shop Drawings: Contractor shall submit detail drawings of precast sills, coping and lintels for approval by the Engineer before proceeding with fabrication.

1.03 STORAGE AND PROTECTION

Store masonry units above ground on level platforms which allow air circulation under stacked units. Cover and protect against wetting prior to use. Handle units on pallets or flat bed barrows. Do not permit free discharge from conveyor units or transporting in mortar trays.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

- A. Concrete block shall have 8 x 16-inch face with 4, 6, 8, 10 or 12-inch nominal width, as required.

- B. Hollow load-bearing units shall comply with "Specification for Hollow Load-Bearing Concrete Masonry Units", ASTM C90, Grade N, Type I. Load-bearing units shall be normal weight with an 800 psi minimum compressive strength.
- C. Solid load-bearing units shall comply with "Specification for Solid Load-Bearing Concrete Masonry Units," ASTM C145, Type I. Load-bearing units shall be normal weight with a 1,500 psi minimum compressive strength.
- D. Hollow non-load-bearing units shall comply with "Specification for Hollow Non-Load-Bearing Concrete Masonry Units," ASTM C129, Type I. Non-load-bearing units shall be lightweight Type I.

2.02 CONCRETE BRICK

Concrete brick shall comply with "Specifications for Concrete Building Brick", ASTM C55, Type I, Grade N.

2.03 REINFORCEMENT

- A. Block wall reinforcement shall be of the prefabricated type for use in masonry mortar joints. Wall reinforcement shall be of truss design for composite wall construction with No. 9 gauge deformed galvanized side rods and No. 9 gauge galvanized cross rods. Joint reinforcement shall comply with "Standard Specification for Cold Drawn Steel Wire for Concrete Reinforcement", ASTM A82.
- B. Dovetail anchors shall be galvanized steel. Lengths, spacings and locations shall be in accordance with standard construction practice, where required.

(1) 2.04 FLASHING

Virgin polyvinyl chloride with plasticizers and other modifiers, formed into uniform flexible sheets not less than 20 mils thick and black in color, unless otherwise indicated.

(1) 2.05 PRECAST SILLS, LINTELS AND TRIM

Precast concrete sills, lintels and trims shall be provided as shown on the Drawings. All sills, lintels and trim shall be constructed of white Portland cement and light granite aggregate. All exposed surfaces shall be found and treated with a water-repellent material."

PART 3 EXECUTION

3.01 ERECTION AND WORKMANSHIP

- A. Scaffolding shall be provided, as required. Scaffolding shall not be overloaded and shall be inspected regularly by the Contractor to verify that it is amply strong, well braced and securely positioned. The Contractor shall be unconditionally responsible for the safety of the scaffolding at all times.

- B. Masonry shall not be laid when the temperature is below 40 degrees F. Walls shall be carried up level and plumb all around. Unfinished work shall be stepped face for joining with new work; toothing shall not be permitted. Heights of masonry shall be checked by the Contractor with an instrument at each floor and at sills and heads of openings to maintain the level of the walls.
- C. Masonry units shall be handled with care to avoid chipping, cracking and spalling of faces and edges. Drilling, cutting, fitting and patching to accommodate the work of others shall be performed by qualified masons. Masonry shall be cut with a masonry saw outside of buildings. Chipping or breaking with a hammer will not be permitted.
- D. Door and window openings, louvered openings, anchors, pipes, ducts and conduits shall be built in carefully as the work progresses. Ties and anchors shall be placed accurately. Metal work specified elsewhere shall be placed in position as the work progresses. Grouting of ties and anchors into hardened mortar or grout shall not be permitted.
- E. Masonry units shall be laid in running bond. The first course of masonry shall be laid in a full bed of mortar; and the succeeding courses shall be shoved (not laid) in beds of mortar to fill the joints full without subsequent flushing and filling. Unless shown or specified otherwise, all joints shall be 3/8-inch thick. Where ties, anchors and bolts occur within the cells of the units, such cells shall be filled with mortar or grout as the work progresses.
- F. Concrete masonry units shall be dry when laid. Each unit shall be adjusted to final position in the wall while the mortar is still soft and plastic. Any unit disturbed after mortar has stiffened shall be removed and relaid with fresh mortar. Vertical cells to be filled with grout shall be aligned to provide a continuous unobstructed opening of the dimensions shown. Chases shall be plumb and shall be minimum one unit length from jambs of opening.
- G. Exterior or exposed masonry joints shall be finished with smooth concave contour. Procedure used in striking joints shall be as follows: first strike the bed joints; next strike the head joints; then strike bed joints as required to remove any spots, etc., from intersection of bed and head joints. After mortar has initial set but before mortar is hard, restrike the head joints to provide clean, smooth intersection of the head and bed joints. Interior joints shall be tooled flush.
- H. At the end of each day's work, the tops of exposed masonry walls shall be covered with a strong, nonstaining waterproof membrane well secured in place. Surfaces not being worked on shall be properly protected at all times. Unfinished work shall be stepped for joining with new work. Before new work is started, all loose mortar shall be removed and the exposed joint thoroughly wetted, not less than 30 minutes before laying new work.

3.02 WALL REINFORCEMENT

- A. Place wall reinforcement in first masonry bed joint above finished floor and in alternate bed joints (16-inches on center) thereafter.

- B. Masonry joint reinforcement shall be placed so that longitudinal wires are located over face shell mortar beds and are fully embedded in mortar for their entire length with minimum mortar cover of 5/8-inch of exterior side of walls and 1/2-inch at other locations. Reinforcement shall be placed in first and second bed joint above and below openings. Reinforcement in the first bed joint immediately above and below openings shall be continuous. In the second bed joint it shall extend 2 feet beyond each side of the opening.
- C. Reinforcing shall be lapped a minimum of 6-inches at splices. Corner and abutting wall reinforcement shall be prefabricated corner and tee sections.

3.03 WEEP HOLES

Provide weep holes in head joints of first masonry course immediately above concealed flashings. Weep holes shall be spaced 24-inches on center, unless shown otherwise on the Contract Drawings.

(1) 3.04 FLASHING

Extend flashings the full length of lintels and shelf angles and minimum of 4-inches into masonry each end. Extend flashing from a line 1/2-inch in from exterior face of outer wythe of masonry. At heads and sills turn up ends not less than 2-inches to form a pan.

(1) 3.05 CLEANING

- A. During construction, care shall be taken to keep exposed face of masonry clean of mortar and other stains. Joints shall be raked as they reach thumbprint hardness. The exposed work shall then be brushed with a soft fiber brush to remove adhering mortar. A wooden paddle shall be used to remove more tenacious material. Bases of walls shall be protected from splash stains by covering the adjacent floor or ground with sand, sawdust or polyethylene film.
- B. At completion of work, holes in exposed masonry shall be pointed and defective joints shall be cut out and tuck pointed solidly with mortar.
- C. If necessary, exposed masonry surfaces shall be scrubbed with warm water and soap and fiber brush and thoroughly rinsed with clear water. Work which may be damaged, discolored or stained shall be protected during the cleaning process. The use of sapolio or wire brushes or acid for washing down walls shall not be permitted.
- D. Protect all finished work against freezing, for a period of not less than 48 hours, by means of enclosures, temporary heat or such other protective methods as may be required and directed by the Engineer.

END OF SECTION

SECTION 05120
STRUCTURAL METALS

PART 1 GENERAL

1.01 SCOPE

- A. This Section covers all items fabricated from metal shapes, plates, sheets, rods, bars or castings and all other wrought or cast metal except component parts of equipment and items covered by other sections.
- B. Fabricated metal items, which are detailed on the Drawings but not mentioned specifically therein, shall be fabricated in accordance with the applicable requirements of this Section.

1.02 FACTORY TESTING

- A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory. Payment for such services will be made by the Contractor. If approved by the Engineer, certified tests performed by the manufacturer's testing laboratory at no cost to the Owner will be acceptable.
- B. If so desired by the Engineer, inspection of the fabrication shall be made at the place of manufacture. Access shall be permitted to all places where the work is being done.

1.03 SUBMITTALS

Detailed shop drawings, product data sheets and erection and installation details for miscellaneous metal items shall be submitted in accordance with the section entitled "Shop Drawings, Product Data and Samples" of these Specifications. Submittals shall indicate thickness, type, grade, class of metal, dimensions and shall show construction details, reinforcement, anchorage, welds, fasteners and installation with relation to other construction.

1.04 STORAGE AND PROTECTION

- A. Store structural metals above ground on platforms or other supports and protect from weather with suitable covering. Do not permit water ponding or moisture collection on stored items.
- B. Handle steelwork to prevent damage to members and to shop paint coat and to prevent accumulation of mud, dirt or other foreign materials capable of interfering with field paint application.

1.05 QUALITY ASSURANCE

Structural steel manufacturers shall provide written certification to the Engineer that all materials furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

- A. All materials shall be new and undamaged and shall conform to pertinent AISC, ANSI, ASTM or other industry standards. Unless specified otherwise in other sections, all materials in fabricated metal items shall conform to the following requirements:
1. Structural steel shapes, plates and bars shall conform to Specifications of Structural Steel ASTM A36.
 2. Structural steel tubing shall conform to ASTM A501.
 3. Stainless steel shall conform to the following AISI Type 304 for sheets and plates; AISI Type 316 for bolts and stainless steel items in corrosive areas.
 4. Galvanizing shall be hot dipped in accordance with Specifications for Zinc (Hot Galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plate, Bars and Strip ASTM A123.
 5. Gray cast iron shall conform to ASTM Specifications A48, Class 30B.
 6. Ductile iron shall conform to ASTM Specifications A536 Grade 65-40-18.
 7. Aluminum alloy shall conform to the following Aluminum Association Specifications and designations:

6061-T6	Structural shapes, tubes and pipes in corrosive areas, sheets, plates, wire, rods, bars, bolts and screws
6063-T6	Tubes and pipes in non-corrosive areas
6066-T6	Weldings and extrusions
6151-T6	Forgings and forging stock
 8. High strength steel bolts, nuts and washers shall conform to ASTM A325.
 9. All embedded anchor bolts or anchor bolt materials shall be ASTM A193, Grade B8; ATM A276, Type 304; or IFI-104, Grade 304 stainless steel, threaded per ANSI B1.1. Nuts shall be heavy hex nuts, ANSI B18.2, semifinished pattern and shall be ASTM A194,

Grade 8 or IFI-104, Grade 304 stainless steel. Flat washers shall be 18-8 stainless steel and shall conform to ANSI B27.2.

10. Electrodes for welding structural steel shall conform to "Specification for Mild-Steel Covered Arc-Welding Electrodes", AWS A5.1, E-70 series. Electrodes for welding aluminum shall conform to AWS A5.10.

(1) B. Checkered Floor Plates: Unless otherwise shown, checkered floor plates shall be 6061-T6 aluminum alloy with raised diamond pattern on the upper surface. Floor plate shall have a minimum thickness of 1/4-inch and shall be designed for an extreme fiber stress in bending of not more than 10,000 psi and a deflection of not more than 1/300 of span under a uniform load of 200 pounds per square foot. However, in no case shall the thickness of the floor plates be less than that shown on the Drawings for the specified clear span.

(1) C. Welding and Brazing - General

1. All welds shall be sound and free from embedded scale and slag. All butt welds shall be continuous and where exposed to view shall be ground smooth. All continuous welds shall be gas and liquid-tight. Intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.
2. All welding of steel and aluminum, including materials, welding techniques, general safety practices, appearance and quality of welds and methods of correcting defective work, shall conform to the latest requirements of AWS Specifications. Structural steel welding shall conform to the requirements of the AWS Structural Welding Code. The general recommendations and requirements of the AWS Structural Welding Code shall also apply to welded aluminum structures. The welding process and welding operators shall meet qualification tests and welding performance tests in accordance with the latest provisions of ASME Boiler and Pressure Vessel Code, Section IX, Welding and Brazing Qualifications. Welding process and qualification procedures for welding of pipe shall conform to the latest requirements of ANSI B31.1, Section 327, Welding and Section 328, Brazing and Soldering. All costs associated with the qualification or testing of welders and welding operators shall be borne by the Contractor.
3. The Owner may inspect any weld by radiographic or other means. Welds not in accordance with the requirements specified herein shall be repaired or replaced at the Contractor's expense. Excessive porosity, non-metallic inclusions, lack of fusion, incomplete penetration and cracking shall constitute grounds for rejection of welds.

(1) D. Metal Stairs and Gratings

1. This paragraph is intended to include the technical requirements and shop fabrication of aluminum stairs and gratings complete

with anchors and brackets, ready for site installation, including handrails and posts when applicable.

2. References

- a. ASTM B221, Aluminum-Alloy Extruded Bars, Rods, Shapes, and Tubes
- b. Aluminum Association, Designation System for Aluminum Finishes
- c. AWS D1.1 - Structural Welding Code
- d. ANSI A202.1 - Metal Bar Grating Manual for Steel and Aluminum Gratings and Stair Treads

3. Submittals

- a. Submit six sets of shop drawings and two sets of calculations in accordance with the section entitled "Shop Drawings, Product Data and Samples" of these Specifications. Calculations and shop drawings shall be sealed by a licensed professional engineer registered in the State of Georgia.
- b. Indicate construction details, sizes of metal sections, thickness of metals, profiles, attachments, dimensions and field joints, method of support from structure, work to be built-in or provided by other sections and finishes to conform to the Drawings and this Section.
- c. Samples: Two pieces, each 8-inches square in area, of each type finished material.
- d. Indicate welded connections, both shop and field, using standard AWS Welding Symbols. Indicate net weld lengths.
- e. Certificates: Manufacturer's certification that materials meet specification requirements.

(1) E. Shop Fabrication

1. Structural steel shall be fabricated in conformity with dimensions, arrangement, sizes and weights or thicknesses shown on the Drawings or stipulated in the Specifications.
2. All members and parts, as delivered and erected, shall be free of winds, warps, local deformations or unauthorized bends. Holes and other provisions for field connections shall be accurate and shop checked, so that proper fit will result when the units are assembled in the field.

(1) F. Galvanizing

1. All galvanizing shall be done by the hot-dip process, after fabrication in conformity with requirements of ASTM A123, A153, A384 and A385. Articles to be galvanized shall be pickled before galvanizing.
2. Areas of galvanizing damaged by welding or burning or otherwise damaged shall be thoroughly stripped and cleaned and recoated with zinc to the required thickness by the hot-dip process.

3. Galvanized articles shall be free from uncoated spots, blisters, flux, black spots, dross, projections and other defects not consistent with acceptable galvanizing practice.
4. Zinc and cadmium plating shall be subject to visual examination to determine uniformity of coating. The Engineer may require that the coating uniformity be tested in accordance with ASTM A239.

PART 3 EXECUTION

3.01 INSTALLATION

A. Structural Steel

1. General: Except as otherwise specifically noted on the Drawings, or specified herein, all materials and work for structural steel and miscellaneous metal work shall be in conformity with applicable provisions of the latest edition of the AISC "Steel Construction Manual" and AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings".
2. Connections
 - a. Connections not specifically detailed on the Drawings shall be as defined in Tables I and III, Framed Beam Connections, in the seventh edition of the AISC manual. The shop fabricated portion of structural connections may be bolted or welded. Except for connections detailed on the Drawings or specified otherwise, field connections shall be made with ASTM A 325 high strength bolts.
 - b. Connections for miscellaneous metal work not included in the AISC definition of structural steel may be made with ASTM A307 bolts. Bolts shall be equipped with self-locking nuts or lock washers.
 - c. High strength bolts shall be installed using turn-of-nut tightening as described in "Specifications for Structural Joints Using ASTM A 325 or A 490 Bolts" as set forth in the AISC manual. Beveled washers shall be used when the bearing faces of bolted parts have a slope of 1:20 or greater with respect to a plane perpendicular to the bolt axis. A platform or other means of access shall be provided at each field connection and shall be left in place until the connection has been inspected by the Engineer.
 - d. Field welded connections will not be acceptable for structural steel unless shown on the Drawings or specifically permitted by the Engineer. Where structural or miscellaneous steel connections are welded, all butt and miter welds shall be continuous and where exposed to view shall be ground smooth. In addition, intermittent welds shall have an effective length of at least 2-inches and shall be spaced not more than 6-inches apart.
 - e. Field Erection: Before assembly, surfaces to be in contact with each other shall be thoroughly cleaned. All parts shall be assembly accurately as shown on the Drawings.

Light drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field shall be done by reaming with twist drills. Enlarging holes by burning is absolutely prohibited.

B. Structural Aluminum

1. General Except as specifically noted on the Drawings, or specified herein, all materials and work for structural aluminum shall conform with the applicable provisions of the latest edition of "Specifications for Aluminum Structures", published by the Aluminum Association, Inc., New York, New York.
2. Lay Out: Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain on fabricated material. A temperature correction shall be applied where necessary in the layout of critical dimensions. The coefficient of expansion shall be taken as 0.000013 per degree F.
3. Cutting: Material 1/2-inch thick or less shall be sheared, sawed, or cut with a router. Material more than 1/2-inch thick shall be sawed or routed. Cut edges shall be true and smooth, and free from excessive burrs or ragged breaks. Edges or plates carrying calculated stresses shall be planed to a depth of 1/4-inch, except in the case of sawed or routed edges of a quality equivalent to a planed edge. Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting. Flame cutting of aluminum alloys is not permitted.
4. Heating: Structural material shall not be heated except as provided herein. Material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending. Such heating shall be done only when proper temperature controls and supervision are provided to ensure that the limitations on temperature and time are carefully observed. The Engineer shall be so informed if this method is to be used.
5. Punching, Drilling and Reaming: Rivet or bolt holes may be punched or drilled to finished size before assembly. The finished diameter of holes for unfurnished bolts shall be not more than 1/6-inch larger than the nominal bolt diameter. All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal. All chips lodged between contacting surfaces shall be removed before assembly.
6. Bolting: All bolts for bolting aluminum shall be Type 304 or 316 stainless steel as specified herein.
7. Welding
 - a. Dirt, grease, forming or machining lubricants or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing.

Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This may be done by etching or scratch brushing. The oxide coating need not be removed if the welding is done with the automatic or semi-automatic inert gas shielding metal arc. Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.

- b. Any welding of aluminum shall be done using a non-consumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the Engineer. Preheating for welding is permissible provided the temperature does not exceed 400 degrees F for a total time of 30 minutes. Welding of any structure which is to be anodized shall be done using filler alloy rods which will not discolor when anodized.
- c. The welding process and welding operators shall both meet a qualification test conforming to the qualification methods described in the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

3.02 FIELD PAINTING

- A. Aluminum surfaces to be placed in contact with wood, concrete, or masonry construction shall be coated with bitumastic coating.
- B. Where aluminum surfaces come in contact with dissimilar metals, except stainless steel, the aluminum surfaces shall be kept from direct contact with said metal by the use of neoprene gaskets, 10 mil polyethylene film or insulating washers. Paint or galvanizing will not be considered as adequate protection.
- C. Unpainted aluminum surfaces shall be cleaned of all fabrication marking, grease, dirt and oil. Anodized surfaces shall be cleaned with a mild soap and water solution and no acid, caustic or abrasive cleaning agents shall be used.
- D. Structural and miscellaneous metals shall be cleaned, shop primed and painted in accordance with the requirements of the section entitled "Painting" of these Specifications.

3.03 INSPECTION AND TESTING

Materials or workmanship not conforming to the provisions of these Specifications shall be rejected at anytime defects are found during the progress of the work.

3.04 CLEANING

Prior to the acceptance of the work under this Section, thoroughly clean all installed materials, equipment and related areas in

accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 05210

STEEL JOISTS

PART 1 GENERAL

1.01 SCOPE

Furnish and install all the steel joists and accessories as shown and indicated on the Drawings and as specified in this Section, complete.

1.02 APPLICABLE PUBLICATIONS

The publications listed below form a part of these Specifications.

A. Steel Joist Institute (SJI) Publications

1. Standard Specifications, Load Tables, and Weight Tables for Steel Joists and Joist Girders (1986)
2. Recommended Code of Standard Practice for Steel Joists and Joist Girders (1985)

B. Steel Structures Painting Council (SSPC) Specification

1. PS 14.01-82 - Steel Joist Shop Painting System

C. American Welding Society (AWS) Publication

1. D1.1-86 - Structural Welding Code-Steel

1.03 QUALIFICATIONS

Manufacturer: For purposes of designating type and quality for the work under this Section, Drawings and Specifications are based on products manufactured by a member firm of the Steel Joist Institute.

1.04 SUBMITTALS

- A. Shop Drawings: Shop drawings shall show all details and dimensions necessary for checking, fabrication and installation of joists.
- B. Certification: Submit certification from the Steel Joist Institute on membership and class of joists approved for manufacture.
- C. Mill Certification: The Contractor shall furnish to the Engineer two certified copies of all mill reports or certified laboratory reports covering the chemical and physical properties of the steel used in the work.
- D. The Contractor shall provide to the Engineer a certification by a structural engineer (registered in the state where this Project is located) stating that the steel joists for this Project are designed in accordance with these Specifications.

PART 2 PRODUCTS

2.01 STEEL JOISTS

- A. Joists shall be steel joists (open-web) meeting the requirements of the SJI Specifications for the series indicated on the Drawings.
 - 1. Configurations: Steel joists shall have parallel chord, underslung configuration, unless otherwise shown or noted on the Drawings.
 - 2. End Support: Ends of steel joists shall be bolted to the supporting structure.
 - 3. Primer: Steel joists shall be given a shop coat of paint after fabrication conforming to SSPC Specification PS14.01 Type I, Red or Grey Oxide Primer. Primer shall be applied in accordance with manufacturer's recommendations to provide a minimum dry film thickness of 2 mils.

2.02 BRIDGING

- A. Type: Bridging shall consist of "X" bracing where shown on the Drawings.
- B. Spacing: Spacing of bridging shall be as shown on the Drawings.

PART 3 EXECUTION

3.01 PRODUCT HANDLING

- A. Handling: Care shall be exercised at all times to avoid damage during unloading, storing and erecting. Dropping of joists will not be permitted.
- B. Joists damaged beyond repair, as determined by the Engineer, shall be removed from the construction site by the Contractor. The Contractor shall replace all such damaged joists at no cost to the Owner.
- C. Storage: Contractor shall provide on-site storage for joists before erection. Joists and accessories shall be kept free from dirt, grease and other foreign matter and shall be protected from corrosion.

3.02 ERECTION

- A. Spacing: The spacing of steel joists shall be as indicated on the Drawings.
- B. Connections: Connections of joists to supporting members shall be bolted unless otherwise noted or shown on the Drawings.

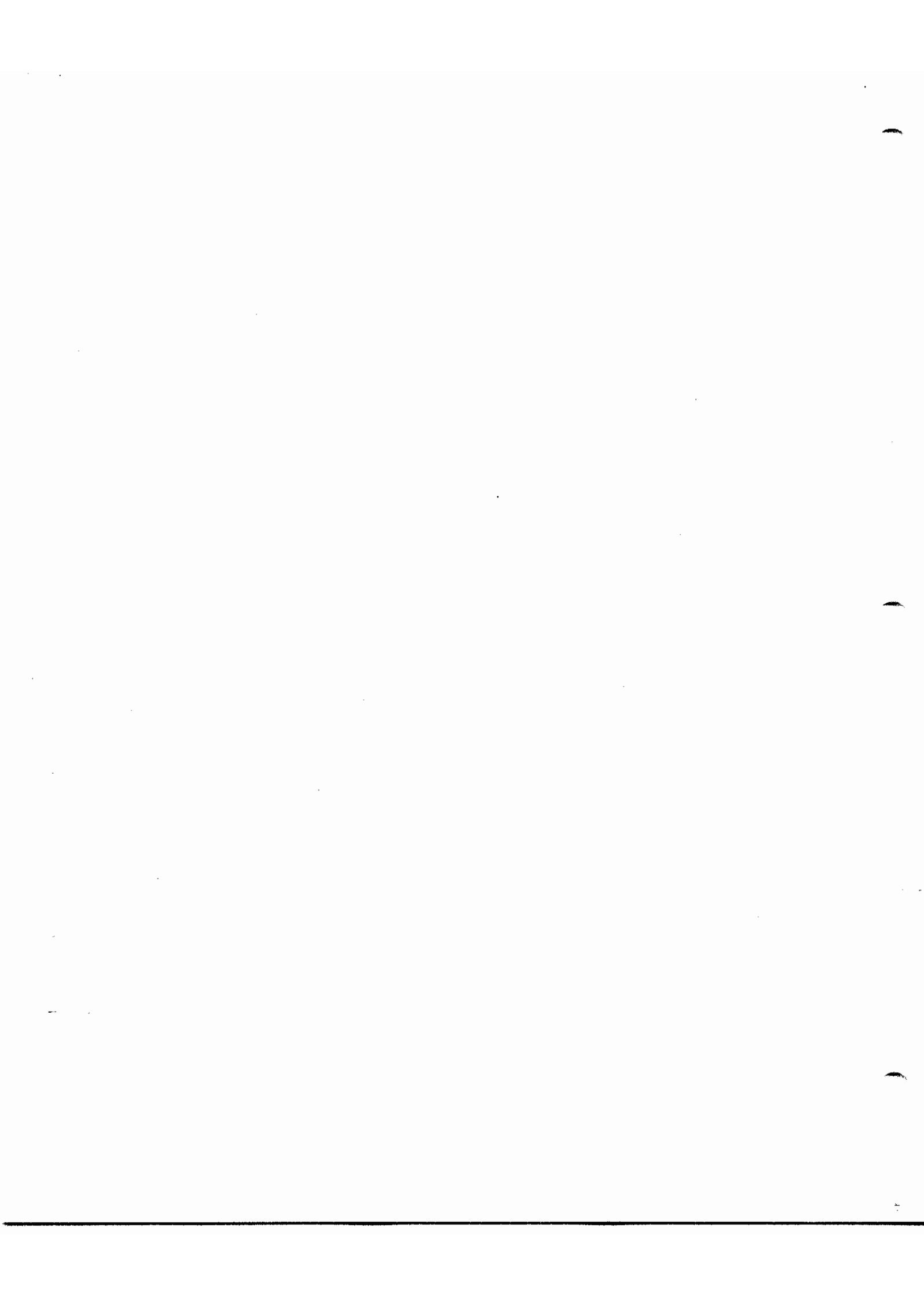
3.03 FIELD PAINTING

Field Touch-up: Abraded shop coats shall be touched-up after erection with the same primer material as used for the shop coats.

3.04 SOURCE QUALITY CONTROL

- A. The material to be furnished shall be subject to inspection and tests in the shop and field. Inspection and tests in the shop and field will be conducted by a testing laboratory employed by the Owner.
- B. Joists with cracked or improper welds or joists otherwise damaged so as to affect their structural properties, shall not be used in the work. Field repair of such damaged joists will be allowed only by special permission and subject to approval of the Engineer. The method of repairs shall be in accordance with the manufacturer's recommendations and shall be subject to the approval of the Engineer.

END OF SECTION



SECTION 05312
STEEL ROOF DECKING

PART 1 GENERAL

1.01 SCOPE

Completely furnish and install the steel roof decking and accessories as shown and indicated on the Drawings and as specified in this Section.

1.02 QUALIFICATIONS

For purposes of designating type and quality for work under this Section, Drawings and Specifications are based on products manufactured or furnished by a member firm of the Steel Deck Institute with design properties determined in accordance with the "Light Gauge Cold-Formed Steel Design Manual of the AISI".

1.03 DESIGN REQUIREMENTS

A. The publications listed below form a part of these Specifications:

1. Steel Deck Institute (SCI) Publication

SDI-82 Design Manual for Composite Decks, Form Decks and Roof Decks

SDI-Jan 81 Diaphragm Design Manual, First Edition

2. American Society for Testing and Materials (ASTM) Publications

A 525-81 General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

3. American Welding Society (AWS) Publications

D1.1-82 Structural Welding Code, Steel

D1.3-80 Welding Sheet Steel in Structures

4. Military Specification (Mil. Spec.)

DOD-P-21035A Paint, High Zinc Dust Content, Galvanizing Repair (Metric)

5. American Iron and Steel Institute (AISI) Publication

Specification for the Design of Cold-Formed Steel Structural Members (1980 Edition)

1.04 SUBMITTALS

- A. Shop Drawings: Shop drawings shall be submitted for approval and shall include deck types, locations and necessary details of decking units, accessories and supporting members, required section properties, sizes and locations of holes to be cut and reinforcement to be provided, location and sequence of welded and fastener connections and the manufacturer's erection instructions. Shop drawings shall show all steel roof decking support framing.
- B. Manufacturer's Data: Submit for review by the Engineer three copies of manufacturer's data on deck system to be furnished for the Project.

1.05 STORAGE AND PROTECTION

- A. The Contractor shall coordinate delivery of materials. Care shall be exercised at all times to avoid damage through handling during unloading, storing and erection.
- B. The Contractor shall provide on-site storage for deck sheets and accessories in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications. Steel decking not promptly erected shall be stored off the ground with one end elevated for drainage and shall be protected from the weather by waterproof covering.

1.06 QUALITY ASSURANCE

- A. The material to be furnished shall be subject to inspection and tests in the field. Inspection and tests in the field will be conducted by a testing laboratory employed by the Owner.
- B. The manufacturer shall provide written certification that all materials furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Consolidated Systems, Inc.
- B. Rollform Products, Inc.
- C. Mac-Fab Products, Inc.
- D. Epic Metals Corporation
- E. Inryco, Inc.
- F. United States Steel Corporation

2.02 MATERIALS AND CONSTRUCTION

- A. General: Galvanized steel sheets shall conform to ASTM A 525 and AISI Specifications, with a minimum yield point of 33,000 psi. Galvanizing shall be not less than 0.40 ounce per square foot.
- B. Fabrication
 - 1. Design: Roof decking shall be deep-rib, nestable side-lap type deck, of sizes and gauges shown on the Drawings to span three or more supports with flush ends.
 - 2. Deck units shall be factory-cut square ends with field skew saw cutting to match diagonal framing.

2.02 ACCESSORIES

The manufacturer's standard type accessories shall be furnished as necessary to complete the roof deck installation. Metal accessories shall be of the same material as the decking and have minimum gauge as follows:

Saddles	18-gauge
Welding Washers	16-gauge
Sump Pans at Drains	14-gauge
Cant Strip	22-gauge
Other Metal Accessories	20-gauge, unless otherwise indicated

PART 3 EXECUTION

3.01 INSTALLATION

- A. Decking shall be placed in accordance with approved shop drawings.
- B. Erection of decking and accessories shall be in accordance with the SDI "Steel Roof Deck Design Manual" and the approved shop drawings. Damaged decking and accessories and units with burned holes shall not be installed. The deck units shall be placed on secured supports, properly adjusted and aligned at right angles to supports before being permanently secured in place. Locate end laps only over supports, with a minimum lap of 2-inches. The deck shall not be used for storage or as a working platform until the units have been secured in position. The maximum uniform distributed storage load shall not exceed 10 pounds per square foot.
- C. The deck units shall be welded to the steel framework at ends of units and at intermediate supports by fusion welds not less than 1/2-inch diameter, spaced not more than 8-inches across width of deck units and at least one weld in each flute joined to form a continuous diaphragm. Holes and similar defects will not be acceptable. Side laps of adjacent units shall be fastened between supports by screws at intervals not exceeding 18-inches. For beams parallel to deck spans, the maximum spacing of welds shall not be greater than 16-inches.

Where two units abut, each unit shall be welded to the steel framing. Welding pattern for the deck diaphragm shall be as indicated on the Drawings.

- D. Perform all welding in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the base metal alloys being used. Welds shall be made only by operators previously qualified by test prescribed in AWS D1.3 to perform the type of Work required. Location, size and spacing of welds shall be as specified above.
- E. Holes and other openings required shall be drilled or cut, adequately reinforced and framed as necessary for rigidity and sufficient load-carrying capacity as approved by the Engineer.

3.02 FIELD PAINTING

All welds, weld scars and abraded shop coats shall be cleaned by chipping and wire brushing and touched-up, after erection, with a galvanized repair coating conforming to Mil. Spec. DOD P-21035A.

3.03 PROTECTION OF DECK

Areas of high traffic volume shall be protected by plywood flooring over the metal deck. The metal deck shall be protected against undue abuse during construction when the metal deck is used as a platform. The Contractor shall insure that the metal deck configuration and structural integrity is maintained until the work is completed. Damaged deck must be replaced at no additional cost to the Owner.

END OF SECTION

SECTION 05500
MISCELLANEOUS METALS

PART 1 GENERAL

1.01 DESCRIPTION

The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all miscellaneous metals and related items as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this work.

1.02 SUBMITTALS

- A. Make all submittals in accordance with the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Shop Drawings
 - 1. Submit shop drawings of all items to be furnished.
 - 2. Shop drawings for steel members shall be as specified in the section entitled "Structural Metals" of these Specifications.
 - 3. Submit plan locating embedded connections in masonry and cast-in-place concrete for precast plank and tees. (Precast supplier shall furnish locations unless noted otherwise on the Drawings).

1.03 DIVISION OF WORK

- A. General: The following list of items to be furnished under this Section is placed here to aid the various trades in estimating their portion of the Work. It is not a full and complete list and does not relieve the Contractor from providing a totally complete Project including all miscellaneous items.
- B. Miscellaneous Metal Items
 - 1. Loose angle and wide flange lintels
 - 2. Stairs and landings including posts, bearing plates, and integral support beams
 - 3. Beams, angles and other supporting grating over pipe trenches including embedded connections
 - 4. Embedded connections and plates in masonry and cast-in-place concrete for precast plank and tees
 - 5. Bumper posts and sleeves
 - 6. Bearing plates for other items specified herein

7. Aluminum ladder
8. Railings
9. Edge angles cast-in-concrete
- (1) 10. Decorative metal fence and gate

1.04 QUALITY ASSURANCE

- A. Qualifications: For fabrication and erection of the work of this Section, use only personnel completely trained and experienced in the type of work being performed and thoroughly familiar with the original design and the approved shop drawings.
- B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with applicable standards for materials design and construction of the following:
 1. American Society for Testing Materials
 2. American Institute of Steel Construction
 3. American Iron and Steel Institutes "Specifications for the Design of Light Gage Cold Formed Steel Structural Members"
 4. Occupational Safety and Health Act
 5. American Welding Society
 6. National Association of Architectural Metal Manufacturers
- C. Conflicting Requirements: In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or these Specifications, the provisions of the more stringent shall govern.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Materials shall be new, top quality of their respective kinds, standard sizes and fabricated in a shop whose principal business is manufacturing the items specified in this Section. Materials shall be free of defect impairing strength, durability or appearance. Miscellaneous anchors, plates, clips, bolts, nuts and the like shall be provided as necessary to complete the work, whether or not they appear on the Drawings or in the Specifications.
- B. Steel shall conform to ASTM A 36.
- C. Cast iron shall be soft, gray iron, true to pattern, smooth and straight, free from defects impairing strength, durability or appearance.

- D. Malleable iron shall be high grade white iron castings, fulling annealed and of uniform ductile structure throughout.
- E. Use genuine wrought iron conforming to ASTM A 41 for bolts, rods, and bars; ASTM A 42 for plates and ASTM A 162 for sheets.
- F. Aluminum alloys shall be of uniform quality and free from injurious defects and meet the properties and applicable specifications of the Aluminum Company of America.
- G. Stair Treads: Provide safety treads on all interior and exterior stairs and landings.

1. Materials

- a. Treads shall have an extruded aluminum alloy base, heat treated for increased strength. Treads shall be 1/4-inch thick, 6-inches wide and shall incorporate nosing 1/4-inch underside.
- b. Dovetail slots 3/16-inch deep shall be filled with a black abrasive consisting of a blend of aluminum oxide and carborundum.
- c. Treads shall be anchored into concrete by strap anchors double riveted to the aluminum base or by a continuous "arrow" anchor extruded as an integral part of the tread base. Strap anchors shall be located at the end of each section of tread and on maximum 12-inch centers between.
- d. Treads shall have heavy duty factory applied protective tape applied to all finished surfaces.

2. Installation: Coat all aluminum surfaces to be cast into concrete with a bitumastic coating. Set treads level, straight and flush with finished floor surface. Extend treads to within 6-inches of each end of stair tread. Miter all corners where nosing turns. Do not remove protective tape until all construction and cleanup is complete.

3. Manufacturer: Safety treads shall be equal to those manufactured by Wooster Products (Type 161), American Abrasive Metals Company.

(1) H. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized as follows:

- 1. ASTM A 153 for galvanizing iron and steel hardware.
- 2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8-inch thick and heavier.
- 3. ASTM A 386 for galvanizing assembled steel products.
- 4. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.

- (2) I. Aluminum Ladders: Ladders shall be aluminum alloy 6063-T5 fabricated by Sigma arc welding. Rungs shall have flat top and shall be equal to Waco rung extrusion A-5680. Stringers shall be ASTM B 429 Schedule 40 tubing. Where shown on the Drawings, "inverted U" stringer returns shall be provided. Ladders shall meet or exceed the requirements of OSHA.
- (2) J. Ship's Ladder: Ship's ladder shall consist of handrail, bar grating, aluminum channel and extruded aluminum treads. Handrails and bar grating shall be as specified in the sections entitled "Aluminum Handrails" and "Aluminum Gratings and Treads" of these Specifications. Treads shall be dimensioned as shown and shall include a cast abrasive nosing. Ship's ladder shall be fabricated as shown on the Drawings.
- (2) K. Interior Trench Grating: Trench grating shall be light-duty grating equal to Neenah R-4468. Angle frame with integral cast anchor lugs shall be equal to Neenah R-4899.
- (2) L. Exterior Trench Grating: Grating shall be heavy-duty grating equal to Neenah R-4525 F. Angle frame with integral cast anchor lugs shall be equal to Neenah R-4899.
- (2) M. Steel Safety Grating
 - 1. Steel grating for walking surfaces shall be fabricated from minimum 12 gauge hot dipped mill-galvanized steel in sections a maximum of 12-inches wide. Grating shall have a slip resistant safety surface. Depth and gauge of the grating shall limit mid-span deflection to a maximum of 1/4-inch when loaded with a uniform load of 100 pounds per square foot and a concentrated load of 300 pounds.
 - 2. Grating shall be anchored to the supporting structure by mechanical devices that will lessen shifting of individual sections. All bolt heads shall be below the top surface. Anchor each grating section with a minimum of one anchor on each end.
 - 3. Grating shall be inherently interlocking and in addition shall be equipped with a mechanical fastener at mid-span to lock adjacent sections together.
 - 4. Steel grating shall be Grip Strut as manufactured by the Metal Product Division, United States Gypsum Company.
- (2) N. Chain shall meet Federal Specification RR-C-271, Type I, Grade C, Class 5, Style 2, galvanized, welded steel, twist-link style, short link pattern.
- (1) O. Galvanized Steel Fencing
 - 1. Fencing shall be fabricated from pregalvanized mild steel formed into rectangular tubing with welded seams. After welding, weld zone shall be zinc metallized. Pickets, posts and rails shall be

made of not less than 16 gauge metal of size shown on the Drawings. Post caps shall be galvanized cast iron or zinc die castings.

2. Pickets shall be fastened to rails with stainless steel rivets. Post shall be pre-drilled to accept rails. Rails shall be connected to posts with flat head aluminum drive rivets. Fence components shall be pre-assembled in standard 6 foot sections. Traditional picket fencing accepts a 5 degree change in ground level. Modern rail fencing accepts a 6 degree change in ground level.
- (2) P. Bird screen shall be No. 2 mesh, brass or copper wire cloth, minimum wire diameter 0.063-inch.
- (2) Q. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds and as selected by the Contractor subject to approval of the Engineer.

2.02 FABRICATION

A. General

1. Workmanship: Install items square and level, accurately fitted and free from distortion and defects.
2. Temporary Bracing: Make provision for erection stresses by temporary bracing; keep work in alignment.
3. Welding: Welding shall be continuous along entire area of contact. Welding shall be in accordance with "Code for Welding in Building Construction" of the American Welding Society. Grind exposed welds smooth and flush with adjacent finished surfaces.
4. Painting: Prime paint metal fabrications in accordance with the section entitled "Painting" of these Specifications.
5. Items fabricated from structural steel members which are to be architecturally exposed shall be given special attention for material selection with respect to rolling tolerances, surface finish and straightness.
6. Normal structural steel fabrication tolerances will not be acceptable where in conflict with the intent and requirements of this Section.
7. Straightness tolerance, additive to deflection, shall not exceed $\pm 1/16$ -inch to 10 feet.
8. All cope, mitre, and butt caps on exposed surfaces shall be made to the closest possible tolerances consistent with metal shop equipment and practice in order to provide a pleasing appearance.

9. Galvanizing: Items specified to be hot-dip galvanized shall be coated after fabrication.
10. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

B. Specific Items

1. Stairs: Design and fabrication shall be done by the supplier. Minimum design live load is 100 pounds per square foot and a concentrated live load of 300 pounds per square foot. Recommended standards of NAAMM and AISC shall be followed. Refer to the Drawings for stairs and landings receiving brick or tile pavers.
2. Aluminum Ladder: Meet OSHA requirements

PART 3 EXECUTION

3.01 EXECUTION

- A. Workmanship: Install items square and level, accurately fitted and free from distortion and defects.
- B. Coordination: Supply to appropriate trades, items requiring to be cast into concrete, embedded in masonry, complete with necessary setting templates.
- C. Touch-Up: After installation, touch-up field welds and scratched and damaged surfaces.
- D. Protection: Where required, provide approved protection against galvanic action between contacts of dissimilar metals or situations that will cause deterioration of metals in contact or associated in any way.

3.02 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the section entitled "Cleaning" of these Specifications.

3.03 PAINTING

Painting shall be in accordance with the section entitled "Painting" of these Specifications.

END OF SECTION

SECTION 05501

ANCHOR BOLTS

PART 1 GENERAL

1.01 SCOPE

- A. Furnish all labor materials and equipment required to install the following anchors:
1. Adhesive anchor bolts for mechanical equipment as detailed on the Drawings or as required by equipment manufacturer's anchor bolt setting plan.
 2. All expansion bolts indicated on the Drawings required to attach anchor ladders, handrails, stairs, ship's ladders and structural steel shapes to hardened concrete or masonry.

1.02 APPLICABLE SPECIFICATIONS AND STANDARDS

- A. The following publications of issues listed below, but referenced to thereafter by basic designation only, apply to this Section to extent applicable in each reference thereto.
1. American Society for Testing and Materials (ASTM)
 - F 593-80 Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - F 594-80 Specifications for Stainless Steel Nuts
 2. Federal Specification
 - FF-S-325 Shield, Expansion; Nail Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
 3. Manual of Steel Construction (AISC)

1.03 MATERIAL STORAGE

All material shall be stored in manner which will protect it from deterioration and damage.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Adhesive anchor bolts shall consist of a stainless steel threaded rod meeting the requirements of ASTM F593 (AISI 304) and a sealed glass capsule containing polyester resin, quartz sand aggregate and a hardener. Installation shall be in conformance with the manufacturer's instructions and under the supervision of a

manufacturer's field representative for maximum pullout and shear strength. Adhesive anchor bolts shall be of "HVA Adhesive Anchors" by Hilti, Inc. or "ParaBond Capsule Anchors" by Molly Fastener Group.

- B. Expansion anchor bolts shall be stainless steel, AISI Type 304 or 316 and shall be of the cinch anchor, wedge or self-drilling type. Expansion anchors shall conform to the applicable requirements of Federal Specifications FF-S-325. Installation methods shall be in conformance with the manufacturer's recommendations for maximum pullout and shear strength, but in no case shall the depth of the hole be less than four bolt diameters. The minimum distance between the center of the expansion anchor and an edge or exterior corner shall not be less than 4-1/2 times the diameter of the hole in which it is installed. Expansion anchors shall be "Phillips Red Head" by Phillips Drill Company, "Wej-It" by Expansion Products, or "Kwik-Bolt" by Hilti, Inc.
- C. All nuts shall be of stainless steel meeting requirements of ASTM F 594 Alloy Group I, Condition CW.
- D. All washers shall meet dimensional requirements of ASTM F436. Material for washers shall be stainless steel, Type 304, 305, 384 or MX7.

PART 3 EXECUTION

3.01 ADHESIVE ANCHOR BOLT INSTALLATION

- A. Drilled Holes: Holes for adhesive anchors shall be drilled with a rotary percussion hammer drill with a carbide tipped masonry drill bit conforming to ANSI B94.12-77. Hole diameter and depth shall be as specified by the manufacturer.
- B. Hole Cleaning and Preparation: After drilling, dust and fragments shall be cleared out using a water jet, circular wire brush and compressed air. The hole may be damp but all water must be blown out.
- C. Curing: Anchor shall be unloaded and allowed to cure for manufacturer's recommended curing time.

3.02 EXPANSION BOLT INSTALLATION

- A. Drill expansion bolt holes into concrete through item being supported or locate by a template. Drill all holes by a tool designed by or approved by manufacturer of expansion anchors.
- B. Installation of expansion anchors shall be in compliance with manufacturer's recommendations for maximum holding power, but in no case shall depth of hole be less than four bolt diameters. Minimum distance between center of any expansion anchor and an edge or exterior corner of concrete shall be not less than 4-1/2 times diameter of hole in which it is installed.

END OF SECTION

SECTION 05520

WELDED ALUMINUM HANDRAIL

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install aluminum handrail for walkways, stairs, and openings, including all fittings, anchors, sleeves and accessories, as shown on the Drawings or specified herein.
- B. Unless specifically designated otherwise on the Drawings, all handrails shall be aluminum pipe handrail.
- C. Handrails shall be furnished and installed where shown on the Drawings and at the edge of all walking or working surfaces where the distance from the surface to the adjacent floor, ground or slab exceeds four feet.
- D. Handrails, located on surfaces below which persons or moving equipment can pass, shall be furnished with a 4-inch aluminum toeboard, unless a toeboard is furnished with the grating support angles. Kickplates will not be required on the railings for stairs or where concrete curbs are provided.

1.02 DESIGN REQUIREMENTS

- A. Railings shall be designed and constructed in strict compliance with the requirements of OSHA and SSBC.
- B. Aluminum handrail shall be designed for a minimum safe working load of 50 pounds per linear foot applied horizontally to the top rail or a concentrated load of 200 pounds applied in any direction at any point on the railing, whichever is greater. All handrail sections and components shall withstand the design loads with a minimum factor of safety of 1.5 based on the ultimate strength of the alloy used.

1.03 SUBMITTALS

- A. Submit complete shop drawings and engineering data in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Submit, in accordance with the requirements of the section entitled "Operating and Maintenance Data", supplier's recommendations and procedures for maintaining and repairing handrail, including methods, cleaning materials, refinishing materials and precautions as to the use of materials which may be detrimental to handrail finish.

1.04 STORAGE AND PROTECTION

- A. Provide storage and protection for aluminum handrail in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.
- B. Keep handling to a minimum and maintain protective covering on handrail until the work is complete.

1.05 QUALITY ASSURANCE

The Contractor shall provide the Engineer with written certification that the aluminum handrail and accessories are in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the aluminum handrail supplier may be considered evidence of compliance, provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on certified samples of handrail stock. Cost of this testing to be borne by the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Aluminum Handrail

- 1. Aluminum tubing shall be 1-1/2-inch nominal diameter, Schedule 40, 6061-T6 aluminum tubing meeting the requirements of ASTM B 429.
- 2. Handrail shall be fabricated by welding. All weld joints shall be ground smooth and polished.
- 3. Handrail shall meet all OSHA requirements and shall be uniform throughout the work.
- 4. Slip joints to facilitate removal of pipe railing shall be provided at all intersections, changes in direction or at intervals not to exceed 25 feet in straight runs of railing. The slip joint shall be designed and constructed to provide strength equivalent to a straight section of pipe.
- 5. All handrail installations shall provide for draining of entrapped water from the railing system by minimum 15/64-inch diameter weep holes or other approved means.

B. Toeboards: Toeboards shall be of the same material and finish as the rails and posts.

C. Eyebolts: Stainless steel eye bolts shall be furnished and installed on stanchions where guard chains will be attached.

- D. Guard Chains: Guard chains shall be provided across all pipe railing openings where shown, specified or required. Chain links shall be 1/4-inch aluminum of welded construction, 12 links to the foot. One end shall be connected to a 1/4-inch stainless steel eye bolt in the stanchion and the other end shall be connected by means of a heavy, bronze, swivel eye, snap hook to a similar eye bolt in the opposite stanchion.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Aluminum railings shall be erected plumb, straight and true at the locations and elevations shown on the Drawings. Prefabricated aluminum handrail shall be assembled and installed in strict compliance with the manufacturer's instructions.
- B. Aluminum handrail coming into contact with concrete or dissimilar metals shall be coated with bituminous protective coating or installed with a vinyl isolation gasket.
- C. All rails at splice joints to be fabricated 1/2-inch longer in the shop to permit cutting to fit in the field. Adequate provisions for expansion and contraction are to be incorporated in the rails. Handrail shall not be continuous across concrete expansion joints. Posts shall be fixed as shown on the Drawings. Open rail ends shall be closed by terminal end fittings. Where shown on the Drawings, aluminum chain shall be provided to close access openings. One chain shall be required with a permanent connection and a quick-disconnect. Provide toe plate where required to meet OSHA regulations.
- D. All defective, damaged or otherwise improperly installed handrail shall be removed and replaced with material that satisfies the requirements of this Section.

3.02 CLEANING

- A. Following installation, aluminum handrail shall be cleaned using soap and clean water. Acid solutions, steel wool or harsh abrasives shall not be used. If stains remain after cleaning, remove finish and restore in accordance with the manufacturer's recommendations.
- B. Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION



SECTION 05530

ALUMINUM GRATINGS

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install all aluminum gratings and stairway treads, including all supporting angles, anchors and incidental fastenings where shown on the Drawings or specified herein.
- B. Unless specifically designated otherwise on the Drawings, all gratings and treads shall be aluminum.

1.02 DESIGN REQUIREMENTS

Aluminum grating shall be designed for an extreme fiber stress in bending of not more than 10,000 psi and a deflection of not more than 1/300 of the span length or 0.25-inch, whichever is smaller, under a uniform live load of 100 pounds per square foot. The depth and thickness of the main bearing bars shall not be less than that shown on the Drawings (1-inch minimum) and the clear spacing between main bearing bars shall not exceed 1-1/8-inches.

1.03 SUBMITTALS

Complete shop drawings and engineering data shall be submitted in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.04 STORAGE AND PROTECTION

Aluminum gratings shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.05 QUALITY ASSURANCE

The Contractor shall provide the Engineer with written certification that the aluminum grating and treads are in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the grating or stair tread supplier may be considered evidence with the appropriate ASTM testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Engineer may require that the Contractor furnish test reports from an independent testing laboratory on certified samples of aluminum bar stock. Cost for this testing to be borne by Contractor.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Grating shall be IKG (S-192), Seidelhuber, Liskey or Ohio Grating.

2.02 ALUMINUM GRATINGS

- A. Aluminum gratings shall be fabricated of I-shaped or rectangular 6061-T6 or 6063-T6 aluminum alloy bars welded or pressure locked together into rigid panels. Grating and banding bars shall be machine cut. Top surfaces of main bearing bars shall be grooved or serrated to provide a nonslip surface.
- B. Grating panels shall be simply supported by shelf angles on two sides of the openings and shall be reversible. The gratings shall be of the type that can be made in panels of the widths and lengths appropriate to the openings shown on the Drawings, no gratings will be accepted which require individual panels to be made up by binding narrow panels together with end or intermediate binding strips welded thereto. The ends of all grating panels and the edges of all openings shall be provided with banding strips of the same depth and thickness of the main bars, welded thereto and neatly finished at the intersections with the bars. After installation, there shall not be more than 1/4-inch clearance between sides of adjacent panels. Panels shall be furnished in sizes that are easily handled.
- C. The top surface of all bars shall be flush and all gratings shall lie flat with no tendency to rock when installed. Cross bars and edge bars of adjacent panels shall align for neatness. Maximum spacing between adjacent panels shall not exceed 1/4-inch. All main bearing bars shall be parallel. Cross bars shall be cut off flush with outside face of side bars.
- D. Grating panels shall be securely anchored in place with stainless steel "J" bolts or aluminum saddle or hook clamps. Galvanized hardware shall not be acceptable. A minimum of two fasteners over each support shall be provided.
- E. Main bearing bars shall be supported by aluminum shelf angles of the size and thickness as shown on the Drawings. There shall not be more than 1/4-inch clearance between the ends of the grating panels and the inside vertical face of the shelf angle.
- F. Grating panels shall be within 3/16-inch, plus or minus of authorized length and width, and shall have a maximum difference in length of opposite diagonals of 3/16-inch. Spacing of bearing bars shall be within 1/32-inch of authorized spacing.
- G. All surfaces shall be sound, smooth, clean and free from defects. Completed sections shall be level and true so as to rest firmly on the bearing angles along the entire contact surface. Openings, where required, shall be neatly and accurately made to the dimensions required as shown on the Drawings. Poorly fitted or damaged grating shall be replaced. All angular, circular or reentrant cuts shall be made by sawing or shearing. Flame cutting will not be permitted.

- H. Unless otherwise shown, openings to be covered with grating shall be bound on all four sides with a continuous shelf angle frame having welded corners and sufficient strap anchors for anchorage into the concrete.
- I. Where changes in channel direction, openings for gates, ends of grating runs, etc., prohibits adequate support for grating, additional cross angles shall be furnished to provide a seating surface.
- J. Grating shall be laid out so that openings in the gratings are centered on a joint between adjacent panels. Where joints occur normal to the direction of span, they shall be centered on structural support with not more than 1/8-inch between ends of adjoining panels.
- K. Solid plank grating shall be I-bar reinforcing designed to meet the deflection requirements specified herein. The solid plank shall have a non-slip surface.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Gratings shall be installed in accordance with the manufacturer's recommendations and instruction.
- B. Gratings shall have no tendency to shift, rock or rattle and shall not exhibit excessive deflection under normal foot traffic.
- C. Stair treads shall be installed at the proper spacing and alignment and shall be level. Stairs shall not sway or vibrate under ordinary foot traffic. Additional bracing or supports shall be provided, if necessary.

3.02 SURFACE PREPARATION AND SHOP PAINTING

- A. Surface preparation and shop painting shall be in accordance with the requirements of the section entitled "Painting" of these Specifications.
- B. Aluminum surfaces to be embedded in concrete or otherwise placed in contact with masonry construction shall be given a heavy shop coat of a zinc chromate primer in accordance with Federal Specification TT-P-645. The paint shall be applied as received from the manufacturer without the addition of any thinner.

3.03 FIELD PAINTING

Field painting shall be in accordance with the requirements of the section entitled "Painting" of these Specifications.

3.04 CLEANING

Prior to the acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to fabricate and install all rough carpentry work as described herein, shown on the Drawings or necessary for proper completion of the work.
- B. The Contractor shall properly coordinate the work of other trades to ensure accurate placement of anchors, inserts, receptacles, cutouts and other items.

1.02 STORAGE AND PROTECTION

- A. All lumber shall be protected and kept under cover, both in transit and at the job site. Material shall not be delivered unduly long before it is required for proper performance of the work.
- B. All materials, when delivered to the job site, shall be stacked to ensure ventilation and protection from the weather. Lumber shall not be stored within a structure during the process of any wet work being done or until the wet work is reasonably dry.

1.03 QUALITY ASSURANCE

- A. The following grading rules and standards, latest editions, shall apply to all materials furnished under this Section:
 - 1. Softwood Lumber - Standard grading and dressing rules approved under U.S. Product Standard PS 20
 - 2. Southern Pine - Standard grading rules as published by Southern Pine Inspection Bureau
 - 3. Hardwoods - Standard grading rules as published by National Hardwood Lumber Association
 - 4. Redwood - Standard specifications for grades of California redwood lumber as published by Redwood Inspection Service
 - 5. Douglas Fir - Standard grading rules as published by West Coast Lumber Inspection Bureau or the Western Wood Products Association
 - 6. Douglas Fir Plywood - U.S. Product Standard PS-1 and the grading rules of the American Plywood Association
 - 7. Southern Pine Plywood - U.S. Product Standard PS-1 and the grading rules of the American Plywood Association

8. Hardwood Plywood - U.S. Product Standard PS-51 or U.S. Commercial Standard CS-35

B. Each piece of lumber or plywood shall bear the grade and trademark of the appropriate lumber inspection agency and a mark of mill identification. Plywood shall bear the DFPA grade and trademark of the American Plywood Association.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

A. Framing and Rough Lumber

1. Wood for furring, blocking and framing for all permanent work, unless specified otherwise, shall be construction grade Douglas fir of full and square dimensions, free of large or loose knots, shakes, wains or saps. Maximum moisture content shall not exceed 19 percent.
2. All framing, blocking, etc., in contact with concrete or masonry construction shall be pressure treated with a water soluble salt conforming to AWWA Standard P-5 using a process conforming to AWWA Standard C2 and shall bear the AWPB LP-2 or LP-22 quality mark. Pressure treated wood shall be paintable, stainable, oil free and odorless. Pressure treated plywood shall conform to AWWA Standard C9.
3. Where fire retardant treated wood is specified or shown on the Drawings, lumber and plywood shall be impregnated with a special fire retardant chemical. Fire retardant treated wood shall have a fire hazard classification of less than 25 for flame spread, fuel contributed and smoke generated in accordance with ASTM E 84 and shall be UL designated as FR-S. For exterior grade fire retardant treated wood, there shall be no change in classification following exposure to the standard rain test in accordance with ASTM D 2898. Following treatment, fire retardant treated wood shall be kiln dried to a moisture content of not more than 19 percent for exterior grade and 15 percent for interior grade. Each piece of lumber or plywood shall bear the approved UL and Factory Mutual labels for fire performance rating. Allowable design stresses of fire retardant treated wood shall not exceed 90 percent of those published by NFPA.

PART 3 EXECUTION

3.01 INSTALLATION

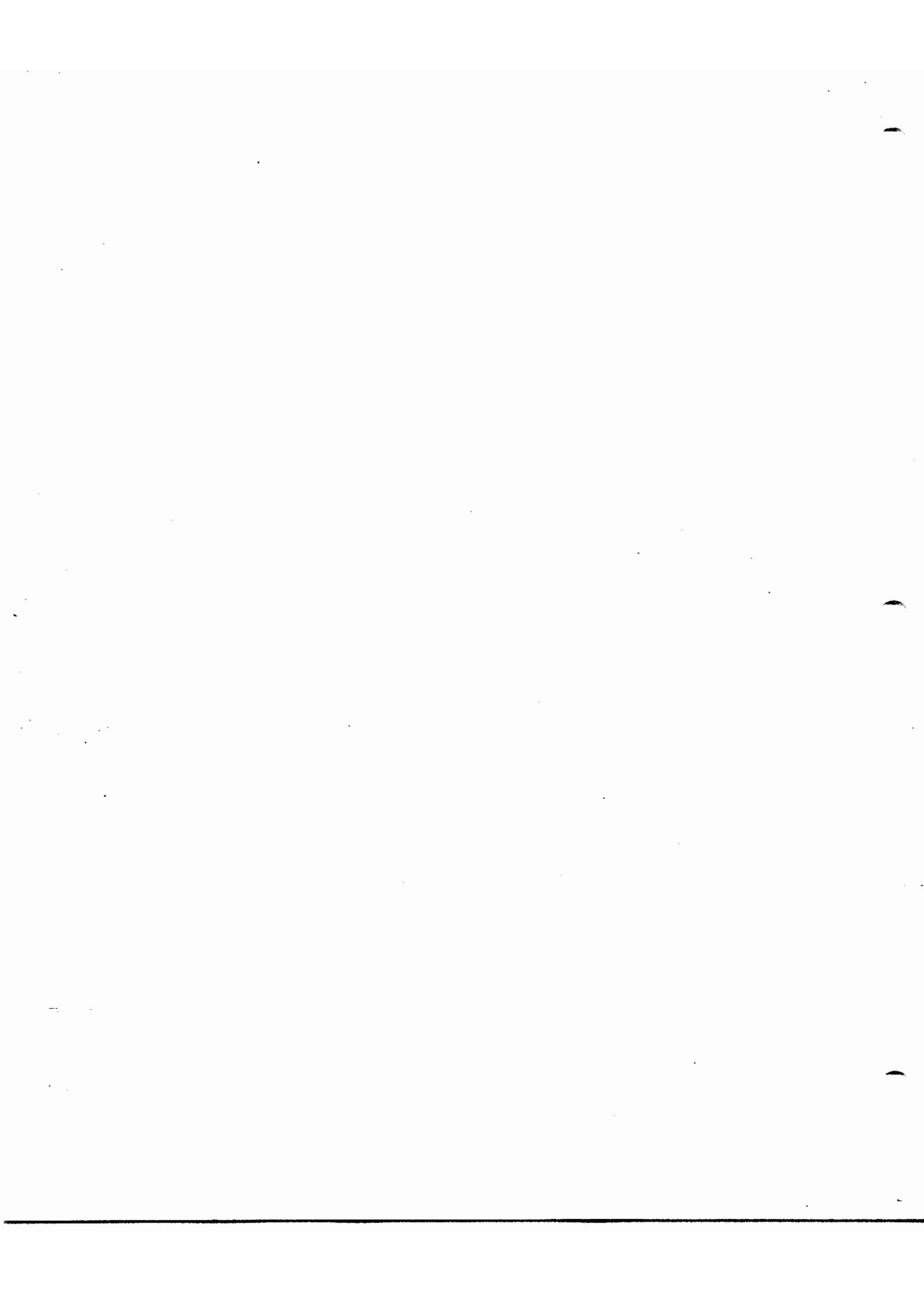
- A. All materials shall be installed by an erector of proven experience and shall be accomplished in a first class manner. Any damages to exposed members shall be repaired to the satisfaction of the Engineer or damaged members shall be replaced. All installation work shall conform to AITC Standard 105.

- B. Furnish dressed wood nailing strips and wood blocking of the sizes indicated or required and install on or in concrete or masonry as required for the attachment of carpentry and the work of other trades. All grounds and nailing strips shall be anchored to the masonry with countersunk 1/4-inch toggle bolts or other type anchors not over 24-inches on center. Grounds shall be set rigid in perfect alignment and shall be trued with a long straight edge. Wood plates shall be anchored to concrete slabs using concrete nails or power actuated fasteners.
- C. Framing lumber and other rough work shall be properly framed, closely fitted, accurately set to required lines and levels and rigidly secured in place. Special framing or construction not explicitly shown or specified shall be provided as required to complete the work in the best and most workmanlike manner. Nailing and spiking shall be done in a thoroughly workmanlike manner, with nails of ample size, using spikes larger than 12 penny where practical. Members shall be framed for the passage of pipes and ducts to avoid cutting structural members.
- D. Brush cut surfaces of pressure treated lumber with a heavy coat of preservative (same preservative used in original application).

3.02 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the section entitled "Cleaning" of these Specifications.

END OF SECTION



(1)

SECTION 07150

DAMPPROOFING

PART 1 GENERAL

1.01 SCOPE

The bituminous dampproofing shall be applied to the exterior face of the interior walls of all cavity walls.

1.02 REFERENCES

A. Standards of the following as referenced:

1. American Society for Testing and Materials (ASTM)

1.03 SUBMITTALS

Submit approved manufacturer's product literature for dampproofing materials including all special details and recommended application procedures in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect dampproofing materials before, during and after installation and to protect the installed work and materials of all other trades, contiguous to the dampproofed surfaces. Packaged containers shall be stored on wood skids, 6-inches off the ground and covered with heavy plastic sheeting which shall remain in place at all times.
- B. Replacement: All broken containers and their contents shall be removed from the premises, discarded in a legal fashion and replaced with new materials at no additional cost to the Owner.

1.05 COORDINATION

- A. Review all Drawings and details of installations of other adjoining materials and cooperate with the respective trades.
- B. The applicator's particular attention is directed to the requirement to properly prepare surfaces for the attachment of other materials and to chip out and repack surfaces at all attachments.

1.06 WARRANTY

Furnish a written warranty, warranting materials and workmanship for a period of five years after acceptance of the work of this Section and binding the Contractor to repair and make good, at no additional cost to the Owner, all defects which appear during this period.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products specified as standard of quality are indicated in Article 2.02.
- B. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified by specified characteristics listed below, certified as asbestos free, are acceptable for use, subject to approval of product list:
 - 1. ChemRex, Inc.
 - 2. Karnak Chemical Corp.
 - 3. Lambert Corp.
 - 4. W.R. Meadows, Inc.

2.02 MANUFACTURED UNITS

- A. Cavity Wall Dampproofing
 - 1. Acceptable Product: Lambert Corp., Waterban 60SM.
 - 2. Characteristics: Fibrated, mineral colloid, asphalt emulsion; brush applied, meeting ASTM D1227-87, Type II.
 - 3. Primer: Type recommended by dampproofing manufacturer for application to concrete unit masonry substrate.

PART 3 EXECUTION

3.01 PREPARATION

- A. Prior to application of materials, remove dirt, grease, mortar droppings, and foreign matter from substrate.
- B. Prime wall surfaces prior to dampproofing application in accordance with the manufacturer's product data.
- C. Apply dampproofing at temperatures above 40 degrees F to dry, cured surfaces.

3.02 APPLICATION

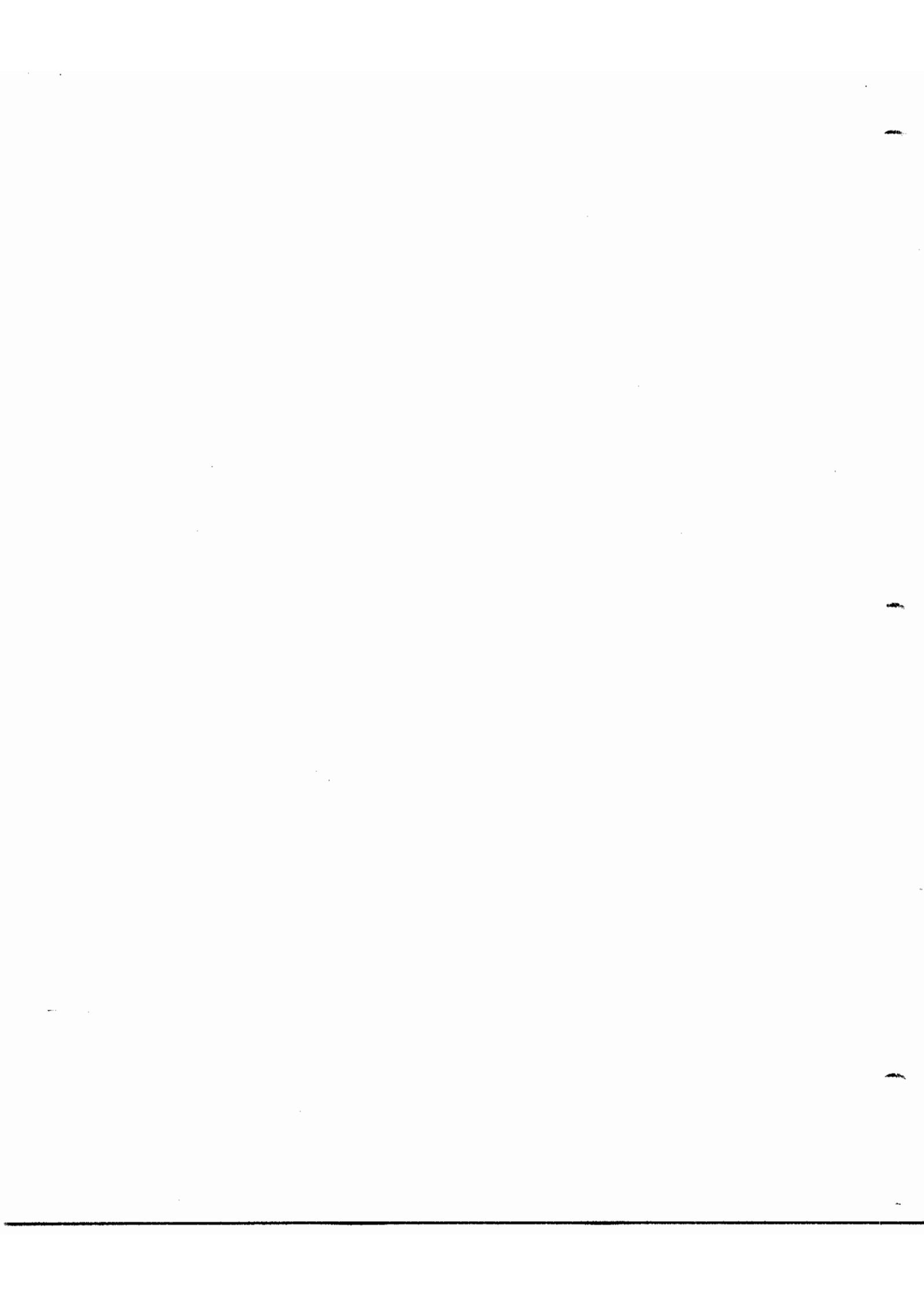
- A. Cavity Wall
 - 1. Brush or spray apply dampproofing at four gallons per 100 square feet rate in accordance with the manufacturer's product data.
 - 2. Apply dampproofing to exterior face of interior masonry wythe in exterior double wythe walls.

3. Schedule dampproofing application to precede rigid wall insulation installation so insulation may be embedded in dampproofing.

3.03 CLEAN-UP

- A. Protect adjacent finished surfaces from damage or staining from this work by masking prior to application. Repair or replace surfaces damaged or stained by dampproofing work.
- B. Remove debris resulting from work at completion of dampproofing operations; include spilled materials.

END OF SECTION



(1)

SECTION 07151

WATERPROOFING

PART 1 GENERAL

1.01 SCOPE

- A. The work under this Section includes, but is not necessarily limited to, the furnishing and installation of all waterproofing as indicated on the Drawings, herein specified and as necessary for the proper and complete performance of this work.
- B. The bituminous waterproofing materials specified herein shall be surface applied to the entire face of all exterior concrete building walls below grade. Do not apply to outside of wet wells or screen room.
- C. The cementitious penetrating type waterproofing materials specified herein shall be surface applied, capillary action type. Apply to interior surface of concrete dry well walls below grade where the exterior wall surface is in contact with fill materials or is adjacent to the wet well. Apply from bottom slab (EL. 816.0) to top of wall (EL. 871.0).

1.02 SCOPE OF WORK

- A. Provide all labor, materials, equipment and appliances as required for the proper installation of waterproofing as follows:
 - 1. Prepare all surfaces as specified herein to receive waterproofing.
 - 2. Provide waterproofing at all vertical and horizontal surfaces specified under this Section or shown on the Drawings.
 - 3. The manufacturer shall provide all certifications, test data, affidavits or samples requested by the Engineer.
 - 4. Perform all installations to comply with local rules, ordinances and regulations, OSHA Requirements and EPA Statutes complying with environmental protection.
 - 5. Perform all installations in accordance with the approved construction progress schedule or at such times necessary for the orderly and expeditious completion of the Project.
 - 6. Upon completion of waterproofing, remove all waste or rubbish resulting from waterproofing operations and all equipment used for same.

1.03 SUBMITTALS

Submit approved manufacturer's product literature for waterproofing materials including all special details and recommended application procedures in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.04 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect waterproofing materials before, during and after installation and to protect the installed work and materials of all other trades, contiguous to the waterproofed surfaces. Packaged containers shall be stored on wood skids, 6-inches off the ground and covered with heavy plastic sheeting which shall remain in place at all times.
- B. Replacement: All broken containers and their contents shall be removed from the premises, discarded in a legal fashion and replaced with new materials at no additional cost to the Owner.

1.05 COORDINATION

- A. Review all Drawings and details of installations of other adjoining materials and cooperate with the respective trades.
- B. The applicator's particular attention is directed to the requirement to properly prepare surfaces for the attachment of other materials and to chip out and repack surfaces at all attachments.

1.06 QUALITY ASSURANCE

- A. Qualifications of Installers
 - 1. The applicators performing this work must have a minimum of five years experience in this type of waterproofing and be able to show that they have successfully carried out contracts of a similar nature, size and scope.
 - 2. Provide at least one person who shall be present during execution of this portion of the work and who shall be thoroughly experienced in installation of the specified products and shall direct all work performed under this Section.
- B. Manufacturer's Certification: Prior to start of installation of the work of this Section, arrange a visit to the job site by a representative of the manufacturer of the waterproofing materials used, who shall inspect and certify:
 - 1. That the surfaces to which waterproofing is to be applied are in condition suitable to receive waterproofing.
 - 2. That the materials to be installed comply in all respects with the requirements of this Section.

3. That the applicator has the experience to install said materials in complete accordance with the manufacturer's current recommendations.

1.07 WARRANTY

Furnish a written warranty, warranting materials and workmanship for a period of five years after acceptance of the work of this Section and binding the Contractor to repair and make good, at no additional cost to the Owner, all defects which appear during this period.

PART 2 PRODUCTS

2.01 BITUMINOUS WATERPROOFING

Bituminous waterproofing of exterior concrete surfaces shall be Sonneborn or W.R. Meadows.

2.02 CEMENTITIOUS PENETRATING TYPE WATERPROOFING

- A. The penetrating cementitious waterproofing for concrete surfaces shall be factory formulated in a designed mix to be applied in a slurry paste mixed to the proper consistency with the addition of water in quantities recommended by the manufacturer.
- B. The material shall be warranted not to contain additives such as chlorines, sulphates, iron oxides, or similar deleterious substances.
- C. The material shall be composed of specially prepared Portland cement, fine oven dried quartz aggregates and moisture active, chemically treated ingredients. The waterproofing material shall be Permquick Super 200, Vandex Super or Penetron.

PART 3 EXECUTION

3.01 INSTALLATION

Application shall be by a waterproofing specialist as recommended by the waterproofing material manufacturer. The manufacturer, or manufacturer's approved representative, shall supply the necessary supervision to satisfy the Engineer that application of the waterproofing conforms strictly to the manufacturer's recommendations.

3.02 PREPARATION

- A. Concrete surfaces shall be sound, free of structural defects and have open capillaries.
- B. All surfaces shall be clean and free of laitance, oil form release agents, curing compounds, hardeners, and any other material likely to affect the bond penetration or performance of the waterproofing material.
- C. Areas that have become dirty and concrete pours which have resulted in an extremely smooth surface shall be acid etched in accordance with

the manufacturer's recommendations. Special details of joining surfaces where waterproofing is continuous or stopped shall be made as required by the manufacturer.

3.03 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 07210
BUILDING INSULATION

PART 1 GENERAL

1.01 SCOPE

- A. The work covered by this Section includes furnishing all labor, materials and equipment required to furnish and install all building insulation as specified herein and/or shown on the Drawings.
- B. Roof insulation shall be furnished and installed under applicable roofing section(s) of these Specifications.

1.02 SUBMITTALS

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.03 STORAGE AND PROTECTION

Insulation shall be stored indoors in a dry location in accordance with the manufacturer's instructions.

1.04 QUALITY ASSURANCE

- A. All insulation shall be delivered to the site in unopened packages. Packages shall be clearly marked with the manufacturer's name, type, quantity of insulation and "R" value (where applicable).
- B. "R" values shall be determined in accordance with the standards of the National Mineral Wool Insulation Association.
- C. The Contractor shall submit a certificate to the Engineer stating that all loose fill insulation conforms to the latest applicable specifications of the Perlite Institute.

PART 2 PRODUCTS

2.01 PERIMETER INSULATION

- A. Perimeter insulation shall be rigid, closed cell, urethane board insulation conforming to Federal Specification HH-1-530A, Type III, Grade 2, Class 1, equal to that manufactured by the Upjohn Company or Owens Corning.
- B. Urethane perimeter insulation shall have a density of not less than 2.0 pcf in accordance with ASTM C303. Thermal conductivity of not less than 0.14 Btu in./sq.ft.-hr.- degree F in accordance with ASTM C518, and a water absorption not to exceed 0.1 percent in accordance with ASTM C272.

- C. Perimeter insulation shall be approved for use in FHA construction.
- D. Adhesive shall be as recommended by insulation manufacturer.

2.02 RIGID WALL INSULATION

- A. Rigid wall insulation shall be rigid, closed cell, expanded polystyrene board insulation conforming to Federal Specification HH-I-542a, Type I, Class A.
- B. Polystyrene wall insulation shall have a density of not less than 1.0 pcf in accordance with ASTM C 303, a thermal conductivity not to exceed 0.26 Btu/in./sq.ft./hr./degree F in accordance with ASTM C518, and a water absorption not to exceed 2 percent in accordance with ASTM C 272. Flame spread and fuel contributed shall not exceed 25 and smoke generated shall not exceed 50 in accordance with ASTM E 84 for 1-inch thickness.
- C. Polystyrene wall insulation shall be approved for use in FHA construction.

(1) D. Spandrel Panel Insulation

1. Acceptable Products

- a. Fibrex: FBX Curtain Wall Insulation
- b. Manville Corp.: Pyro-Fiber Curtain Wall Insulation
- c. USG Acoustical Products Company: Thermafiber Curtainwall Insulation

PART 3 EXECUTION

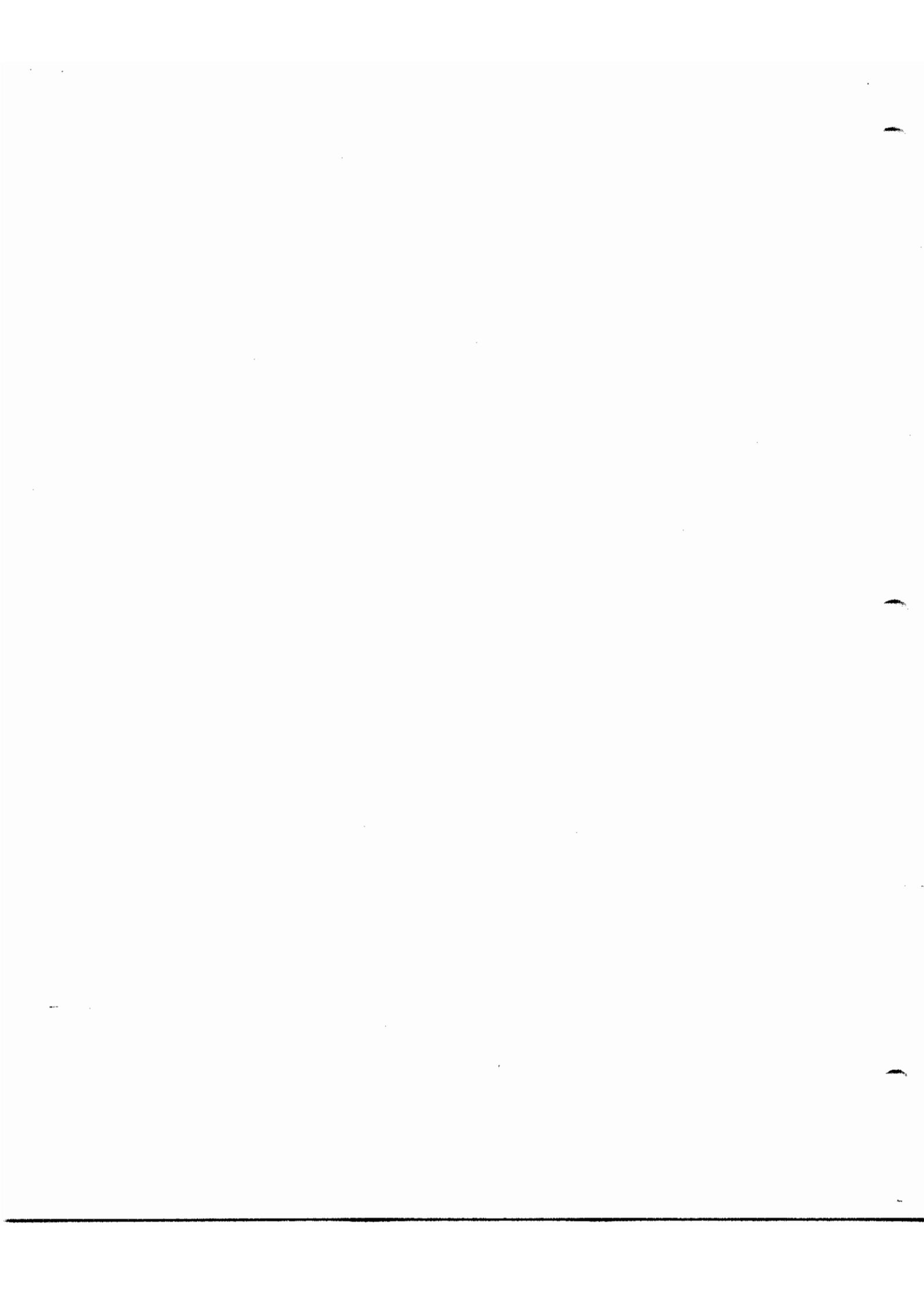
3.01 INSTALLATION OF PERIMETER INSULATION

- A. Provide a horizontal layer of insulation under all slabs on grade immediately adjacent to exterior walls.
 - B. Place vapor barrier and insulation directly on level, well-tamped fill before concrete floor slab is poured. Pour concrete slab floor directly over perimeter insulation.
 - C. Place insulation carefully over the vapor barrier, and bed in a manner to keep top surfaces level and in same plane. Cement sections together tightly.
- (1) D. Spandrel insulation: Install in aluminum channels or angles fastened to window system at spandrel panels; completely fill space in frame; maintain 1-inch clear from spandrel glass inner face to insulation face.

3.02 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION



SECTION 07220
ROOF DECK INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Related Sections

- (1) 1. Section 05310: Metal Roof Decking
- (1) 2. Section 06100: Rough Carpentry
- (1) 3. Section 07510: Single Ply Roofing

B. Alternates: Voluntary alternate allows use of either base insulation board, polyisocyanurate or phenolic, at Contractor's option.

1.02 REFERENCES

A. Standards of the following as referenced:

- 1. American Society for Testing and Materials (ASTM)
- 2. Factory Mutual System (FM)
- 3. National Roofing Contractors Association (NRCA)

B. Industry Standards

- 1. FM: Approval Guide and Loss Prevention Data 1-28, May 1983
- 2. NRCA: NRCA Built-up Roofing Water Proofing Manual, 1985 edition

1.03 SUBMITTALS

A. General: Coordinate submittals; verify use of insulation manufacturer acceptable to roofing system manufacturer to receive warranty specified.

B. Product Data

- 1. Manufacturer's dated product description and complete installation instructions for insulation materials. Indicate specific systems and procedures proposed for use.
- 2. Intent to use products specified does not relieve from responsibility of submitting product line.

C. Shop Drawings

1. Tapered insulation
2. Indicate insulation layout showing crickets, valleys, and drain locations.
3. Include longitudinal and transverse sections and sections through crickets showing insulation layout.

D. Quality Control Submittal Certificates: Indicate materials supplied or installed are asbestos free.

1.04 QUALITY ASSURANCE

A. Preinstallation Conference

1. Prior to beginning roofing work, pre-roofing conference will be held to review work to be accomplished.
2. Requirements specified in Built-up Bituminous Roofing Section.

1.05 DELIVERY, STORAGE AND HANDLING:

A. Storage and Protection

1. Store bitumen cartons level, standing in upright position. Do not stack cartons. Protect open top containers from debris and precipitation.
2. Store solvent bearing materials in dry, cool storage and keep lids tight on opened containers to prevent solvent escape.
3. Store insulation materials under cover, off ground, protected from weather. Use canvas tarps or breathable covers over insulation; using sheet polyethylene or other material allowing condensation is prohibited. Handle to prevent damage to edges.
4. Remove insulation from under covered area; stockpile on roof just prior to installation; maintain same type covers on insulation until actual use.

1.06 PROJECT CONDITIONS

Environmental Requirements: Apply insulation in dry weather, when ambient temperature is above 45 degrees F.

1.07 WARRANTY

A. Special Warranty

1. Warrant insulation work to be free of defects in materials and workmanship.
2. Combine warranty with roofing warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Products specified as standard of quality are indicated in Article 2.02.
- B. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified by specified characteristics listed below, are acceptable for use, subject to approval of product list and acceptance by related sections.
- C. Perlite Roof Insulation
 - 1. The Celotex Corp.
 - 2. GAF Corp.
 - 3. International Permalite, Inc.
 - 4. Lucas Sales Company, Inc.
 - 5. Manville Roofing Systems Div.
- D. Polyisocyanurate Roof Insulation
 - 1. Apache Building Products Company
 - 2. Atlas Industries
 - 3. The Celotex Corp.
 - 4. GAF Corp.
 - 5. International Permalite, Inc.
 - 6. Manville Roofing Systems Div.
 - 7. NRG Barriers, Inc.
 - 8. RMax, Inc.
- E. Phenolic Roof Insulation
 - 1. Domtar Gypsum
 - 2. Manville Roofing Systems Div.
 - 3. NRG Barriers, Inc.

2.02 MANUFACTURED UNITS

A. Tapered Perlite Roof Insulation for Top Layer

1. Acceptable Product: Manville Roofing Systems Div.; Fesco Dri-Deck, Factory Tapered.
2. Characteristics
 - a. Insulation Type: Rigid perlite boards meeting ASTM C728-82; 2 x 4 feet up to 4 x 4 feet.
 - b. Slope per Foot: 1/4-inch
 - c. "K" Value at 75 Degrees F: 0.36
 - d. Fill Insulation: Perlite insulation specified above; thicknesses required for slope.

B. Polyisocyanurate Roof Insulation, Base Layer; Note Voluntary Alternate Above

1. Acceptable Product: Manville Roofing Systems Div.; Ultra Gard.
2. Characteristics
 - a. Type: Isocyanurate foam core, glass fiber reinforced boards with fiberglass faces laminated to core; asphalt saturated, if required by manufacturer for specified roofing system.
 - b. Size: 3 X 4 feet up to 4 x 8 feet.
 - c. Thickness: 2.0 minimum

C. Phenolic Roof Insulation, Base Layer: Note Voluntary Alternate Above

1. Acceptable Product: Manville Roofing Systems Div.: Ultra Gard Premier.
2. Characteristics
 - a. Type: Closed cell phenolic foam core, 2.7 PCF density, nominal; glass fiber reinforced boards with fiberglass faces laminated to core.
 - b. Size: 3 x 4 feet or 4 x 8 feet.
 - c. Thickness: 1.5

2.03 ACCESSORIES

A. Blocking, Nailers and Fasteners for Blocking and Nailers

1. Blocking and Nailers: Preservative-treated lumber, specified in Rough Carpentry Section.
2. Fasteners: Non-corroding; types recommended in reviewed product data, lengths required for indicated conditions.

B. Concrete Primer: Asphalt primer, meeting ASTM D41-78.

C. Bitumen: Meeting ASTM D312-78, Type III.

- D. Fire retardant cant strips: Perlite; 4-inch nominal face by 4 feet long.
- E. Flashing Cement: Asphalt roof cement meeting AST D4586-86, Type II.
- G. Insulation Fasteners
 - 1. Type: Acceptable to roof insulation manufacturer for achieving FM Class I-90 wind classification.
 - 2. Meet FM 44-70-1986 for corrosion resistance.
 - 3. Meet SO Corrosion Test Cabinet (Kesternich Cabinet, DIN 50018) test for 30 cycles with less than 10% red rust.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions

- 1. Verify locations of roof openings and penetrations are in accord with reviewed shop drawings.
- 2. Verify nailers and blocking locations and anchorages are in accord with reviewed shop drawings.
- 3. Examine conditions and substrates where products of this section are to be installed; submit written notification of unacceptable conditions or substrates.
- 4. Submit copy of installer's report to Architect within 72 hours of report receipt.
- 5. Proceeding with construction activity of this section:
 - a. Prior to correction of unacceptable conditions or substrates are prohibited.
 - b. Indicates installer's acceptance of conditions and substrates.

3.02 PREPARATION

A. Protection

- 1. Mask and otherwise protect adjacent surfaces to prevent marring of adjacent finishes.
- 2. Protect building and site from damage and defacing by operations. Use tarps at hoisting points.
- 3. Restore or replace adjacent work or materials damaged during handling of bitumens and insulation materials.

- B. Surface preparation: Immediately prior to application of insulation materials, sweep roof deck; remove debris and foreign material.

3.03 INSTALLATION

- A. General: Install roof insulation and accessories in quantity capable of being covered by roofing materials by end of same Work period.
- B. Nailers: Install at perimeter of penetrations and projections in roof deck, at perimeter of areas to be roofed, and at other locations indicated.
- C. Insulation
 - 1. First Layer Insulation
 - a. Stagger end joints in adjacent boards, 1/2 board width; butt edges for moderate contact. Insulation joints at steel beams, girders or joints below are prohibited.
 - b. Metal Deck: Mechanically fasten insulation at corners, changes in deck direction, and field with specified fasteners to receive FM Class I-90 Classification.
 - (1) Bear ends of boards on deck ribs.
 - (2) Space fasteners indicated in FM Loss Prevention Data 1-7, April 1983 and I-28, May 1983.
 - c. Tapered and cricket installation:
 - (1) Install tapered roof insulation and crickets where indicated in reviewed shop drawings. Install with joints staggered to main roof insulation 1/2 board width, stagger end joints in adjacent boards 1/2 board length; butt edges for moderate contact.
 - (2) Adhere in solid bitumen mopping at rate recommended by insulation manufacturer.
- D. Accessories
 - 1. Install cant strips and tapered edge strips in solid mopping of bitumen.
 - 2. Butt lengths together and to adjacent construction.
 - 3. Install cant strips at abutting vertical surfaces except those surfaces having built-in cants.

END OF SECTION

(1)

SECTION 07460

ALUMINUM FACED SIDING AND ALUMINUM FASCIA AND SOFFIT

PART 1 GENERAL

1.01 SCOPE

The extent of siding is indicated on the Drawings. Types of siding in this Section include aluminum faced plywood siding and aluminum fascia/soffit/drip edge system.

1.02 SUBMITTALS

- A. Product Data: Submit specifications, installation instructions, and general recommendations from siding manufacturer, including data that materials comply with requirements.
- B. Samples: Full range of samples for color and texture selection, two 12-inch lengths or two 12-inch square pieces for verification of each color, style and texture selected.
- C. Provide siding manufacturer's standard warranty on installed work, agreeing to inspect, repair and replace defective siding.

1.03 JOB CONDITIONS

- A. Substrate: Proceed with siding work only after substrate construction and penetrating work have been completed.
- B. Weather Conditions: Proceed with siding work only when substrate is completely dry.
- C. Store siding materials at the site to prevent warping and weather damage, elevating above ground on level blocking and covering to prevent water damage and to permit adequate ventilation within bundles.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide products from a single manufacturer. Color shall be selected by the Engineer from the manufacturer's standard colors.
- B. Fascia and soffit is manufactured by Certainteed Corporation, products of other manufacturers are acceptable if equal to that specified.
- C. Siding specified is manufactured by Weyerhaeuser Architectural Panels, Type Panel 15. Products from other manufacturers are acceptable if equal to that specified.

- D. If material from other manufacturers are submitted, the Contractor shall submit complete data on products in sufficient detail to permit comparison and evaluation of materials submitted. If, in the opinion of the Engineer, sufficient data is not submitted or the materials are not equal to those specified, the substituted products will be rejected.
- E. Sizes and Styles
1. Siding: 4 x 10 sheets with aluminum face on one side.
 2. Soffit: Triple 4-inch premium soffit, 12-foot lengths, 12-inch exposure, Style 116.
 3. Fascia: Solid aluminum fascia panel, 8-inch face, 12-foot 6-inch lengths.
 4. Accessories
 - a. J-Channel; length 12-feet 6-inches, size as required
 - b. Vertical starter strip; length 12-inches
 - c. 8-inch fascia; length 12-feet 6-inches
 - d. Quarter round molding; length 12-feet 6-inches
 - e. Soffit cove trim; length 12-feet 6-inches
 - f. 1/2-inch F-Channel frieze; runner; length 12-feet 6-inches
 - g. "H" divider bar; length 12-feet 6-inches
 - h. Other special accessories as required for complete installation.
 5. All aluminum siding and soffit shall be provided with elongated nailing slots on the nailing flange.
 6. Ends of horizontal siding panels shall be factory notched so as to form an overlapping joint.
- F. Miscellaneous Materials - Sealants: Comply with the requirements of Division 7 on caulking and sealants for materials required for siding work.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General: Comply with the instructions and recommendations of the siding manufacturer, except to the extent more stringent requirements are indicated.
- B. Aluminum Faced Siding: Install starter strip, corner posts, and necessary trim as recommended by the manufacturer of siding materials; install siding with tolerances and fastener spacings as recommended by the manufacturer, interlocking subsequent courses to form a weathertight surfacing.
- C. Aluminum Soffit and Fascia: Install "F" channel, starter strip, soffit molding, divider bars, soffit panels and fascia panels as

recommended by the manufacturer. Install with tolerances and fasteners spacing as per manufacturer instructions.

- D. Leave siding and soffit in clear condition, free of dirt, dust and fingermarks. Replace any poorly fitting or damaged portions of the work.

END OF SECTION



SECTION 07533

MECHANICALLY ATTACHED SINGLE PLY MEMBRANE

PART 1 GENERAL

1.01 SUMMARY

A. Section includes, but is not limited to:

1. Mechanically-attached single ply membrane system, including but not limited to the following:
 - a. Substrate preparation
 - b. Blocking installation
 - c. Membrane installation
 - d. Membrane fastener system installation
 - e. Membrane coating installation
 - f. Flexible flashing installation
2. Products installed but not furnished under this Section:
 - a. Metal counterflashing; specified in Flashing and Sheet Metal Section.
 - b. Roof installation; specified in Roof and Deck Insulation Section.

B. Related Sections

1. Section 06100: Rough Carpentry
2. Section 07220: Roof Deck Insulation
3. Section 07600: Flashing and Sheet Metal
4. Section 07721: Manufactured Curbs
5. Section 07700: Roof Specialties and Accessories
- (1) 6. Section 07900: Sealants and Caulking

1.02 REFERENCES

A. Standards of the following are referenced:

1. American Society for Testing and Materials (ASTM)
2. Environmental Protection Agency (EPA)
3. Federal Specification (Fed. Spec.)
4. National Roofing Contractors Association (NRCA)

- B. Industry Standards: NRCA: Roofing and Waterproofing Manual, Second Edition, 1985.

1.03 DEFINITIONS

A. Terms

- 1. CPE: Chlorinated Polyethylene
- 2. DFT: Dry Film Thickness

1.04 SUBMITTALS

A. Product Data

- 1. Manufacturer's dated product literature for each specified product; indicate specific systems and materials proposed for use.
- 2. "Manufacturer's Safety Data Sheets", (M.S.D.S.), for materials.

B. Shop Drawings; indicate the following:

- 1. Membrane layout
- 2. Membrane fastener layout
- 3. Joint locations
- 4. Joining and flashing details
- 5. Cricket, valley, and drain locations
- 6. Metal counterflashing installation details

C. Samples: Components of membrane fastener system, if requested by Architect.

D. Quality Control Submittals

1. Certificates

- a. Certificates: Indicate materials supplied or installed are asbestos free.
- b. Contractor's indicating membrane manufacturer, insulation manufacturer, and installer are qualified; include following documentation:
 - (1) Membrane manufacturer's indicating installer is approved for warranted membrane installation.
 - (2) Insulation manufacturer's indicating installer is approved for warranted insulation installation.
- c. Membrane Manufacturer's Certifications
 - (1) Insulation manufacturer, and insulation material proposed for use, are approved for use in warranted membrane system installation.

- (2) Surfaces and conditions are acceptable for purpose of providing specified warranty.
- (3) Materials supplied meet specified requirements.
- d. Insulation manufacturer's indicating materials supplied meet specified requirements.
- e. Intent to warrant, executed by authorized representative of membrane manufacturer; certify the following:
 - (1) It has reviewed drawings and specifications, conditions affecting membrane and insulation, and relationship of membrane and insulation.
 - (2) It intends to provide warranties as referenced without further stipulation.

2. Manufacturer's Instructions

- a. Manufacturer's dated installation instructions for each specified product: indicate specific procedures proposed for use, and conditions applicable to installation.
- b. Disposal requirements for expended material or partially expended containers.

3. Manufacturer's Field Reports: Certified copy of inspection report specified below.

E. Contract Closeout Submittals

- 1. Project Record Documents: Minutes of meeting, preinstallation conference.
- 2. Operation and Maintenance Data: Roofing manufacturer's printed maintenance and repair instructions.
- 3. Warranties; executed copies of the following documents:
 - a. Contractor warranty
 - b. Subcontractor warranty
 - c. Roofing warranty
 - d. Membrane manufacturer's warranty documents

1.06 QUALITY ASSURANCE

A. Qualifications

- 1. Membrane Manufacturer: Minimum five years experience in manufacture of membrane materials similar to product specified.
- 2. Installer: Minimum five years experience in installation of roofing systems similar to system specified, and approved by membrane and insulation manufacturers.

B. Preinstallation Conferences

- 1. Prior to beginning roofing work, pre-roofing conference will be held to review work to be accomplished.

2. Attendees
 - a. Contractor.
 - b. Membrane manufacturer's authorized representative.
 - c. Insulation manufacturer's authorized representative.
 - d. Roofing system installer.
 - e. Subcontractors who have equipment penetrating roof.
 - f. Subcontractors whose construction activities require access to roof.
 - g. Subcontractors whose construction activities occur on roof.
3. Notify Architect at least three days prior to time for conference.
4. Record minutes of meeting; distribute to attending parties. Copy is required in closeout submittals.

1.06 DELIVERY, STORAGE AND HANDLING

A. Storage and Protection

1. Store materials in dry area in manufacturer's protective packaging in original containers with labels and installation instructions intact.
2. Store materials under cover, off ground; protect from moisture.
3. Handle roll goods to prevent damage to edges.
4. Protect materials from exposure to spark or flame.
5. Maintain temperatures in storage areas between 50 and 90 degrees F.
6. Store materials containing solvents in dry, cool storage; keep lids tight on opened containers to prevent solvent escape.
7. Dispose of expended or partially expended materials containers in accord with EPA requirements.

1.07 PROJECT CONDITIONS

A. Environmental Requirements

1. Install in accord with climatic conditions indicated in manufacturer's installation instructions.
2. Begin membrane installation only when forecasted weather conditions predict acceptable conditions.

1.08 SEQUENCING AND SCHEDULING

- A. Schedule installation, testing and approval of products and materials penetrating membrane, or are made watertight by membrane installation, prior to membrane installation.

- B. Schedule construction activities to minimize traffic on membrane or exposed insulation.
- C. Provide water cut-off at exposed edges of roof membrane at end of each period of construction activity; remove cut-offs prior to beginning next period of construction activity.
- D. Allow installed surfaces receiving membrane coating to weather two weeks, minimum, before coating installation; allowing traffic on installed membrane coating before manufacturer's recommended drying time has elapsed is prohibited.

1.09 WARRANTY

A. Special Warranties

- 1. Provide Contractor Warranty, Subcontractor Warranty, and Roofing Warranty for membrane, insulation, flashing and sheet metal materials, and installation.
- 2. Warranty Period: Ten years; begin at Date of Substantial Completion.

B. Warranty

- 1. Provide manufacturer's warranty for installed membrane and insulation system.
- 2. Warranty Period: 15 years; begin at Date of Substantial Completion.
- 3. Dollar Limit: ND (No Dollar Limit) warranty; include membrane only for ordinary wear and tear and workmanship deficiencies to return roofing system to watertight condition.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Products specified as standard of quality are indicated in Article 2.2.

B. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified by specified characteristics listed below, are acceptable for use, subject to approval of product list.

- (1) 1. Carlisle Tire and Rubber Company, Brite-Ply 45 mil, reinforced EPDM, mechanically attached.
- (1) 2. Goodyear Tire and Rubber Company, "Versiguard", white 45 mil, reinforced EPDM, mechanically attached.
- (1) 3. Manville Roofing System Division, white 60 mil, EPDM, mechanically attached.

(1) 2.02 ACCESSORIES

A. Blocking, Nailers and Fasteners for Blocking and Nailers

1. Blocking and Nailers: Preservative-treated lumber, specified in Rough Carpentry Section.
2. Fasteners: Non-corroding; type recommended in reviewed product data, lengths required for indicated conditions.

B. Membrane accessories, including but not limited to bonding adhesives, fasteners and fastening systems, splice adhesives, cements, butyl-based lap sealants, and primers: Selected membrane manufacturer's standard products for use with mechanically fastened membrane.

C. Metal Counterflashing: Specified in Flashing and Sheet Metal Section.

- (1) D. Roof Walkway Pads: Manufactured or approved by selected membrane manufacturer; size 30 x 0.45-inch minimum thickness.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions

1. Verify roof openings and penetrations locations are in accord with reviewed shop drawings.
2. Verify nailers and blocking locations and anchorages are in accord with reviewed shop drawings.

3.02 PREPARATION

A. Protection: Mask and otherwise protect adjacent surfaces to prevent marring of adjacent finishes.

B. Surface Preparation

1. Immediately prior to beginning installation of insulation and membrane, sweep substrate clear of debris.
2. Ensure surfaces receiving membrane coating are clean, dry, and free of debris and contaminants before beginning coating installation.

3.03 INSTALLATION

- (1) A. General: In accord with reviewed product data and shop drawings and manufacturer's instructions.

B. Nailers: Install at perimeter of penetrations and projections in roof deck, at perimeter of areas to be roofed, and at other locations indicated.

C. Membrane

1. Membrane Fastener System: Lay out in indicated locations and patterns. Secure fasteners through insulation to concrete deck, using specified anchoring devices for fastener system; ensure anchoring devices penetrate deck 1", minimum.
2. Lay out membrane sheets, lapping sheets 3" minimum.
3. Allow membrane to relax 30 minutes, minimum, before adhering.
4. Thoroughly clean and prime surfaces to be bonded, using specified cleaner and primer.
5. Apply specified membrane bonding adhesive on membrane and fastener system at rate recommended in reviewed product data; creasing of membrane is prohibited.
6. Seal lap completely, using specified lap adhesive.
7. Attach membrane at perimeter.
8. Roll seams to ensure full contact of surfaces.
9. Apply bead of butyl-based lap sealant to lap joints; completely embed edge of membrane in sealant.
10. Completely seal lap joints during same work period as lap joints are cemented.
11. Install 12" diameter uncured neoprene "patch" centered at each "T" joint.

D. Expansion Joints

1. Terminate membrane sheets at each side of joint.
2. Place backer rod, size 1/3 larger than joint opening, minimum, continuous over joint.
3. Form expansion joint cover using flexible flashing sheet; bond continuous, using specified lap adhesive, along membrane sheets with 3" wide lap joint, sealed over entire lap.
4. Bond splice joints in expansion joints with 3" long lap joints; seal entire lap.

E. Flexible Flashing

1. Install at roof hatch, curbs, parapets, and similar vertical surfaces.

2. Install at cant strips at curbs and equipment not having integral curbs.
3. Bond splice joints in flashing with 3" wide lap joints; seal entire lap.

F. Metal Counterflashing

1. General: In accord with requirements of Flashing and Sheet Metal Section.
2. Install over top edge of flexible flashings and non-self flashing curbs.

G. Walkway Roof Pads

1. Install in locations indicated; adhere directly to membrane, using specified splice adhesive.
2. Install butyl-based lap sealant continuous around each pad perimeter.

H. Membrane Coating

1. Install on membrane and flexible flashing surfaces.
2. Install using brush having solvent-resistant bristles or 9" wide roller having 1/4" - 1/2" solvent-resistant nap.
3. Install in two coats, three mils DFT each; allow 24 hours drying time between coats.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service

1. Membrane Manufacturer's Authorized Representative: Conduct installed system inspection; submit written report stating installed system is acceptable for purpose of providing specified warranty.
2. Surfaces Receiving Membrane Coating: Inspect and approve by membrane manufacturer's authorized representative before beginning membrane coating installation.

3.05 CLEANING

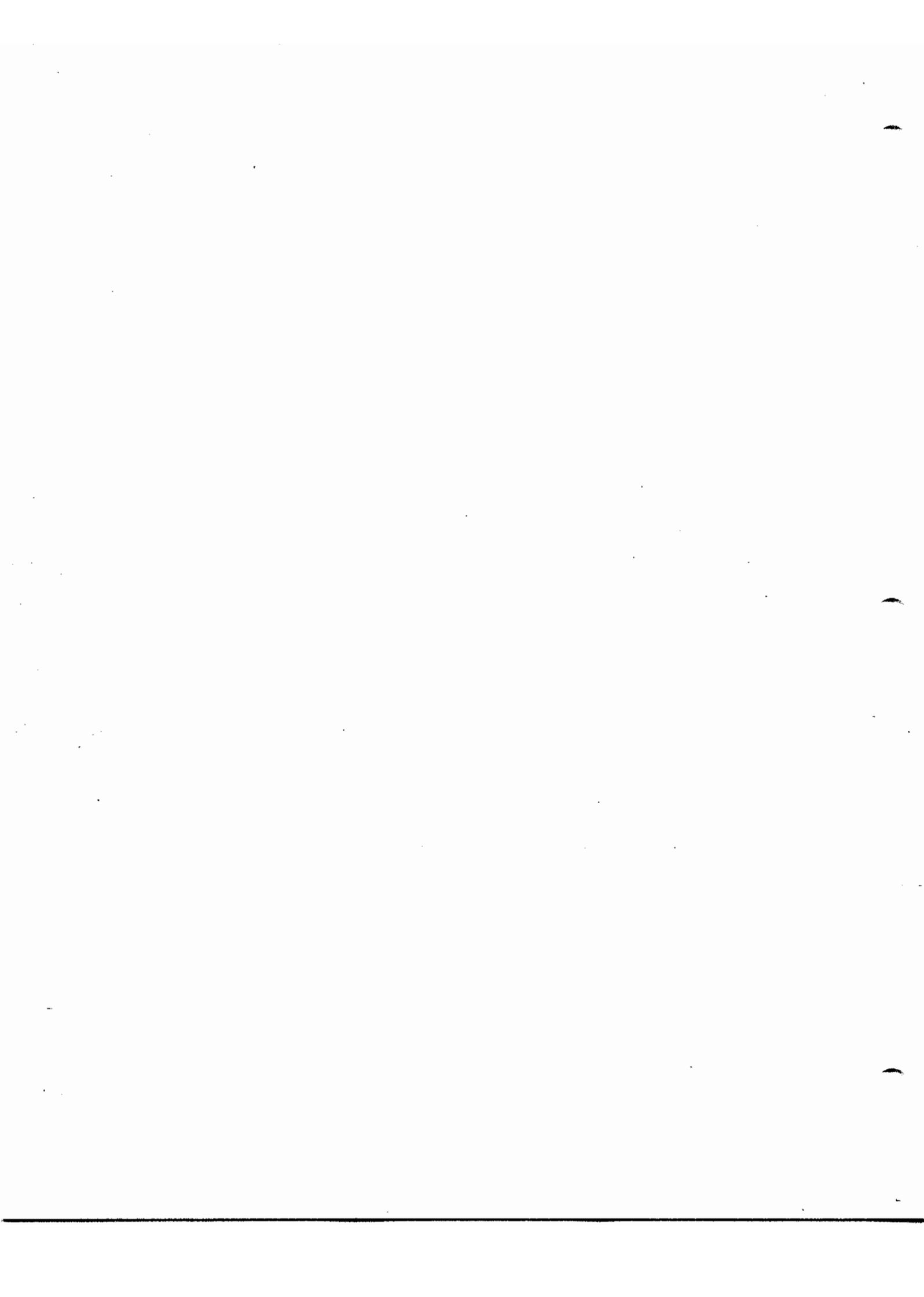
Remove debris from membrane surface at end of each construction activity period.

3.06 PROTECTION

- A. Protect installed products from damage by subsequent construction activity and other causes until Date of Substantial Completion.

- B. Repair products damaged prior to Date of Substantial Completion;
replace unrepairable products.

END OF SECTION



SECTION 07600

FLASHING AND SHEET METAL

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor, equipment and material required to install all sheet metal work, including metal flashing and counterflashing, flashing transitions, wall flashing, gutters, downspouts, scuppers, and related work as described herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Submit written information regarding material proposed and installation instructions for the use substantiating compliance with Specification requirements. Submit two samples, 12 x 12-inches, of each type of flashing or sheet metal material and each accessory specified. Submit sample packs of each type of fastener.
- C. Submit shop drawings, showing manner of forming, jointing and securing flashings, guttering and accessories. Detail waterproof connections to adjoining work and at obstructions and penetrations. Shop drawings shall indicate thickness and dimensions of all parts, fastening and anchoring methods, details and locations of all seams, joints and other provisions necessary for thermal expansion and contraction.

1.03 STORAGE AND PROTECTION

- A. Sheet metal materials and accessories shall be stored and protected in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.
- B. Contractor shall protect all stainless steel materials from exposure to chlorides and muriatic acids. Wash affected areas immediately with five percent soda solution and rinse with clear water.
- C. Sheet metal work shall be handled with sufficient care to prevent damage to surfaces, edges and ends. All material at site shall be stored above ground in a covered, dry location. Damaged material that cannot be restored to its original condition will be rejected and shall be replaced at no additional cost to the Owner.

1.04 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

(1) 2.01 MATERIALS AND CONSTRUCTION

- A. Stainless Steel: Unless otherwise specified or indicated, all flashing and counterflashing shall be stainless steel conforming to ASTM A 167, Type 304 with No. 2D annealed finish, of dead soft temper. Concealed thru-wall stainless steel flashing shall be minimum 30 gauge with ribbed texture. Exposed stainless steel flashing shall be minimum 26 gauge, Terne coated.
- B. Zinc Coated (Galvanized) Steel: Where galvanized sheet metal items are specified or shown on the Drawings, provide galvanized items conforming with ASTM A 527, lock-forming quality. Coating shall be G90, ASTM A 525 having a minimum thickness of 26 gauge. All galvanized metal shall be paint grip type for receipt of field primer and paint in accordance with the requirements of the section entitled "Painting" of these Specifications.
- C. Aluminum
 - 1. Where aluminum sheet flashing or metal items are specified or shown on the Drawings, the aluminum shall conform with ASTM B 209, Alloy 3003, temper H14. These items shall have a finish conforming with AA-C22A41 and shall be minimum 22 gauge.
 - 2. Aluminum coping shall be 16 gauge prefinished with clips and splice plates.
- D. Fasteners: Nails, screws, bolts, rivets and other fastenings for sheet metal shall be of the size and type suitable for the intended use and shall be compatible with metal which it shall contact. Fasteners used with aluminum and stainless steel shall be stainless steel. Types of fasteners shall be as recommended by the manufacturer and shall conform with Federal Specifications.
- E. Aluminum Gutters and Downspouts
 - 1. Provide linear sheet metal items in 10 foot sections minimum, except as otherwise noted. Form flashing using single pieces for full width.
 - 2. Form specified sheet metal items in accordance with SMACNA details noted, gauge indicated in SMACNA description of particular plate; gauges for items not specifically noted below are in accordance with SMACNA practice.
 - a. Manufactured Gutters, Prefinished: SMACNA Plate #3 OGEE.
 - b. Manufactured Downspouts, Prefinished: SMACNA Plate #31, 3 x 4-inches, complete with elbows.
 - c. Downspout-Gutter Connection, Prefinished: SMACNA Plate #33.
 - d. Downspout Hanger, Prefinished: SMACNA Plate #35.
 - e. Drip Edge, Prefinished: Aluminum, formed in accordance with SMACNA Plate #74.

- F. Splash Blocks: Splash blocks shall be reinforced precast concrete, 3,000 psi, 30 x 16 x 4-inches thick.
- G. Sealant: Equal to Pecora Corp.; BR-96, non-shrinking, non drying butyl caulk.
- H. Bituminous Plastic Cement: Where bituminous plastic cement is specified or shown on the Drawings, use cement conforming to Federal Specification SS-C-153, Type I.
- I. Solder: Solder shall be ASTM B 32, Alloy grade 58, composed of 50 percent tin and 50 percent lead.
- J. Flux: Flux used on stainless steel shall be a phosphoric acid base flux equal to "MicroFlex Soldering Flux" by Washington Steel Corporation or Type "MA" by Lake Chemical Co.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that substrates are smooth and clean to extent needed for sheet metal work.
- B. Verify that reglets, nails, cants and blocking to receive sheet metal are installed and free of concrete and soil.
- C. Do not start sheet metal work until conditions are satisfactory.

3.02 PREPARATION

Before installing sheet metal, verify shapes and dimensions of surface to be covered.

3.03 INSTALLATION

A. General

1. Install all flashing and sheet metal work in accordance with the "Architectural Sheet Metal Manual" by SMACNA.
2. Install work watertight, without waves, warps, buckles, fastening stresses or distortion, allowing for expansion and contraction.
3. Hem exposed edges except edges forming drip lips.
4. Angle bottom edges of exposed vertical surfaces away from finished surface to form drips.
5. Thru-wall flashing shall start 1/2-inch from outside of wall and shall be turned up not less than 2-inches and shall be anchored in interior block wall mortar joint. Flashing shall be laid in a thin bed of mortar and topped with a thin bed of mortar. Joints shall be lapped at least 4-inches and sealed with plastic cement.

6. Lintel and sill flashing shall extend 6-inches beyond ends of lintel or sill and shall be turned up at the ends to form a pan.
7. Set one splash block below each downspout unless shown or noted otherwise.

(1) B. Counter Flashing

1. Where metals abut adjacent dissimilar metals, the juncture shall be executed in a manner that will facilitate drainage and shall be coated with a bituminous coating as specified or as recommended by the manufacturer.
2. Factory form flashing components to suit all conditions and wall thicknesses, offsets, corners and others to minimize field forming. Where field forming is necessary, fabricate to shapes indicated on the Drawings and specified herein.
3. Except as otherwise indicated on the Drawings, comply with instructions and applicable details of "Architectural Sheet Metal Manual" by SMACNA.
4. Install with lines and corners of exposed units true and accurate. Exposed faces shall be flat and free of buckles, excessive waves and avoidable tool marks, considering temper and reflectively of metal. Provide uniform and neat seams.
5. All joints at flashing transitions shall be neatly joined and they shall be fastened and sealed or fastened and soldered.

(1) C. Downspouts

- (1) 1. Hangers shall conform with SMACNA, minimum 0.024 x 1-inch flat stock prefinished aluminum.
2. Downspout shall be securely fastened to the wall with aluminum bands located not more than five feet apart. Anchorage shall be made with 1/4-inch stainless steel machine bolts into noncorrosion anchors.
- (1) 3. Construct with riveted joints, lap 1-inch minimum in direction of flow; provide 3/4-inch minimum expansion joints at 60 feet on center maximum. Form expansion joints in accordance with SMACNA Manual, Plate #7 for gutters up to 22 gauge; Plate #11, 22 gauge and heavier.
4. Hang gutters with high points equidistant from downspouts, evenly sloped toward downspouts. Support gutters in accordance with SMACNA Manual, Plate #19C.
5. Secure downspouts to exterior walls at 6 feet on center maximum using straps and expansion type fasteners. Lap downspout joints, 1-1/2-inches minimum lower over upper and poprivet.

6. Finish gutters, downspouts and hangers in accordance with the section entitled "Painting" of these Specifications.

(1) D. Soldering

1. Stainless Steel

- a. Remove foreign material, grease and dirt from metal surfaces using a clean rag soaked in solvent. Smooth surfaces to be soldered may be roughened with clean emery cloth or sandpaper (not steel wool). Apply noncorrosive phosphoric acid-type flux to all surfaces to be joined and pre-tin.
- b. Remove flux residue by using a clear-water rinse.
- c. Assemble parts and solder using non-corrosive phosphoric or rosin flux. Heat metal thoroughly to completely sweat solder through full contact area.

(1) 2. Deleted

(1) E. Reglets: Install in accurate locations, straight, in-line and leak proof joints.

3.04 PAINTING

All galvanized items shall be factory-painted in accordance with the requirements of the section entitled "Painting" of these Specifications. After installation, the galvanized items shall be touched up with identical paint supplied from the factory.

3.05 INSPECTION

Damaged work shall be repaired or replaced. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or alterations required to ensue a satisfactory installation.

3.06 CLEANING

- A. As work progresses, neutralize excess flux with 5 to 10 percent washing soda solution, and thoroughly rinse.
- B. Prior to acceptance of the work of this Section, clean all installed materials and affected work areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION



SECTION 07610

METAL ROOFING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

Work included consists of all materials, labor and equipment to complete the metal roofing including all associated and matching trim, flashings, copings and accessories for a complete weathertight project.

1.02 APPRAISAL CERTIFICATES

A. Decrabond Roofing Systems have been fully appraised and received certificates from the following:

1. Southern Building Code Congress International, Inc. Birmingham, Alabama. Compliance Report No. 8801 (1988)
2. International Conference of Building Officials (ICBO) Whittier, California. Report No. 3409 (1990)
3. South Florida Building Code Metropolitan Dade County Building and Zoning Department. Acceptance No. 89-0222.3 (April 10, 1989)
4. Construction Research Laboratories, Miami, Florida. Report No. 3706A (1982)
5. Underwriters Laboratories, Inc., Northbrook, Illinois USA File No. R9723/85NK28901.

1.03 QUALITY ASSURANCE

Work performed shall be in accordance with guidelines as set out by the Decrabond manufacturer's specifications.

1.04 QUALIFICATIONS

Installers shall be trained and experienced in the installation of the roofing system. The independent Decrabond roof tile contractor is responsible for all equipment and labor necessary to complete the installation.

1.05 MANUFACTURER'S CERTIFICATION

Prior to commencement of work, submit manufacturer's certification letter stating that all requirements of these specifications have been met or exceeded, and that the installer is approved by the manufacturer.

1.06 REGULATORY REQUIREMENTS

Work shall conform to applicable building codes, except when local and state codes and ordinances are in excess in which case shall govern by their requirements.

1.07 DELIVERY, STORAGE AND HANDLING

Protection shall be provided during fabrication, shipment, site storage and erection to prevent mechanical abuse, strains, discoloration, and corrosion. During shipment, finished surfaces shall be protected from abrasion. Job site storage shall be in a clean, dry area out of direct contact with the ground, under cover or sloped for drainage, protected from traffic, and contamination by corrosion or staining materials. Stored materials and unfinished work shall be secured against damage by wind.

1.08 WARRANTY

Provide Owner with a 25 year written, leak-free warranty for labor and materials defects from the roof tile manufacturer. A minimum two (2) year written guarantee on labor and workmanship will be supplied by the installed in connection with this contract.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

Carter Holt Harvey Roofing USA Inc.
2600 South Loop West, Suite 230
Houston, Texas 77054
Phone (713) 664-2211 FAX (713) 664-3355

2.02 TILE MATERIALS

- A. Tiles shall be "Decrabond Steel Roofing Tiles" pressure formed No. 26 gauge galvanized sheet steel, ASTM A-361. Tile panels shall be approximately 52-inches long by 14-1/2-inches wide with seven individual tile pans. Color of stone chip finish shall be selected by Architect from manufacturer's standard colors. Synthetic stone chips are not acceptable. Minimum roof pitch to be 3:12.
- B. Hips, Ridges and Barges shall be "Barrel Caps" with end "Barrel End Cap Disc" and/or "Standard Ridge-Hip Cap" of same color and finish as roof tiles.
- C. Trim shall be "Texas Flashing" and/or "General Purpose Lead Edge Apron Flashing" with a surface finish matching roof tiles, installed at all intersections formed by vertical surfaces in accordance with manufacturer's specifications.
- D. "Vent Tiles" shall be installed at locations that a vent pipe intercepts roofing tiles.

- E. Nails shall be 6d hot dipped galvanized flat common nails, painted black or as approved by manufacturer.
- F. Valley flashing shall be galvanized sheet steel 26 gauge or better. 12-inch wide sheets shall be pressed to form valleys that measure minimum 4-1/2-inches wide from centerline to edge of pan.
- G. Screws shall be used in lieu of nails with steel hat sections. 1-1/2 x 3/8-inch diameter galvanized steel molded head screws shall be used or as approved by manufacturer.

2.03 ACCESSORIES

- A. Battens shall be nominal 2 x 2-inch #2 Douglas Fir or better, spaced 14-1/2-inches on center across framing members of roof. Additional 2 x 2-inch and 1 x 4-inch battens shall be installed at all hips, rakes, ridges and valleys to support Decrabond flashing accessories and valleys in accordance with manufacturer's detailed installation.
- B. Battens shall be fastened by 16d common nails spaced maximum of 24-inches on center.
- (1) C. Hat Sections if used in lieu of wood battens shall be minimum 20 gauge galvanized steel.
- D. Sealants shall be as "Vulkem" sealant or equal in accordance with ASTM C 920-86 as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- (1) The roof structure shall be inspected for correct framing prior to installation of roof tiles. Corrections shall be made prior to the installation.

3.02 INSTALLATION

- (1) Skylights/roof hatches, roof penetrations and plumbing vent stacks must be temporarily secured to allow final flashing during tile installation. Roof sheet flashings shall be installed prior to tile installation for dry in. It is the responsibility of the General Contractor that only the installer shall have access over the roof area during tile installation.

3.03 INSTALLATION - VALLEY

Valleys shall be installed with minimum 8-inches overlap in the direction flow. Nail in place minimum 24-inches o.c. through folded outside edge of valley pan.

3.04 TILE INSTALLATION

Each tile pan shall be staggered and fastened with not less than four nails. Fastening points shall be along the nosing of each tile pan, at the adjoining tiles and at two other intermediate positions in accordance with manufacturer's specifications.

3.05 FLASHING AND TRIM INSTALLATION

Decrabond flashings and trim shall be installed in accordance to manufacturer's specifications. Fold exposed ends of ridges and hips neatly, or cap with similar roof material. Seal folds watertight with sealant. Secure with additional galvanized fasteners.

3.06 INSPECTION

Completed work shall be plumb and true, free from dents. Excess shall be removed, and touch-up applied where scrapes occur. Any panel or roof tile badly damaged, and in the judgement of the Architect cannot be repaired, shall be replaced.

3.07 DAMAGED UNITS

Replace any component of the work which have been damaged or which have deteriorated beyond successful repair by means of finish touch up or similar minor repair procedures.

3.08 CLEANING

Upon completion of installation, surfaces shall be cleaned in accordance with manufacturer's recommendations, and maintained in a clean condition during construction.

3.09 PROTECTION

Installed work shall be protected from abuse by other trades. It is the General Contractor's responsibility to advise the independent roof contractor on any necessity for protection from the work of other trades and take measures required to prevent damage by his own crews. The General Contractor's shall see to that work is protected from wet cement, plaster, painting and other operations.

END OF SECTION

SECTION 07700

ROOF SPECIALTIES AND ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all labor, equipment and materials required to furnish and install all roof hatches, prefabricated roof curbs, smoke vents, access doors and related work as shown on the Drawings and/or specified herein.

1.02 SUBMITTALS

Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.03 STORAGE AND PROTECTION

Equipment shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.04 QUALITY ASSURANCE

The manufacturer shall provide the Engineer with written certification that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 ROOF HATCHES

- A. Roof hatches shall be constructed of aluminum and shall be designed to support a minimum imposed live cover load of 40 psf.
- B. Cover shall be one-piece of 11 gauge aluminum with 1-inch thick fiberglass insulation enclosed by a 18 gauge aluminum cover liner. Cover shall be supported by heavy-duty, tamperproof, interior pintle hinges equipped with compression springs in telescoping tubes for easy operation. Cover shall be provided with 3-inch beaded lip flange and a continuous sponge neoprene gasket for a weatherproof, draftproof, dusttight seal.
- C. The cover shall be provided with an automatic latching, hold open arm with vinyl grip release handle for one-handed release. A spring latch capable of both inside and outside operation shall be furnished on the cover. The latch shall have provisions for padlocking.
- D. The roof hatch shall be provided with a prefabricated, 11 gauge aluminum curb with a height of 12-inches. The curb shall have

integral cap flashing, padlock hasp, 1-inch rigid fiberglass insulation around outside of core and 3-1/2-inch anchorage flange. Coat flange with bituminous paint to prevent contact with concrete roof surfaces.

- E. All hardware shall be cadmium plated or of stainless steel for corrosion resistance.
- (1) F. Roof hatches shall be single leaf and shall be equal to Bilco Type S, L, 2'-6" x 3'-0".

PART 3 EXECUTION

3.01 INSTALLATION

- A. All doors and hatches shall be completely assembled in the containing frames and shipped as a complete unit.
- B. Roof hatches and access doors shall be installed as shown on the Drawings and in accordance with the manufacturer's shop drawings and instructions.. Curbs shall be properly flashed and watertight.
- C. Install roof walkway boards where shown and as recommended by the manufacturer.

3.02 INSPECTION AND TESTING

- A. The Contractor shall test all smoke vents for operation by heating the fusible link to 160 degrees F until the vent opens. The Contractor shall replace all fusible links used in the test.
- B. Following installation, operating tests will be performed, demonstrating to the Engineer that all doors and covers operate freely, without binding and close without forcing or springing. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory performance.

END OF SECTION

SECTION 07900

SEALANTS

PART 1 GENERAL

1.01 SCOPE

- (1) The work covered by this Section consists of furnishing all labor, equipment and material required to apply all sealants and related work as described herein and/or shown on the Drawings. Sealants specified in other sections of these Specifications are in addition to sealants specified in this Section.

1.02 SUBMITTALS

Complete engineering and product data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications. Color samples shall be submitted for approval by the Owner.

1.03 STORAGE AND DELIVERY

- A. Materials shall be stored in strict conformance with the manufacturer's instructions and in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.
- B. Materials shall be delivered to the job site in sealed containers, with the manufacturer's original labels attached and accompanied by written certification indicating compliance with the requirements of these Specifications.

1.04 QUALITY ASSURANCE

The manufacturer shall provide the Engineer with written certification that all products furnished comply with all applicable requirements of these Specifications.

1.05 WARRANTY

- A. Provide a warranty against defective materials and workmanship in accordance with the requirements of the section entitled "Warranties and Bonds" of these Specifications.
- B. The following types of failures will be considered defective work requiring replacement; leakage, hardening, cracking, crumbling, melting, shrinking or running of caulking compound or staining of adjacent work by caulking compound.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All caulking shall be a two component polysulfide sealant containing 100 percent solids and conforming to ANSI A116.1 and Federal Specification TT-S-00227E, Type II, Class A or B. Sealant shall be "Thiokol Sealant" by the Euclid Chemical Company, "Sikaflex 411/412" by the Sika Chemical Corporation or "Synthacaulk GC-5" as manufactured by Pecora Chemical Corporation. Use Class B for gun Grade and Class A for pour grade. The caulking shall be nonbleeding and shall not stain any material to which it is applied.
- B. Joint backing, where indicated or required, shall be equal to "Tremco Joint Backing" by Tremco Mfg. Company or "Ethafoam SB" backer rod by Dow Chemical Company. Application shall be in accordance with sizes listed below:

<u>Joint Size</u> <u>(Inches)</u>	<u>Rod Diameter</u> <u>(Inches)</u>
3/16	1/4
1/4	3/8
3/8	1/2
1/2	5/8
5/8	4/4
3/4	1

- C. Color of sealant or caulking shall be as selected by the Engineer.
- D. Caulking shall have a minimum life expectancy of 20 years and shall be resistant to the effects of sunlight, abrasion, oils, mild chemicals, cleaning agents and immersion in water.

PART 3 EXECUTION

3.01 PREPARATION

- A. All joints or channels shall be cleaned and free of dirt, oil, grease, moisture, old paint, loose mortar and other foreign matter.
- B. Metal surfaces shall be wiped with material equal to Zylol or Mek and then dried.
- C. Masonry surfaces shall be cleaned with a wire brush and then blown clean. Any waterproofing treatments contaminating the joint must be completely removed.
- D. Where joints are 1/2-inch wide, they should be backed to 1/2-inch of the surface. All 3/4-inch wide joints shall be backed to 1/4-inch of the surface. Size of joint backing shall be large enough so that it can be compressed by at least 30 percent before inserting into the joint.
- E. Surface of concrete or masonry shall be primed in accordance with the manufacturer's printed instructions.

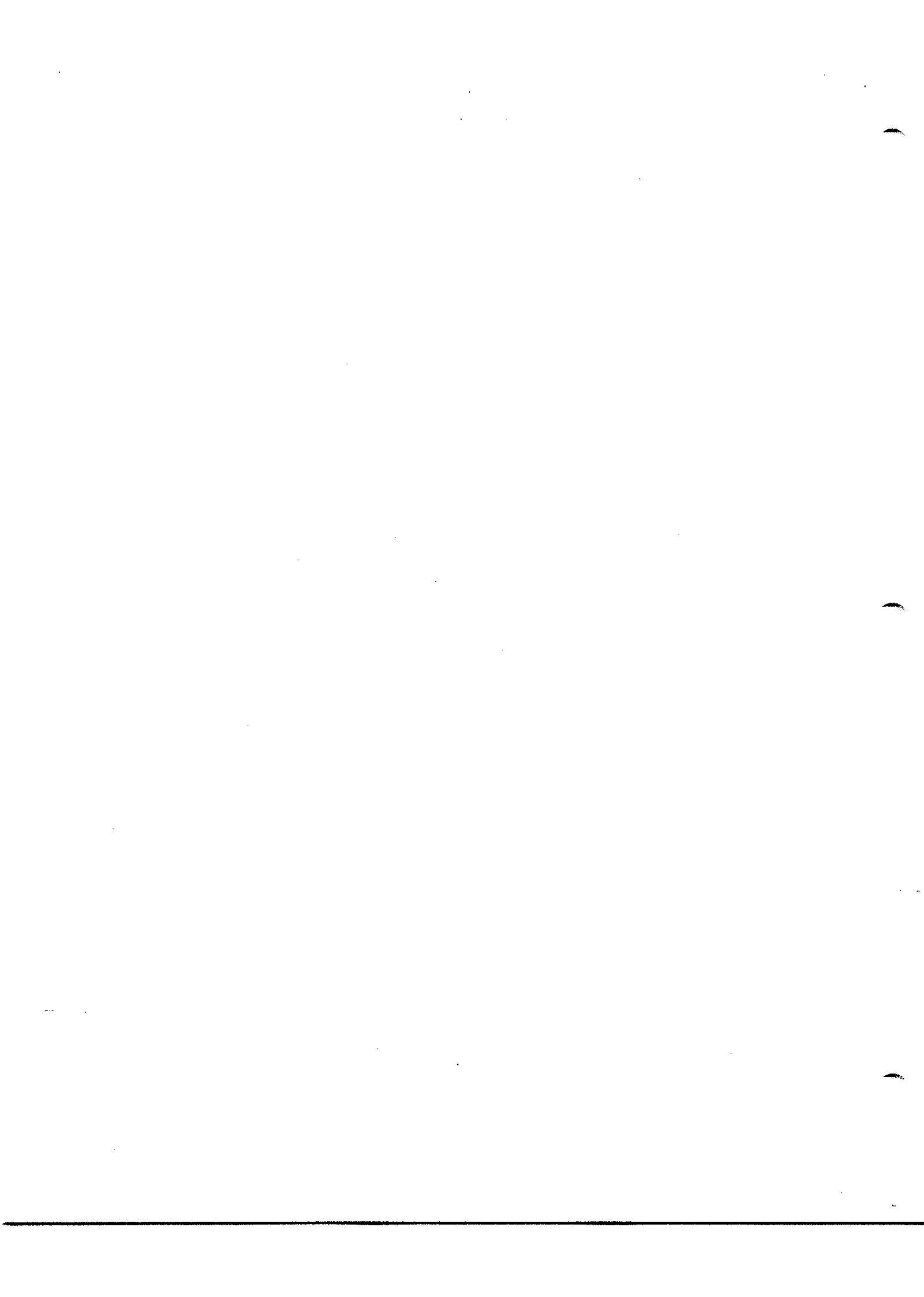
3.02 APPLICATION

- A. The Contractor shall caulk all joints (both inside and outside of jambs, heads and sills) between the metal doors, windows, louvers, etc. and masonry throughout the buildings, as indicated on the Drawings, or otherwise required, so as to leave the building weathertight.
- B. Apply sealant with hand or air gun under sufficient pressure and through nozzle openings of such a diameter so that a full bead of sealant is run into the joint and fills the opening completely.
- C. Apply joint backer with a blunt rounded tool in accordance with manufacturer's instructions so it will not stain the sealant.
- D. All beads should be tooled immediately after application to insure firm and full contact with the interface of the joint.
- E. Work shall be of highest quality and in accordance with the manufacturer's current printed instructions.

3.03 CLEANING

Remove all excess material and smears adjacent to joint as work progresses.

END OF SECTION



SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor, equipment and material required to furnish and install all steel doors, frames and related work as described herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Submit complete shop drawings and engineering data in accordance with requirements described in the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Shop drawings shall indicate elevations of each door type, details of each frame type, location in the building for each item, conditions and special details of construction, methods of assembling sections, locations and installation requirements for hardware, size, shape and thickness of materials, joints and connections and finishing system.

1.03 TRANSPORTATION AND HANDLING

- (1) Shipment: For welded type frames, provide temporary steel spreaders fastened across bottom of frames where construction will permit concealment; leave spreaders in place after installation, otherwise remove spreaders after frames are set and anchored. Before shipping, label each frame and door with metal or plastic tags to show their location, size, door swing and other pertinent information.

1.04 STORAGE AND PROTECTION

Protect doors and frames from damage during transportation and at the job site. Store doors and frames at the site, under cover, on wood blocking or on suitable floors. After installation, protect doors and frame from damage during subsequent construction activity. Damaged work will be rejected and shall be replaced with new work.

1.05 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 MATERIALS AND CONSTRUCTION

- A. All hollow steel doors and frames shall be the product of a member of the Steel Door Institute. Doors and frames shall conform to the requirements of Steel Door Institute SDI-100 and SDI-112 for Type III extra heavy-duty doors.
- B. Metal Frames
- (1) 1. Location and Type: All metal frames shall be formed of steel to sizes and shapes indicated. Frames shall be combination type with integral trim and fabricated with full welded unit and shall be the double rabbet design.
2. Type and Gauges of Metal: Metal for frames shall be cold-rolled, steel sheets with clean, smooth surfaces complying with ASTM A 366. Except where other gauges are indicated or specified, frames shall be fabricated from steel, not lighter than 16 gauge. Provide concealed metal reinforcement for hardware as required. The gauges of metal for reinforcement shall be in accordance with the manufacturer's recommendations for the type of hardware, and the thickness and width of doors to be hung in the frame, provided that the gauges used are not lighter than 7 gauge for hinges, 12 gauge for closers and 14 gauge for lock strikes and rod strikes. All frames shall be galvanized, meeting ASTM A525-87 Coating Designation G60.
- (1) 3. Workmanship and Design: The finished work shall be strong and rigid, neat in appearance and free from defects. Fabricate moulded members straight and true with corner joints well formed, in true alignment and fastenings concealed where practicable. Where exterior frames are set in masonry, provide a caulking groove 1/4-inch wide by 5/8-inch deep, with a closed back to receive the caulking compound. Metal frames for use in interior exposed masonry partitions shall be trim and neat at masonry to receive caulking compound. Frames shall be manufactured and machined to within $\pm 1/32$ -inch of required dimensions.
- (1) 4. Forming Corner Joints: Joints for welded frames shall be mitered, mechanically interlocked, and arc-welded accross entire joint. All contact edges shall be closed tight and all welds on exposed surfaces dressed smooth and flush.
5. All frames shall be of the rigid welded type.
6. Provisions for Hardware: Frames shall be prepared at the factory for the installation of hardware in accordance with the requirements of the section entitled "Finish Hardware" of these Specifications. Welding of hinges to frames will not be permitted. Frames shall be mortised, reinforced, drilled and trapped to templates to receive all mortised hardware. Frames to receive surface applied hardware shall be provided with reinforcing plates only. Provide cover boxes in back of all

hardware cut-outs. Door frames shall be punched to receive rubber or vinyl door silencers. Provide three silencers on lock sides of single doors and two silencers for each leaf in heads of double door frames. Furnish the required number and type of silencers with the frames. Lock strikes shall be set out and adjusted to provide clearance for silencers. All hardware preparation and reinforcement shall be in accordance with Steel Door Institute SDI 107.

- (1) 7. Wall Anchors; Provide metal anchors of shapes and sizes required for the adjoining type of wall construction. Fabricate jamb anchors of steel, not lighter than the gauge used for frame. Then locate anchors on jambs near the top and bottom of each frame and at intermediate points not over 24-inches apart. For frames set in masonry, provide 10-inch long corrugated or other deformed type adjustable anchors at jambs. Provide mortar guard at lock. Anchors shall be galvanized.
- (1) 8. Floor Anchors: Provide floor clips of not less than 16 gauge steel and fasten to bottom of each jamb member for anchoring frame to floor construction. Clips shall be adjustable and drilled for 3/8-inch diameter anchor bolts. Anchors shall be galvanized.
- (1) 9. Frame Prime Coat: All surfaces of all frames that will be concealed after the installation shall receive a field application of an approved coat of asphaltic bituminous primer paint.
- (1) 10. The manufacturer shall use extreme care in preparing the frames for contact with the concrete grout required in the jamb portion of all frames. Frames that rust out or become defective by rusting action shall be removed, new frames installed and refinished, all by the Contractor at no additional cost to the Owner.
- (1) 11. Grouting: All hollow metal frames set in masonry shall have the head and jambs grouted full.
- (1) 12. Labeled Frames: Where a UL-labeled fire door is specified or shown, metal frame and anchorage hardware shall be UL listed and labeled. Do not remove label from frame.
- (1) 13. Frames shall be prime painted at the factory in accordance with 3.02 of this Section.

C. Flush Hollow Metal Doors

1. General Requirements: Doors indicated on Drawings as flush hollow metal and including flush hollow metal doors with glazed and/or louvered openings shall comply with the type, or types, or construction as specified. Doors shall be furnished as a package unit complete with frames as specified herein before and prepared

to receive the hardware in accordance with the requirements of the section entitled "Finish Hardware" of these Specifications.

2. Construction: Hollow metal doors shall be of the flush, seamless, extra heavy-duty type for high use, industrial applications. Doors shall be constructed using 16-gauge sheet steel face panels either welded to a reinforced steel core or chemically bonded to a composite core. Core shall be constructed of rigid urethane foam, rigid polystyrene foam, phenolic resin impregnated hexagonal honeycomb, or a metal grid fabricated from 16 gauge steel channels. Doors constructed using metal spacers or a metal grid shall be filled with glass fiber insulation. Top and bottom edges of door shall be formed with continuous, minimum 16 gauge steel channels. Top and bottom edges shall be finished flush and sealed against water penetration. Hinge edge shall be reinforced with a continuous, minimum 14 gauge steel channel built up to additional thickness at hinges. Lock edge shall be reinforced with a continuous 14 gauge steel channel or bar. Internal reinforcement for lock and exit hardware shall be box type, minimum 16 gauge, with reinforcing plates on both sides of door. Internal reinforcement for closers and overhead holders shall be 12 gauge, located on both sides of door. Edge seams formed by face sheets at hinge and lock stiles shall be continuously arc welded top to bottom and ground smooth.
- (1) 3. Type and Gauges of Metal: Metal for doors shall be cold-rolled sheets with clean smooth surfaces. The gauges of metal shall be as herein specified. All doors shall be galvanized, meeting ASTM A525-87 Coating designation G60. Metal shall be phosphate treated prior to painting.
4. Workmanship: The finished work shall be rigid, neat in appearance and free from defects. Form moulded members shall be straight and true, with joints coped or mitered, well formed and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so they are invisible after finishing.
5. Door Sizes and Clearances: Doors shall be of type, sizes and design indicated, 1-3/4-inch thick. The clearances for doors shall be 1/8-inch maximum at jambs and heads, 1/8-inch maximum at meeting stiles of pairs of doors, 3/4-inch maximum at sills without thresholds and 1/4-inch maximum between threshold and door.
- (1) 6. Stile Edges: The lock edges of stiles shall be beveled 1/8-inch (1) in 2-inches for other hollow metal doors. Pairs of hollow metal doors shall have rebated edges at stiles. Pairs of doors, except for pairs of doors with vertical rod panic hardware, shall have a steel astragal attached to the inactive leaf for inswinging doors and attached to the active leaf for outswinging doors.
7. Weatherstripping: Weatherstripping shall be furnished in accordance with the requirements of the section entitled "Weatherstripping and Thresholds" of these Specifications.

8. Provisions for Hardware: Mortise, reinforce, drill and tap doors at factory to receive all hardware in accordance with the requirements of the section entitled "Finish Hardware" of these Specifications. Doors shall be field drilled and tapped for surface hardware. Provide metal reinforcing plates for locks and all mortised hardware as required. The gauges of metal for reinforcing plates shall comply with the manufacturer's recommendations for the type of hardware used and the size required by commercial standard. All hardware preparation and reinforcement shall be in accordance with Steel Door Institute SDI 107.
9. Location of Hardware: The location of hardware in connection with hinged and other swing type hollow metal doors and frames shall be in accordance with the manufacturer's current printed specifications.
10. Louvers for Doors: Louvers indicated for interior doors shall be stationary sight-proof type with a minimum of 60 percent of free air area. Make louvers for exterior doors weatherproof. Construct louvers of 18 gauge steel for interior doors and 16 gauge steel for exterior doors. Louvers for exterior doors shall be provided with aluminum insect screen. Louvers shall be of fixed type of standard design and construction as produced by the door manufacturer. Louvers on UL-listed fire doors shall be UL approved, fusible link type designed to automatically lock closed at 135 degrees F.
11. Labeled Doors: Where shown or specified, flush metal doors shall be furnished with UL fire door label. Label shall not be removed from door. UL-labeled doors shall be furnished with UL approved automatic closers and shall be self-latching on closure. All labeled pairs of doors, except pairs of doors with vertical rod panic devices, shall have overlapping, surface mounted, steel astragals.
12. Thermal and Sound Rated Doors: All exterior flush metal doors and doors shall have an apparent U factor not to exceed 0.10 Btu/square foot/hour/degree F. Cores of interior doors shall have a sound transmission class rating of not less than STC 34 in accordance with ASTM E 90 and ASTM E 413. Sponge neoprene seals and automatic door bottoms shall comply with the requirements of the section entitled "Weatherstripping and Thresholds" as applicable.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of Metal Frames: Set frames in position, plumb, align and brace securely until permanent anchors are set. Anchor bottom of frames to floors with expansion bolts, or with power fasteners. Build

wall anchors into walls, or secure to adjoining construction as indicated or specified. Grout frames and transoms full in masonry walls. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to ceilings, or structural framing above. All methods shall be in conformance with the manufacturer's recommendations and Steel Door Institute SDI 105. Metal frames shall be field painted after installation to match door panels.

- B. Installation of Metal Doors: Hang doors after frames are securely in place in conformity with the manufacturer's recommendations. Make necessary adjustments after door is installed so that it operates with maximum ease and efficiency. The manufacturer shall provide one pint of each finish color to the field for touch-up of all nicks, mars and other imperfections.

3.02 SURFACE PREPARATION AND SHOP PAINTING

- Primed Finish: Apply a primer finish to all ferrous metal surfaces furnished under this Section. Clean and phosphatize metal surfaces to assure maximum paint adherence, follow with a dip or spray coat of rust-inhibitive primer on all exposed surfaces. Primer shall be oven-baked for maximum hardness and durability. Primer shall be capable of passing a 200 hour salt spray test in accordance with ASTM B 117 and shall be compatible with finish paint specified in the section entitled "Painting" of these Specifications.
- (1)

3.03 CLEANING

Upon completion, metal surfaces of doors and frames that are factory finished shall be thoroughly cleaned and touched-up as recommended by the door manufacturer.

END OF SECTION

SECTION 08331

OVERHEAD ROLLING DOORS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install the overhead doors as shown on the drawings and specified herein.
- B. All power and control wiring from the load side of the disconnect switch shall be furnished and installed under this Section in accordance with Division 16.

1.02 RELATED WORK

- A. Section 05500: Steel Channel Frames (Miscellaneous Metals)
- B. Section 04400: Masonry
- C. Section 16150: Motors
- D. Section 09900: Painting

1.03 SUBMITTALS

- A. Submit to the Engineer for approval, as provided in the General Conditions shop drawings showing plans, sections, and elevations; fabricating, arranging, and fastening details; materials of fabrication, including hardware and hardware reinforcement; methods of fabrication; and manufacturer's printed installation and maintenance instructions.
- B. Color Samples: Manufacturers current color sample(s) for factory finish coatings.

1.04 GUARANTEE

- A. Fluoropolymer coating factory-finish items, furnish manufacturer's written 20-year performance guarantee, including, but not limited to, the following:
 - 1. Color Fastness: Less than 5 NBS units of color change as measured by an IDL color eye Model D.
 - 2. Chalk resistance: No chalking in excess of ASTM D 659 (1980), No. 8 rating.
 - 3. No peeling, blistering, flaking, chipping, cracking, or checking.

- B. Guarantee shall be in effect from date of final acceptance of the Project.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Overhead Rolling Doors shall be face of wall mounted, of the size indicated, and push button electrically operated with chain and chain wheel manual override:
 - 1. Curtain shall be of interlocked insulated 18 ga (B&S) minimum aluminum interior and exterior surface designed to resist a wind pressure of 20 pounds per square foot; deflection shall not exceed 1/240 of the opening width. Curtain shall roll up on a bracket-supported drum, and shall be balanced with a helical spring. Curtain to have a maximum $V=0.84$ insulated flat faced slats.
 - 2. Endlocks shall be of the wind lock design.
 - 3. Bottom rail angles to be aluminum of equal weight, and shall be securely fastened to each side of the bottom of the curtain.
- B. Hardware shall be heavy duty type. Door to be A151, type 316 stainless steel and guides shall be not thinner than 3/16 inch, and shall form a channel picket of a depth which will retain the curtain in place when the curtain is subjected to the wind pressure stipulated above.
- C. Weather-stripping shall consist of rubber loop type astragal affixed to the bottom rail and extending into each channel picket guide, and a rubber strip affixed to the exterior of each guide, thus closing the space between the guide and the curtain.
- D. Hood shall be of not lighter than 18 gauge 1040" thick aluminum with air baffle formed to fit the contour of end brackets, and shall be reinforced with either steel rods or rolled beads at the top and bottom edges. A rubber neoprene or vinyl water seal at the hood shall be provided to prevent airflow around the coil on all exterior doors.
- E. Bottom Draft Seal: Provide flexible seal assembly across full width of door on the bottom panel edge. Bottom panel shall be designed to compensate for sloped floors to an edge-to-edge difference of 2 inches.
- F. Door to be motor operated, insulated flat slat rolling overhead door, model No. FMWI-Motor as manufactured by the Cookson Company or approved equal.

2.02 ELECTRIC OPERATOR

- A. The electric power drive units shall be factory assembled and attached directly to the hoisting mechanism. The electric power drive shall consist of a high starting torque and enclosed gear motor equipped

with an integral brake of adequate size acting on the motor shaft, and a worm worm gear reducer. This unit shall drive the hoist through an adjustable friction clutch which shall be arranged such that in the event of power failure the chain operated clutch will disengage the power drive unit and permit manual operation of the door by means of a chain which shall directly operate the geared hoist. Emergency operation of the door by hand chain, operating through the motor gearing will not be permitted.

- B. Electrical controls shall consist of a standard reversing starter size 0, NEMA Type 1 and 3-button momentary contact push button stations with open, close and stop buttons. One interior NEMA Type 1 push button station shall be furnished for the opening. Constant pressure on the closed button shall be required to lower the door panels. Cam actuated limit switches located on the door guide shall stop the panels at the fully opened and fully closed position. Safety edge bottom bar shall not act as a limit switch.

2.03 FINISH

- A. Finish: Aluminum curtain slats, aluminum hood and all other miscellaneous aluminum parts shall be 5052-h32 alloy conforming to ASTM B (209) 1983, and shall have a factory finish compatible for field finish painting. Color shall be selected by the Engineer from the manufacturer's standard colors.
 - (1)
- B. All other metal parts to be painted in zincolate paint manufactured by Dupont Paint Co. Parts included, but not limited to spring barrel, gears and support brackets.

PART 3 EXECUTION

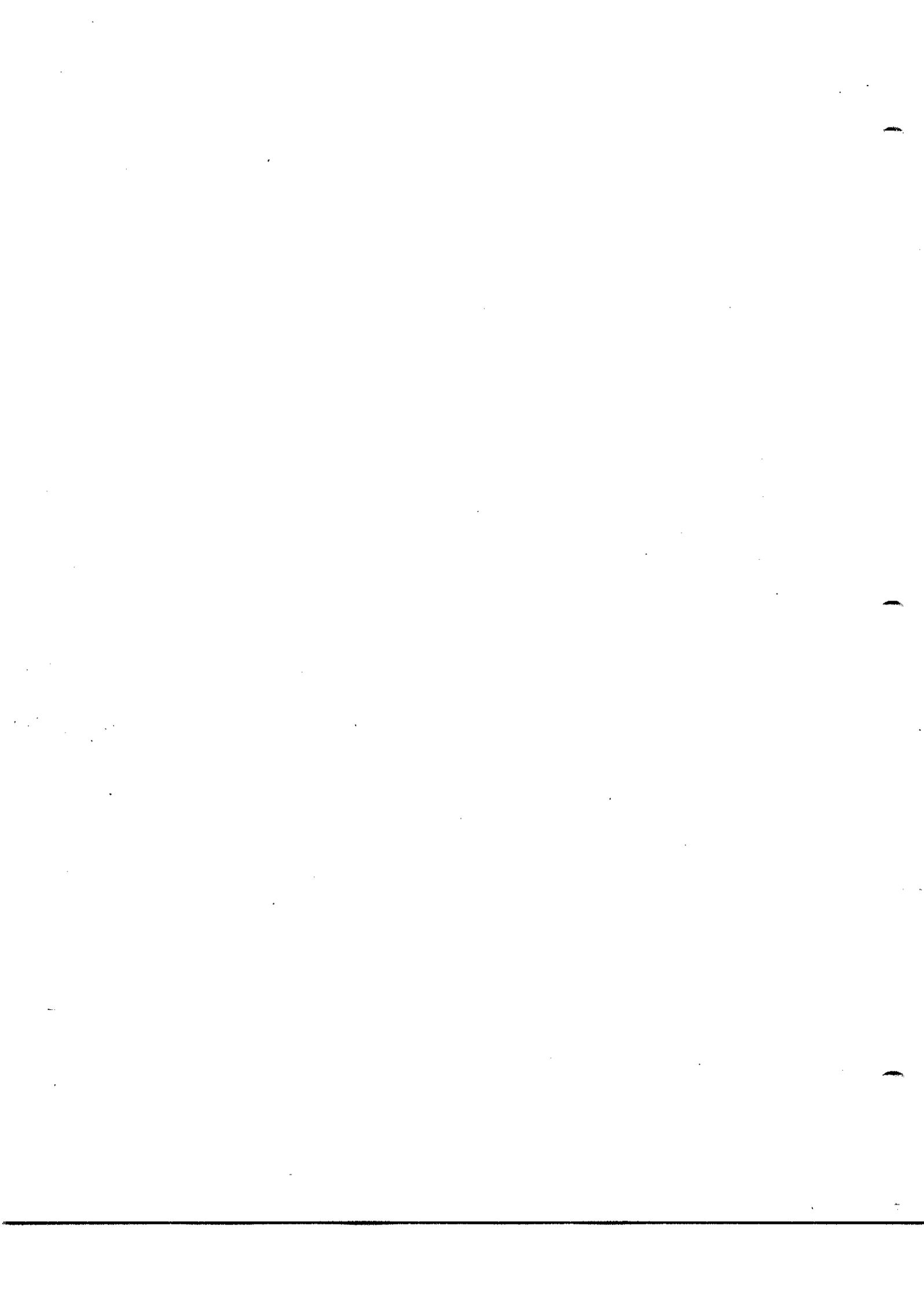
3.01 INSTALLATION

Overhead Rolling Door shall be installed where indicated, and in accordance with the manufacturer's printed installation instructions. Horizontal lines shall be level, and vertical lines shall be plumb. Anchors for guides, brackets, and other fasteners shall be located where indicated.

3.02 ADJUSTING AND CLEANING

- A. Adjusting and Cleaning shall consist of ensuring smooth operation, lubricating and testing the overhead door, and of preparing the overhead door for field painting. Overhead doors shall operate smoothly, quietly, and without squeaking and binding.

END OF SECTION



SECTION 08410

ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SUMMARY

- A. Extent of aluminum entrances and storefronts is indicated on drawings and schedules.
- B. Aluminum entrance and storefront types required for the Project include:
 - (1) 1. Exterior entrance doors
 - (1) 2. Frames for exterior entrances
 - (1) 3. Fixed exterior windows
 - (1) 4. Frames for exterior louvers"
- C. Glazing: Refer to "Glass and Glazing" section of Division 8 for glazing requirements for aluminum entrances and storefronts, including doors specified to be factory-preglazed.

1.02 SYSTEM DESCRIPTION

- A. Performance Requirements: Provide aluminum entrance and storefront assemblies that comply with specified performance characteristics. Each system shall be tested by a recognized testing laboratory or agency in accordance with specified test methods. Provide certified test results.
- B. Thermal Movement: Provide systems capable of withstanding thermal movements resulting from an ambient temperature range of 120 deg. F (67 deg. C), that could cause a metal surface temperature range of 180 deg. F (100 deg. C) within the framing system.
- C. Wind Loading: Provide assemblies capable of withstanding a uniform test pressure of 20 psf inward and 20 psf outward when tested in accordance with ASTM E 330.
- D. Fixed Framing Transmission Characteristics: Provide aluminum entrance and storefront framing system that complies with requirements indicated for transmission characteristics.
 - 1. Air Infiltration: Provide framing system with an air infiltration rate of not more than 0.06 CFM per sq. ft. of fixed area (excluding operable door edges) when tested in accordance with ASTM E 283 at an inward test pressure differential of 6.24 psf.

2. Water Penetration: Provide framing systems with no water penetration (excluding operable door edges) as defined in the test method when tested in accordance with ASTM E 331 at an inward test pressure differential of 6.24 lbf. per sq. ft.
 3. Condensation Resistance: Where framing systems are "thermal-break" construction, provide units tested for thermal performance in accordance with AAMA 1502 showing condensation resistance factor (CRF) of not less than 45.
 4. Thermal Transmittance: Provide framing systems that have an overall U-value of not more than 0.65 BTU/(hr. x sq. ft. x deg. F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.
- E. Aluminum Entrance Transmission Characteristics: Provide entrance doors with jamb and head frames that comply with requirements indicated for transmission characteristics.
1. Air Infiltration: Provide doors with an air infiltration rate of not more than 0.50 CFM for single doors and 1.0 for pairs of doors when tested in accordance with ASTM E 283 at an inward test pressure differential of 1.567 psf.
 2. Condensation Resistance: Provide entrance door units tested for thermal performance in accordance with AAMA 1502 showing a condensation resistance factor (CRF) of not less than 48.
 3. Thermal Transmittance: Provide entrance doors that have an overall U-value of not more than 0.93 BTU/(hr. x sq. ft. x deg. F) at 15 mph exterior wind velocity when tested in accordance with AAMA 1503.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturer's product specifications, technical product data, standard details, and installation recommendations for each type of entrance and storefront product required. Include the following information:
1. Fabrication methods
 2. Finishing
 3. Hardware
 4. Accessories
- B. Shop Drawings: Submit shop drawings for fabrication and installation of entrances and storefronts, including the following:
1. Elevations
 2. Detail sections of typical composite members

3. Hardware, mounting heights
 4. Anchorages and reinforcements
 5. Expansion provisions
 6. Glazing details
- C. Samples: Submit pairs of samples of each type and color of aluminum finish, on 12" long sections of extrusions or formed shapes and on 6" square sheets. Where color or texture variations are anticipated, include 2 or more units in each set of samples indicating extreme limits of variations.
- D. Certification: Provide certified test results showing that entrance and storefront systems have been tested by a recognized testing laboratory or agency and comply with specified performance characteristics.

1.04 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Provide entrances and storefront produces by a single manufacturer with not less than 5 years successful experience in the fabrication of assemblies of the type and quality required.
- B. Installer's Qualifications: Entrances and storefront shall be installed by a firm that has not less than 5-years successful experience in the installation of systems similar to those required.
- C. Design Criteria: Drawings indicate sizes, spacings of members, profiles and dimensional requirements of entrance and storefront work. Minor deviations will be accepted in order to utilize manufacturer's standard products when, in the Engineer's sole judgement, such deviations do not materially detract from the design concept or intended performances.
- D. Design Criteria: Drawings are based on one manufacturer's entrance and storefront system. Another manufacturer's system of a similar and equivalent nature will be acceptable when, in the Engineer's sole judgement, differences do not materially detract from the design concept or intended performance.

1.03 PROJECT CONDITIONS

- A. Field Measurements: Check openings by field measurement before fabrication to ensure proper fitting of work; show measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay in the work. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following:

1. Amarlite/Arco Metals Co.
2. Cronstroms Mfg. Inc.
3. Harcar Aluminum Products Co.
4. Kawneer Company, Inc.
5. PPG Industries, Inc.
6. Rebco, Inc.
7. Tubelite Div., Indal Inc.
8. United States Aluminum Corp., International Alum. Corp.

2.02 MATERIALS

- A. Aluminum Members: Provide allow and temper recommended by the manufacturer for strength, corrosion resistance, and application of required finish; comply with ASTM B 221 for extrusions and ASTM B 209 for sheet or plate. Minimum wall thickness 1/8".
- B. Fasteners: Provide fasteners of aluminum, nonmagnetic stainless steel, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum components, hardware, anchors and other components.
1. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125" thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard noncorrosive pressed-in splined grommet nuts.
 2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For the application of hardware, use fasteners that match the finish of member or hardware being fastened.
 3. Provide Phillips flat-head machine screws for exposed fasteners.
- C. Concealed Flashing: Provide 26 gage minimum dead-soft stainless steel, or 0.026" minimum extruded aluminum of alloy and type selected by manufacturer for compatibility with other components.
- D. Brackets and Reinforcements: Where feasible, provide high strength aluminum brackets and reinforcements; otherwise provide nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.

- E. Concrete/Masonry Inserts: Provide concrete and masonry inserts fabricated from cast-iron, malleable iron, or hot-dip galvanized steel complying with ASTM A 386.
- F. Compression Weather-Stripping: Provide the manufacturer's standard replaceable compressible weather-stripping gaskets of molded neoprene complying with ASTM D 2000 or molded PVC complying with ASTM D 2287.
- G. Sliding Weather-Stripping: Provide the manufacturer's standard replaceable weather-stripping of wool, polypropylene, or nylon woven pile, with nylon fabric or aluminum strip backing, complying with AAMA 701.2.
- H. Glass and Glazing Materials: Glass and glazing materials shall comply with requirements of "Glass and Glazing" section of these specifications.

2.03 COMPONENTS

- A. Storefront Framing System: Provide inside-outside matched resilient flush-glazed storefront framing system with provisions for glass replacement. Shop-fabricate and preassemble frame components where possible.
 - 1. Thermal-Break Construction: Fabricate storefront framing system with integrally concealed, low conductance thermal barrier, located between exterior materials and exposed interior members to eliminate direct metal-to-metal contact. Use manufacturer's standard construction that has been in use for similar projects for period of not less than 3 years.
 - 2. Frames for interior windows need not be thermally broken.
- (1) B. Stile-and-Rail Type Aluminum Doors
 - 1. Frame: Provide tubular frame members, fabricated with mechanical joints using heavy inserted reinforcing plates and concealed tie-rods or j-bolts.
 - 2. Design: Provide 1-3/4" thick doors of design indicated.
 - 3. Wide stile (3-1/2" nominal width).
 - 4. Glazing: Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal.
 - 5. Drip cap at head and bottom rail.
 - 6. Weatherstripping: Manufacturer's standard pile type in replaceable rabbets for stiles and rails.

7. Provide hardware as follows:

a. Each Door:

- 1 set Offset pivots; include intermediate offset pivot
- 1 LCN 4110-CUSH Series surface closer
- 1 Latch lock with interior paddle release and prepared for exterior cylinder
- 2 Push/pull plates
- 1 Threshold

b. Cylinder: Specified in Door Hardware Schedule."

(1) 2.04 FABRICATION

- A. General: Sizes of door and frame units, and profile requirements, are indicated on drawings. Variable dimensions are indicated, with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
- B. Prefabrication: Before shipment to the project site, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble components only as necessary for shipment and installation.
 - 1. Do not drill and tap for surface-mounted hardware items until time of installation at project site.
 - 2. Perform fabrication operations, including cutting, fitting, forming, drilling and grinding of metal work to prevent damage to exposed finish surfaces. For hardware, perform these operations prior to application of finishes.
- C. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
- D. Reinforcing: Install reinforcing as required for hardware and necessary for performance requirements, sag resistance and rigidity.
- E. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator that will prevent corrosion.
- F. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- G. Uniformity of Finish: Abutting extruded aluminum members shall not have an integral color or texture variation greater than half the range indicated in the sample pair submittal.
- H. Fasteners: Conceal fasteners wherever possible.
- I. Weather-Stripping: For exterior doors, provide compression weather-stripping against fixed stops; at other edges, provide sliding

weather-stripping retained in adjustable strip mortised into door edge.

1. Provide EPDM or vinyl blade gasket weather-stripping in bottom door rail, adjustable for contact with threshold.
2. At interior door and other locations without weather-stripping, provide neoprene silencers on stops to prevent metal-to-metal contact.

(1) 2.05 FINISHES

- A. Color Anodized Finish: Provide NAAMM AA-M12C22A41/A44, Class I (non-specular as fabricated mechanical finish; chemical etch, medium matte; minimum thickness 0.7 mil) integrally or electrolytically deposited colored anodic coating.

- (1) 1. Color: Dark bronze anodized.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Comply with manufacturer's instructions and recommendations for installation.
- B. Set units plumb, level, and true to line, without warp or rack of framing members, doors, or panels. Provide proper support and anchor securely in place.
- C. Separate aluminum and other corrodible metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials. Comply with requirements specified under paragraph "Dissimilar Materials" in the Appendix to AAMA 101-85.
- D. Drill and tap frames and doors and apply surface-mounted hardware items. Comply with hardware manufacturer's instructions and template requirements. Use concealed fasteners wherever possible.
- E. Set sill members and other members in bed of sealant as indicated, or with joint fillers or gaskets as indicated to provide weather-tight construction. Comply with requirements of Section 7100 for sealants, fillers, and gaskets.
- F. Refer to "Glass and Glazing" Section 08800 for installation of glass or other panels indicated to be glazed into doors and framing, and not preglazed by manufacturer.

3.02 ADJUSTING

Adjust operating hardware to function properly, for smooth operation without binding, and for weathertight closure.

3.03 CLEANING

- A. Clean the completed system, inside and out, promptly after installation, exercising care to avoid damage to coatings.
- B. Clean glass surfaces after installation, complying with requirements contained in the "Glass and Glazing" section for cleaning and maintenance. Remove excess glazing and sealant compounds, dirt and other substances from aluminum surfaces.

3.04 PROTECTION

Institute protective measures required throughout the remainder of the construction period to ensure that aluminum entrances and storefronts will be without damage or deterioration, other than normal weathering, at time of acceptance.

END OF SECTION

SECTION 08710
FINISH HARDWARE

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor, equipment and material required to construct and install all finishing hardware and related work as described herein and/or shown on the Drawings.

1.02 QUALIFICATIONS

The hardware supplier must be an established firm dealing in contract finishing builder's hardware, with a sample room and adequate inventory. This supplier must be prepared to provide a competent representative to service hardware on the jobs as may be required. This hardware supplier shall be a regular franchised distributor for all hardware, materials and equipment required in this Section.

1.03 SUBMITTALS

- A. Shop drawings and engineering data submittals shall be made in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications. A complete schedule of each item of hardware required for each door or item of equipment shall be submitted. List hardware item number, manufacturer, manufacturer's number or symbol and finish.
- B. Submit complete manufacturing data as follows:
 - 1. Specifications and installation data on door hardware of all types.
 - 2. With shop drawings, a brochure showing and describing each type of hardware that is being supplied to the Project.
- C. Templates: Supply all necessary templates and template information to door and frame manufacturers in ample time to prevent delay to progress of Project.

1.04 STORAGE AND PROTECTION

- A. Provide adequate locked storage space for hardware before distribution and installation.
- B. Properly tag, index and file all keys as directed prior to turning over to Owner.

- C. Hardware shall be checked after delivery to the Project by the hardware supplier before it is installed.
- D. Package each item of hardware and each lock set separately in individual containers, complete with necessary screws, keys, instructions and installation template for spotting mortising tools. Match each container with item number corresponding to number shown on the Contractor's hardware schedule.

1.05 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

(1) 2.01 ACCEPTABLE MANUFACTURERS

- A. The hardware manufacturer shall be an experienced, reputable firm with a full line of door hardware.
- B. Mortise locksets shall be UL listed and shall be manufactured by Sargeant, Yale or Schlage.
- C. Flush bolts shall be manufactured by Quality Hardware Mfg. Corp., Ives Division of Leigh Products, Inc. or Baldwin Hardware Corp.
- D. Butt hinges shall be manufactured by Hager, Stanley, Yale or Lawrence Brothers.
- E. Door closers shall be LCN 4010 Series.

2.02 MATERIALS AND CONSTRUCTION

- A. Keys and Keying: All locksets shall be masterkeyed to all existing locksets with the master key. Five master keys shall be provided to the Owner, with five copies of each key required for the work.
- B. Padlocks on the fence gates shall operate with the master key. Lockset number and keying for each door shall be designated by the Engineer upon receipt of manufacturer's fabrication and installation drawings and proposed door schedule, all of which shall be submitted to the Engineer for approval prior to manufacturer shipment of any doors. Mail all master keys and permanent keys by registered mail to the Engineer.
- C. Construction Keying: Furnish all locks and cylinders construction keyed. Furnish Contractor with six construction master keys. At completion of job, the insertion of permanent key shall void the construction master key.
- D. Mortise Locksets: Unless otherwise shown or specified, mortise locksets shall be heavy duty, mortise type conforming to Federal

Specification FF-H-106, Type 86 and ANSI A156.2, Series 1000, Grade 1. Lockset shall have lever handles, escutcheon, 2-piece, 5/8-inch throw antifriction latch bolt, 1-inch throw deadbolt, 6-pin brass tumbler lock mechanism, and curved lip strike conforming to ANSI A115.1. Lockset shall be UL listed.

- E. Cylindrical Locksets: Unless otherwise shown or specified, cylindrical locksets shall be heavy duty, bored cylindrical type conforming to Federal Specification FF-H-106, Type 161 and ANSI A156.2, Series 4000, Grade 1. Lockset shall have lever handles, standard backset, and curved lip strike conforming to ANSI A115.3. Lockset shall be UL listed.
- F. Panic and Fire Exit Devices: Where shown or specified, UL labeled panic and/or fire exit devices shall be furnished. Panic and fire exit devices on single doors shall be heavy duty, mortise type with 6-pin tumbler locking mechanism, 1-inch diameter crossbar, bar lockdown device, pull-side handle with thumbpiece and escutcheon. Bar lockdown device shall be allen key operated and shall retract latch bolt when in the locked position. Exit devices shall be UL listed.
 - 1. Panic and fire exit devices on pairs of doors without mullions shall be heavy duty, concealed, vertical rod type. Exit device shall have 1-inch diameter crossbar, bar lockdown device, pull-side handle with thumbpiece and escutcheon. Bar lockdown device shall be allen key operated and shall retract vertical rod bolts when in the locked position. Exit device shall be UL listed.
 - 2. Fire-rated pairs of doors with vertical rod exit devices on both leaves shall not have astragals.
- G. Butt Hinges: Unless otherwise specified, doors 60-inches high and not over 90-inches high shall receive three full mortise butt hinges. Doors over 90-inches and not over 120-inches high shall receive four full mortise butt hinges. Hinges shall be of the stainless steel, 2 race ball bearing type. Out-swinging exterior doors shall have nonremovable pins. Minimum gauge of all hinges shall be 0.134-inch, unless indicated otherwise, with minimum size of 4-1/2-inches by 4-1/2-inches. Hinges shall be of a type and size to allow for proper door swing and clearance.
- H. Door Closers: Automatic door closers shall have full rack and pinion construction with heat treated steel rack and pinion and cast iron or bronze hydraulic case. Close shall have separate valves for adjustment of latching speed and closing speed, 50 percent closing power spring adjustment, separate valve for adjustment of backcheck cushioning and tamperproof, rectangular, full metal cover. Backcheck shall be effective at approximately 70 degrees for both regular and parallel arm applications. Closers shall be surface mounted and through bolted on the door and, whenever possible, shall be mounted on the room or interior side. Closers with parallel arms on exterior doors shall be the next larger size than normally used with the door. Closers on exterior doors, cross-corridor doors and stairwell doors shall have hold-open devices adjustable from 85 through 180 degrees.

All door closers shall be furnished with a five year warranty from the manufacturer. Closers shall have finish to match other door hardware. Door closers shall be UL listed.

- I. Combination Door Closer/Door Holder-Release: All fire-rated exterior doors, cross-corridor doors and stairwell doors shall be equipped with a combination door closer and door closer-release device. The closer/holder shall be a UL approved, electromechanical device designed to automatically release the door from a hold-open position and close it in the event of a fire. The device shall feature a solenoid-operated plunger valve to seal the hydraulic diameter and hold the door and a ball-check valve to allow the door to open. The closer/holder shall have a built-in, ionization-type smoke detector mechanism to trip the release mechanism and cause the door to close. On pairs of doors, only one of the closer/holder devices shall be equipped with a smoke detector, but both doors shall be released simultaneously by the action of the single detector. In the event of a power failure, the doors shall be released and the closer shall function as a standard automatic, hydraulic door closer. The release mechanism shall be automatically reset when power is restored or when the products of combustion have cleared. The closer/holder shall be capable of holding the door at any desired angle between 85 and 145 degrees and shall be top-jamb mounted on the stop side of the door. The closer/holder shall operate on 120 volt, 60 Hz, single phase power with concealed wiring.
- J. Latch Bolts: On pairs of doors without panic or fire exit devices, the active leaf shall have lockset and automatic door closer as specified herein. The inactive leaf shall have independent, manually operated, stile-mounted latch bolts at top and bottom. No lockset or closer hardware shall be provided on the inactive leaf with latch bolts. Latch bolts shall be of the flush-mounted, lever arm type and shall have US 26D or US 32D satin finish. Door leaves shall be furnished with an overlapping steel astragal attached to the inactive leaf for in-swinging doors and attached to the active leaf for out-swinging doors.
- K. Stops: Doors shall be equipped with door bumpers or door stops where specified or required to protect wall surfaces. Whenever possible, a wall-type door bumper shall be used in lieu of a floor stop. All wall bumpers shall be the concave type and of cast material with concealed screws. Floor stops shall be of cast material. All bumpers, stops and holders shall have proper type mounting and anchoring devices. Door stops and bumpers shall have US 26D or US 32D satin finish.
- L. Kickplates: Where specified, doors shall be furnished with stainless steel kickplates. One kickplate shall be furnished per leaf unless otherwise specified. Kickplates shall be approximately 10-inches high and shall have a width equal to the door width less 3-inches. Finish shall be US 3D. Kickplate shall be located on the stop side of the door.
- M. Pullplates: Pullplates shall be 3-1/2 x 15-inches in size with square corners and 8-inch flat bar pull. Plate material shall have a minimum thickness of 0.094-inch. Pullplate shall have the word "PULL"

engraved at the top in 7/8-inch high, upper case letters. Letters shall be filled with black enamel. Plates shall include stainless steel oval head screws for installation.

- N. Pushplates: Pushplates shall be 3-1/2 x 15-inches in size with square corners. Plate material shall have a minimum thickness of 0.094-inch. Pushplate shall have the word "PUSH" engraved at the top in 7/8-inch-high, upper case letters. Letters shall be filled with black enamel. Plates shall include stainless steel oval head screws for installation.
- O. Lockset Function: Unless otherwise shown or specified, lockset function shall be as follows:
1. Entrance Doors: Latch bolt by both knobs; from outside by key. Outside knob locked or unlocked from inside by turn button on cylindrical locks (Fed. 161A, ANSI F81) and from door stile by pushbuttons on mortise locks (Fed. 86A, ANSI F08). Dead bolt on mortise locks from outside by key or inside by turn lever.
 2. Restroom Doors: Latch bolt by both knobs on cylindrical locks (Fed. 161N, ANSI F75) and mortise locks (Fed. 86N, ANSI F01).
- P. Weatherstripping: All exterior doors shall be weatherstripped. Weatherstripping shall be in accordance with the requirements of the section entitled "Weatherstripping and Thresholds" of these Specifications.
- Q. Thresholds: Thresholds shall be furnished under the section entitled "Weatherstripping and Thresholds" of these Specifications.
- R. Finish: All hardware shall receive finish as specified herein or selected by the Engineer. In general and unless otherwise shown or specified, all butt hinges, locksets, panic devices and flatware shall be stainless steel with US 32D finish. Cast items, such as stops, bumpers, flush bolts, etc., shall have US 26D dull chrome finish. Those items not available in US 32D or US 26D finish shall be aluminum or anodized aluminum.

(1) 2.03 HARDWARE SCHEDULE

Hardware Set #1

Doors # 101

1 Cylinder

Balance of hardware is specified in Section 08410

Hardware Set #2

Doors # 103 & 104 (Pair shall have)

3 Pair Hinges - BB1279xNRP

1 Lockset - 8104xLNH

1 Closer - 4510

1 Threshold
2 Flush Bolts - 1358x1226
1 Set Weatherstrip

Hardware Set # 3

Door # 105

1-1/2 Pair Hinges - BB1279
1 Latch Set - 8115xLNH
1 Closer - 4510

Hardware Set # 4

Door # 106

1-1/2 Pair Hinges - BB1279
1 Lockset - 8165xLNH
1 Closer - 4510

Hardware Set # 5

Door # 107

1-1/2 Pair Hinges - BB1279
1 Lockset - 8104xLNH

PART 3 EXECUTION

3.01 LOCATION

- A. Before installation of any hardware, verify the positioning of each type of assembly. This will include the exact location of each element of hardware.
- B. Distances from the floor to centerline of each hardware item shall be as recommended by the hardware supplier.

3.02 INSTALLATION

- A. Install hardware such that it is accurately fitted, securely applied and carefully adjusted in accordance with manufacturer's instructions. Use care not to injure other work when installing.
- B. When required, remove and replace doors so that door bottoms and tops may be painted.
- C. Remove all visible hardware before painting is begun and replace afterwards, prior to completion of building.
- D. The Contractor shall protect all hardware during construction work and replace defective units.

3.03 CLEANING

All materials shall be free from sand holes and other imperfections. Finish shall be as noted above. Protect all hardware during construction work and replace defective units. Clean and polish with clean cloth and leave in good operating condition.

END OF SECTION



SECTION 08735

WEATHERSTRIPPING AND THRESHOLDS

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing and installing thresholds and weatherstripping for all doors furnished under these Specifications as shown on the Drawings or required for a complete installation.

1.02 COORDINATION

The Contractor shall coordinate the work under this Section with work under the section entitled "Steel Doors and Frames" of these Specifications.

1.03 SUBMITTALS

- A. Submit complete shop drawings and engineering data in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Submit samples (3-inch minimum length) of all resilient weatherstripping materials.

1.04 STORAGE AND PROTECTION

Weatherstripping and thresholds shall be stored and protected in accordance with the requirements of the section entitled "Storage and Protection" of these Specifications.

1.05 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 THRESHOLDS

- A. Unless otherwise specified or shown, thresholds shall be of the flat saddle type with serrated surface approximately 1/2-inch in height and 4-inches in width.
- (1) B. Thresholds for clear anodized aluminum doors or doors with stainless steel or chrome plated finished hardware shall be of extruded aluminum alloy 6063-T5 with natural mill finish.

- (1) C. Thresholds for bronze anodized aluminum doors or doors with brass or bronze finish hardware shall be of extruded architectural bronze of a type which oxidizes to a rich, dark bronze color.
- (1) D. All necessary screws and fasteners shall be furnished. Fasteners for aluminum thresholds shall be stainless steel. Fasteners for bronze thresholds shall be brass.

2.02 WEATHERSTRIPPING

- (1) A. All exterior hollow metal doors shall be weatherstripped as specified herein.
 - B. Weatherstripping at lock-side jamb, hinge-side jamb and head shall be 3/16 x 1-inch closed cell neoprene held in place on the frame by an extruded aluminum housing having a minimum thickness of 0.094-inch and a clear, anodized finish. Housing shall be furnished with a simulated bronze finish on doors with brass finish hardware. Weatherstripping shall be equal to Reese No. D578, Zero No. 139 or National Guard No. 130NS.
- (1) C. For all exterior pairs of doors, astragal weatherstripping shall be equal to Reese No. 103 series or National Guard No. 115 series.
 - D. Unless otherwise shown, sill weatherstripping shall be provided by a heavy duty, automatic door bottom incorporating an extruded aluminum housing and a retracting, closed cell, neoprene plunger as the weather seal. Plunger shall close automatically with delayed action after the door closes and shall retract immediately when the door opens. Door bottom shall be adjustable and shall have full mortised construction. Door bottom shall be reversible to accommodate either right or left hinged door. Automatic door bottoms shall be equal to Reese No. 372 or National Guard No. 320N.
 - E. Aluminum extrusions shall be of aluminum alloy 6063-T5, anodized as specified above.
 - F. Closed cell neoprene shall be closed cell, neoprene, sponge rubber conforming to Military Specification R6130, Type II, Grade C.
 - G. All fasteners necessary for proper installation shall be provided and shall be brass or stainless steel.

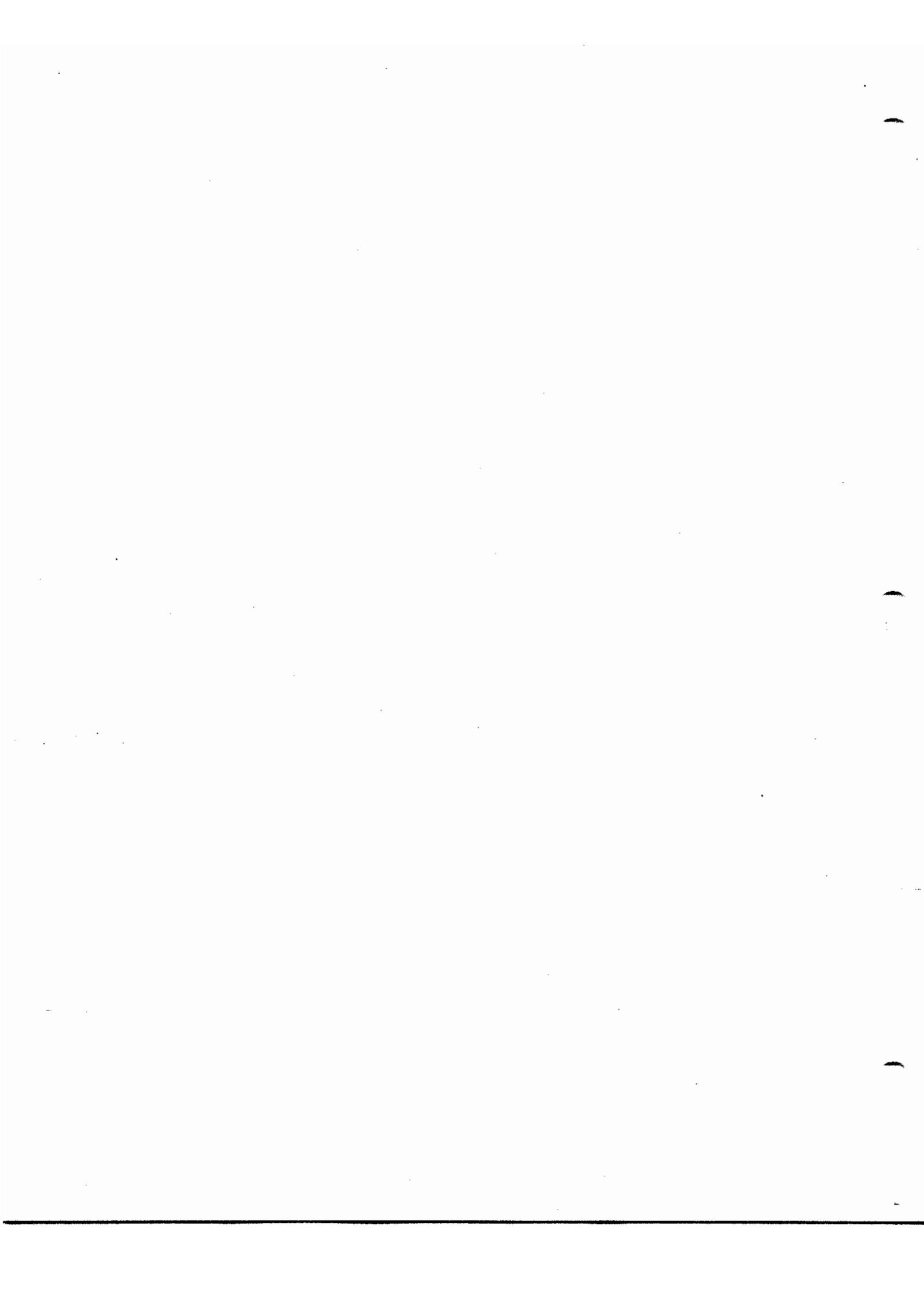
PART 3 EXECUTION

3.01 INSTALLATION

- A. Surfaces to receive work in this Section shall be smooth, even, sound, thoroughly clean, dry and free of defects which would adversely affect application of this work. Surfaces which do not meet the tolerances or quality imposed within the Specifications, shall be repaired or replaced prior to initiating this work.

- B. Install in strict accordance with shop drawings and the manufacturer's printed instructions.
- C. Adjust automatic door bottoms for proper operation.
- D. Protect all work of this Section until all related work is completed. Repair or replace damaged work at no additional cost to the Owner.

END OF SECTION



SECTION 08810

GLASS AND GLAZING

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section consists of furnishing all labor, equipment and material required to fabricate and install all glass and glazing and related work as described herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Manufacturer's Labels: Labels showing glass manufacturer's identity, type of glass, thickness and quality, will be required on each piece of glass. Labels must remain on glass until it has been set and inspected. When glass is not cut to size by the manufacturer and is furnished unlabeled as "stock to cut", the Contractor shall submit an affidavit, or other satisfactory written evidence such as certified laboratory or mill test reports stating the quality, thickness, type and manufacturer of the glass furnished.
- B. The Contractor shall submit engineering and product data on all glazing compounds and materials. If dry glazing systems are to be used and if requested by the Engineer, the Contractor shall submit samples of glazing system.
- C. Prior to the installation of any glass or glazing, the Contractor shall submit a detailed schedule identifying the type and texture of all glass units added in this Contract. The schedule shall include the following product information: manufacturer, type (as described under Part 2 of this Section), thickness and size of the glass unit and color of gasket or glazing compound.

1.03 SIZES, DELIVERY AND STORAGE

- A. Sizes: The sizes of glass indicated on Drawings are approximate only. Determine the actual sizes required by measuring frames to receive the glass at the Project site, or from guaranteed dimensions provided by the frame supplier. No attempt shall be made to change the size of heat strengthened tempered glass after they leave the factory. All heat absorbing glass must be clean cut. Nipping to remove flares or to reduce oversized dimensions of any type of glass shall not be permitted.
- B. Delivery: Deliver glass to site in suitable containers that will protect glass from the weather and from breakage. Deliver sufficient glass to allow for normal breakage. All putty and glazing compounds shall arrive at the Project site in labeled containers which have not been opened.

- C. Storage: Store glass away from construction operations in a protected place. Store glass on edge at a 5 to 7 degree angle from vertical and lean against sturdy uprights. Cushion top and bottom edges with felt and separate panels with protective paper.

1.04 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all products furnished comply with all applicable requirements of these Specifications.

1.05 WARRANTY

Provide a warranty against defective materials and workmanship in accordance with the requirements of the section entitled "Warranties and Bonds" of these Specifications, with the only exception that certain products described within this Section require warranties exceeding one year.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

All types of glass shall be equal to those manufactured by Pittsburgh Plate Glass Company, Libby-Owens-Ford Glass Company or Mississippi Glass Company.

2.02 CLEAR GLASS

Clear glass for windows shall be glazing quality, clear architectural float glass conforming to the requirements of Federal Specification DD-G-451d. Clear glass shall have a thickness of 1/4-inch and a daylight transmittance of not less than 88 percent. Unless noted otherwise on the Drawings, all glass shall be "clear glass" as specified below.

(1) 2.03 TEMPERED SAFETY GLASS

Tempered glass shall be tempered, clear float safety glass conforming to Federal Specification DD-G-1403B, ANSI Z94.1, Consumer Products Safety Council 16 CFR 1201, and the Safety Glazing Certification Council. Tempered glass shall be made by heating and quickly cooling annealed glass so that the resulting glass has a strength 4 to 5 times that of regular annealed glass. Upon breaking, tempered glass shall fracture into many fine, pebble-like particles. Unless otherwise shown on the Drawings, tempered glass shall have a thickness of 1/4-inch.

(1) 2.04 INSULATING GLASS UNITS

Insulating glass units shall consist of two glass panels separated by a 1/2-inch air space. Glass panels shall be 1/4-inch thick, clear, tempered safety glass conforming to 2.04 of this Section. Panels shall be separated by a corrosion resistant, tubular metal spacer

containing a special desiccant to provide an original air space dewpoint of -60 degrees F and to provide a moisture-free air space for the unit's warranty period. Units shall be hermetically sealed with a two-component, vulcanized structural sealant. Insulating glass units shall carry a minimum 10 year warranty against failure of the air space seal.

(1) 2.05 SPANDREL GLASS

- A. Type: Meet ASTM C1048-85, Kind HT, Condition B, Type I, Class 3, Quality q3, tempered glass.
- B. Base Glass Color: Clear.
- C. Thickness: 1/4-inch thick.
- D. Final Color: Selected by Architect from manufacturer's standard colors.
- E. Provide factory applied opacifier coating.
- F. Spandrel insulation specified in section entitled "Building Insulation" of these Specifications.
- G. Inboard Lite: 1/4-inch thickness, clear, tempered spandrel glass.
- H. Outboard Lite: 1/4-inch thickness, bronze, tempered glass.
- I. Total Unit Thickness: 1-inch.
- J. Spacer: Metal complete with dessicant; size to produce indicated air space; provide muntin grid between glass lites for door glass.
- K. Primary Seal: Polyisobutylene; continuously applied each side of spacer to bond spacer to each lite.
- L. Secondary Seal
 - 1. Type: Silicone, similar to General Electric Company Silicone Products Division; SCS 3211 Silicone Construction Sealant.
 - 2. Application: Bonds to metal spacer and glass lite face adjacent spacer; applied as three side bond.
- M. Comply with ASTM E774-84a, Class B.

(1) 2.06 GLAZING

- A. In general, glazing practices and materials shall conform to glazing manuals published by the Flat Glass Manufacturers Association and the Sealed Insulating Glass Manufacturers Association, as appropriate, and the standards of the Architectural Aluminum Manufacturers Association.

- B. Glazing Materials: Adequate provision shall be made for use of glazing compound if applicable. The glazing material shall be particularly adapted for use with the frame material and shall not require painting. Any material to which the glazing compound will not readily adhere shall be removed from the glazing surfaces by the glazing contractor. Windows may be either factory or field glazed by one of the following methods:
1. Glazing Beads: Glazing beads or retainers of any material compatible with the frame material may be used and, if required to retain the glass, shall be of sufficient strength and fixation to serve this purpose. Thickness of glazing beads is optional except as otherwise specified in a particular product specification. Rigid vinyl glazing beads, where used, shall conform to AAMA Specification PS 26-70. Neoprene glazing beads are also acceptable.
 2. Channel-Type Gaskets: Gaskets shall be of material compatible with aluminum, be resistant to weathering and maintain a watertight seal between the glass and its surrounding frame. Flexible vinyl, where used, shall be equal to Commercial Standard CS 230-60. Neoprene gaskets are acceptable.
 3. Glazing Compound: Glass may be back bedded and face puttied with a glazing compound meeting Federal Specification TT-G-401E. There shall be sufficient bedding compound to prevent glass-to-frame contact. Glazing clips shall be used to secure the glass in the frame before face puttying. Compound used for glazing in aluminum or stainless steel frames shall be nonhardening and noncorrosive, colored to harmonize with the frames. It shall be of type and composition that will not require any paint or other coating to protect it.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All glass units shall be installed with approved glazing to match the adjacent materials and shall be cut and set accurately to assure a solid uniform tight setting to eliminate all rattling and movement of the glass. Installation shall be in conformance with the manufacturer's printed recommendations and instructions.
- B. All glass shall be accurately cut to fit openings. The size of the glass unit shall be in accordance with the recommendations of the manufacturer of the window or door in which the glass is set.
- C. Glass shall be set on two neoprene setting blocks placed at the exterior quarter points or between greater points and at least 6-inches from corners of the glass panel. Setting blocks shall be at least 2-inches long and 1/8-inch wider than the glass material. Neoprene material shall have 70-90 Shore Durometer hardness.
- D. In dry glazing systems, soft (30-50 Shore Durometer) neoprene spacer strips shall be used at jambs and heads. Sash sills must weep to

outside through three holes per sill, one at the center and one near each jamb.

- E. Glazing shall not be conducted at outside air temperatures below 40 degrees F.
- F. Tempered glass shall be installed with due consideration of long bow and short kink in selecting width of channel for glazing. Avoid contact between glass and window frame to prevent chipping of edges. Tempered glass panels with chipped edges shall not be used.

3.02 REPLACEMENTS AND CLEANING

- A. At completion of work, all glass shall be free from cracks and other defects not allowed by the Specifications. Any defective glass that may appear before acceptance, or within the warranty period shall be removed and replaced with new glass without cost to the Owner.
- B. Remove from site all boxes, crates, containers and other debris used for glazing operations.
- C. Before acceptance by the Owner, the Contractor shall engage competent personnel to thoroughly clean all glass and window areas.

END OF SECTION



SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SCOPE

This Section includes, but is not necessarily limited to, standards for cleaning and painting structures and equipment described in the Drawings and Specifications. Furnish all materials, equipment and labor necessary to complete the work.

1.02 SUBSTITUTIONS

To the maximum extent possible, all coatings shall be the products of a single manufacturer. Guidelines for determination of acceptability of product substitutions are given in the section entitled "Substitutions and Product Options" of these Specifications. Contractors intending to furnish substitute materials or equipment are cautioned to read and strictly comply with these guidelines.

1.03 SUBMITTALS

All submittals shall be made in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.

1.04 PROJECT MEETING

Prior to ordering any of the materials covered under this Section, the Contractor, Engineer, painting subcontractor and paint manufacturer's representative shall attend a progress meeting in accordance with the requirements of the section entitled "Project Meetings" of these Specifications, and review the work to be performed under this Section.

1.05 PAINTING REQUIREMENTS

- A. Finish paint all exposed surfaces except anodized or lacquered aluminum, stainless steel and copper surfaces. Exposures and surfaces are defined in 3.07 of this Section. Items to be left unfinished or to receive other types of finishes, such as tile, are specifically shown on the Drawings or specified.
 - 1. Unpainted Products: Full field cleaning and priming will be performed in accordance with specification requirements for unpainted products. Maintain adequate equipment on the site to assure proper cleaning.
 - 2. Shop Primed Products
 - a. Manufactured products may be shop cleaned and primed. Shop cleaning must equal or exceed cleaning specified in the

Painting Schedule. Clean as specified and reprime all abrasions, weld splatter, excessive weathering and other defects in the shop prime coating.

- b. Manufacturers furnishing shop primed products shall certify that cleaning was performed in accordance with specification requirements and that the specified primer was used.
- c. Fully field clean and prime any shop primed products which the Engineer determines that were not cleaned in accordance with the Specifications prior to priming, that the wrong primer was applied, that the primer was applied improperly, or has excessively weathered, or that the product is otherwise unacceptable.

- 3. Finish Painted Products: Certain products such as electrical control panels and similar items may, with the approval of the Engineer, be furnished finish painted. Properly protect these products throughout the Project to maintain a bright and new appearance. If the finish surfaces are defaced, weathered or not of the selected color, repaint as necessary.
- 4. Hardware: Remove all electrical plates, surface hardware, fittings and fastenings prior to painting operations. These items are to be carefully stored, cleaned and replaced upon completion of work in each area. Do not use solvent to clean hardware that may remove permanent lacquer finish.

1.06 QUALITY ASSURANCE

- A. The Contractor shall submit to the Engineer, for review, the following information concerning the materials the Contractor proposes to use in work covered by this item:
 - 1. A list of all components (paints or other materials) to be used in each painting system required herein.
 - 2. A complete descriptive specification of each component.
- B. Only those systems and components which are judged acceptable by the Engineer shall be utilized in the work covered by this item. No materials shall be delivered to the job site until the Engineer has evaluated their acceptability.
- C. The following information shall be included on the label of all containers of materials supplied under this item:
 - 1. Manufacturer's name
 - 2. Type of paint or other generic identification
 - 3. Manufacturer's stock number
 - 4. Color (if any)
 - 5. Instructions for mixing, thinning, or reducing (as applicable)

6. Manufacturer's application recommendations

7. Safety and storage information

- D. The Contractor shall obtain the Engineer's review of the first finished room, space, area, item or portion of work of each surface type and color specified. The first room, space, area, item or portion of work which is acceptable to the Engineer shall serve as the Project standard for all surfaces of similar type and color. Where spray application is utilized, the area to be reviewed shall not be smaller than 100 square feet.

1.07 MANUFACTURER'S REPRESENTATIVE DURING PAINTING OPERATIONS

An authorized representative of each coating manufacturer shall be present at the start-up and weekly during painting operations. Such representatives shall instruct and observe the Contractor's workers and shall, at the completion of the work, certify in writing to the Engineer that the manufacturer's application recommendations have been adhered to. The cost of this work shall be borne by the Contractor.

1.08 TESTING EQUIPMENT

- A. The Contractor shall furnish and make available to the Engineer the following items of testing equipment for use in determining if the requirements of this Section are being satisfied. The specified items of equipment shall be available for the Engineer's use at all times when field painting or surface preparation is in progress:

1. Wet film gauge
2. Surface thermometer
3. Keane-Tator surface profile comparator
4. Set of National Association of Corrosion Engineers (NACE) visual standards
5. Holiday (pin hole) detector (low voltage)
6. Sling-psychrometer
7. Magnetic dry film gauge

PART 2 PRODUCTS

2.01 MATERIALS

- A. Application Data: All applicable data currently published by the paint manufacturer relating to surface preparation, coverages, film thickness, application technique, drying and overcoating times is included by reference as a part of this Section. It will be the responsibility of the Contractor to obtain and fully understand the appropriate data sheets for the coatings specified.

B. Products

1. Paints shall be factory mixed and delivered to the site in unbroken original packages bearing the manufacturer's name and brand designation and shall be applied in strict accordance with the manufacturer's printed specifications. Two-component coatings shall be mixed in accordance with manufacturer's instructions. All two-component coatings, once mixed, shall be applied within the pot-life recommended by the manufacturer.
2. Unless otherwise specified, paints shall be of the best grade. All thinners, driers, varnish, etc., shall be of the best grade and shall be furnished by the coating manufacturer for use with the specified paints.

- C. Colors: The Owner will select the colors to be used on the various portions of the work. Provide color cards for the coatings proposed. Where more than one coat of paint is required, job tint the paint for each undercoat off-shade to show complete coverage.

2.02 PIPE AND EQUIPMENT IDENTIFICATION

Different colors will be used on pumps, motors, valves, piping systems and other surfaces as shown in Table 1.

2.03 MIXING AND TINTING

- A. When possible, all paints and other materials shall be mixed and tinted by the paint manufacturer prior to delivery to the job site.
- B. When job site mixing and/or tinting is required, the manufacturer's recommendations shall be strictly adhered to. The Contractor shall be solely responsible for the proper conduct of all on-site mixing and/or tinting.

2.04 OSHA SAFETY COLOR USAGE GUIDE

- A. OSHA Safety colors, in accordance with ANSI Z3.1, shall be used for marking physical hazards and safety equipment and locations. The following OSHA Safety Color Usage Guide will be used in determining the coating color and type of marking required.

1. SAFETY RED

Fire protection equipment
Fire boxes
Extinguishers
Exit signs
Sprinkler piping
Portable containers of flammable liquids
Emergency stop bars

2. SAFETY ORANGE

Exposed box housings
Exposed edges of pulleys, gears, etc.
Safety starting buttons

3. SAFETY YELLOW: Physical Hazard CAUTION (Generally used with Black in checks or stripes).

Unguarded edges of platforms
Elevator door edges
Bollards
Pulley Blocks
Material handling equipment

4. SAFETY GREEN: Safety Equipment and Locations

First aid kits and stretchers
First aid signs, dispensaries and drinking water stations

PART 3 EXECUTION

3.01 GENERAL

Adequately protect other surfaces from paint and damage. Furnish sufficient drop cloths, shields and protective equipment to prevent spray or droppings from fouling surfaces not being painted and, in particular, surfaces within storage and preparation area. Repair damage as a result of inadequate or unsuitable protection.

3.02 PRODUCT HANDLING

A. Delivery

1. Deliver materials in original, sealed containers of the manufacturer with labels legible and intact.
2. Each container shall be clearly marked or labeled to show paint identification, date of manufacture, batch number, analysis or contents, identification of all toxic substances and special instructions.

B. Storage

1. Store only acceptable Project materials on the Project site.
2. Store material in a suitable location and in such a manner as to comply with all safety requirements including any applicable federal, state and local rules and requirements. Storage shall also be in accordance with the instructions of the paint manufacturer and the requirements of the insurance underwriters.
3. Restrict storage area to paint materials and related equipment.
4. Place any materials which may constitute a fire hazard in closed metal containers and remove daily from the Project site.

3.03 CLEANING AREA

Construct a temporary shed no smaller than 40 feet wide and 60 feet long for field cleaning, including blasting and priming operations. Maintain this area for all painting operations until all such work has been completed and approved. Provide all fixtures and appurtenances required to perform the work, including fixtures to support the work off the ground and proper storage facilities.

3.04 ENVIRONMENTAL CONDITIONS

Environmental conditions which affect coating application include, but are not necessarily limited to, ambient air temperature, surface temperature, humidity, dew point and environmental cleanliness. Comply with the manufacturer's recommendations regarding environmental conditions under which coatings may be applied.

3.05 SURFACE PREPARATION

- A. General: All surfaces shall be thoroughly clean, dry, and free from oil, grease or dust. All concrete shall have cured a minimum of 21 days before painting. All fabricated metal products shall have all weld flux and weld spatter removed and sharp peaks in welds ground smooth. The Engineer will inspect the surface preparation prior to the application of coatings. If the preparation is found to be satisfactory, a written order will be given to proceed with coatings.
- B. Ferrous Metals: Standards for the surface preparation of ferrous metals required in the Material Schedules are the standards of the Steel Structures Painting Council (SSPC, SP-1 through SP-10). Inspection of these surfaces will be evaluated by field comparison with visual comparator panels. These panels shall be securely wrapped in clear plastic and sealed to protect them from deterioration and marring.
- C. Concrete Surfaces: For all concrete surfaces, the following surface preparation shall be employed:
 - 1. CC-1 - Wash: Wash and scrub all surfaces with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of trisodium phosphate in each gallon of water used. Flush away all soap and dirt with clean water. After this washing the surface will be re-checked and any rough areas not suitable for painting shall be sandblasted smooth.
 - 2. CC-2 - Acid Etch: Surface preparation for painting shall not commence until 7 days after the concrete has been pronounced cured. Wash and scrub all surfaces with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of trisodium phosphate in each gallon of water used. Flush away all soap and dirt with clean water and then etch the surface with a 15 percent or stronger solution of muriatic acid until an openfaced granular texture, similar to fine sandpaper, is obtained. Any areas that remain smooth are to be re-etched until the desired texture is achieved. Flush and scrub away with clear water all acid and loosened particles.

3. CC-3 - Blast Cleaning: Remove all form oil and dirt by washing the surface with a solution of 1-1/2 ounces of soap chips and 1-1/2 ounces of trisodium phosphate in each gallon of water used. Blast clean all laitance and other foreign material from the surface of the concrete until an openfaced granular texture similar to fine sandpaper is achieved. These results should be accomplished with blast cleaning similar to "brush blasting" steel surfaces.

D. Wood Surfaces: All wood surfaces shall be clean, dry and adequately protected from dampness. Sandpaper to a smooth, even surface, then dust off. After priming coat has dried, apply shellac to all knots, pitch and resinous sapwood. Putty all nail holes, cracks, open joints and other defects; color putty to match finish paint or stain.

3.06 APPLICATION

A. Conditions: No paint shall be applied upon damp or frosty surfaces, or in wet or foggy weather. No paint shall be applied in temperatures below 40 degrees F, when freezing (32 degrees F) is predicted within 24 hours of application, or under temperature or humidity conditions not recommended by the manufacturer.

B. Surface Preparation: After specified surface preparation, all surfaces shall be brushed free of dust or foreign matter. Surfaces shall be completely dry before any paint is applied. All voids, open or hollow places in masonry shall be repaired with an epoxy patching compound.

C. Application: Paint shall be evenly spread in the proper thickness, so that there shall be no drops, runs or saggings of the coating. Where runs and drops do occur, they shall be removed and the surface re-coated to the satisfaction of the Engineer. Sufficient time, as directed by the manufacturer, shall be allowed for the paint to dry before the application of succeeding coats.

D. Protection of Work Area: Use drop cloths or other suitable means to protect other surfaces of the structure or equipment in place. Upon completion of the work, remove all paint spots from surfaces as directed by the Engineer.

E. Inspection: The Engineer will inspect each coat prior to the application of subsequent coats. If the work is found to be satisfactory, a written order will be given to proceed.

F. Defective Work: Remove and replace, at the direction of the Engineer, any painting work found to be defective or applied under adverse conditions.

3.07 PAINTING SCHEDULE

A. General: The Painting Schedule summarizes the painting systems to be applied to the various surfaces. Items which appear in the Painting Schedule are defined as follows:

- B. Exposure terms refer to the environmental conditions to which different surfaces may be exposed. A surface may exist in more than one exposure, e.g. an exterior wall can be categorized not only as "above grade", but also as "below grade", where the exposure is delimited by the grade line.
1. Interior: All surfaces within the confines of a building or other enclosure not constantly exposed to weather, including concealed surfaces subject to trapped moisture, heat or other deteriorating conditions and all surfaces exposed to view.
 2. Exterior
 - a. Above Grade: All surfaces above finished grade and exposed to weather.
 - b. Below Grade: All surfaces below the finished grade line. Building surfaces with this exposure shall only be painted when they are structurally common with an interior surface, e.g. exterior walls of a dry pit, not the exterior wall of a below grade tank.
 3. Submerged: All surfaces below a water surface or exposed to spray. Surfaces exposed to spray includes all areas within 6-inches of maximum water surface in quiescent tanks and within 18-inches of maximum water surface in mixed or agitated tanks. Building surfaces with this exposure shall only be painted when surfaces above water level have an interior exposure.

C. Surfaces

1. Floors: Interior surfaces subject to foot or roller traffic.
2. Building Surfaces: All structural and architectural surfaces except floors. Building surfaces include, but are not limited to, doors and frames, windows and frames, floor doors and walls.
3. Piping: All plumbing and process piping and accessories including valves, fittings, pipe supports, electrical conduit and similar related items.
4. Equipment: All mechanical, electrical, and architectural equipment, items, and accessories installed in the work and not defined above. Equipment includes, but is not limited to: pumps, motors, cabinets, ducts, tanks and process equipment.

3.08 MATERIAL SCHEDULES

Material Schedules list pretreatment coats, wash coats, seal coats, prime coats, intermediate coats, finish coats and cover coats that comprise a complete and compatible system of surface protection for the particular substrate. Maintain the unity of these systems, making sure all coats applied to any surface are from the same system and same manufacturer. Verify with the manufacturer the compatibility of the materials used.

3.09 MAINTENANCE MATERIALS

Furnish the Owner at least 1 gallon of each type and color of paint used for finish coats and 1 gallon of each type of thinner required. Containers shall be tightly sealed and clearly labeled.

(2)

PAINTING SCHEDULE

Exp. Surfaces	Material Schedule					
	Concrete Conc Blk Substrate	Galvanized Metals Substrate	Ferrous Metals Substrate	Wood Substrate	Gypsum Drywall Substrate	PVC Substrate
Interior						
Floors	-	-				
(1) Bldg. Surfaces	134	157	147			-
Piping	-	157	147			173
Equipment	-	157	147			-
Exterior						
Above Grade						
Bldg. Surfaces	238	157				
Piping	-	-	247	221		173
Equipment	-	-	247			
Below Grade						
Bldg. Surfaces	-					
Piping						
Submerged						
Wastewater						
Bldg. Surfaces	-	-	444	-	-	-
Piping	-	-	444	-	-	-
Equipment	-	-	444	-	-	-

(1) Above grade only. No painting of interior concrete walls of dry wells, wet wells, or screen room below Elevation 871.0 required.

MATERIAL SCHEDULE

134

TYPE: EPOXY

USE: INTERIOR MASONRY AND CONCRETE

SURFACE PREPARATION: CC-2 or CC-3

TNEMEC -

1st COAT (PRIMER): 54-660 EPOXY MASONRY FILLER - 80 - 100 sq. ft./gal

2nd COAT: SERIES 104 COLOR HI-SOLIDS EPOXY - 4.0 - 6.0 mils dry

3rd COAT: SERIES 104 COLOR HI-SOLIDS EPOXY - 4.0 - 6.0 mils dry

*MINIMUM 8.0 MILS DRY

AMERON -

1st COAT (PRIMER): AMERLOCK 400 - 4.0 - 6.0 mils dry

2nd COAT: AMERSHIELD - 4.0 - 6.0 mils dry

*MINIMUM 8.0 MILS DRY

VALSPAR -

1st COAT: LATEX BLOCK FILLER 79-W-8

2nd COAT: SERIES 89 HI-BUILD EPOXY - 4.0 mils dry

3rd COAT: SERIES 84 HI-BUILD EPOXY - 4.0 mils dry

*MINIMUM 8.0 MILS DRY

INDURALL -

1st COAT: POLYURETHANE BLOCK FILLER P-1120

2nd COAT: PERMA-CLEAN POLYIMIDE EPOXY - 4.0 mils dry

3rd COAT: PERMA-CLEAN POLYIMIDE EPOXY - 4.0 mils dry

*MINIMUM 8.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

MATERIAL SCHEDULE

147

TYPE: ALIPHATIC POLYURETHANE

USE: INTERIOR FERROUS METAL

SURFACE PREPARATION: SP-10

VALSPAR -

1st COAT (SHOP PRIMER): VAL CHEM EPOXY PRIMER 13-R-60 - 2.0 mils dry

2nd COAT: 89 SERIES VAL-CHEM HI-BUILD EPOXY - 6.0 mils dry

3rd COAT: 40 SERIES VAL-CHEM URETHANE - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

TNEMEC -

1st COAT (SHOP PRIMER): SERIES 66-1211 EPOXOLINE PRIMER - 2.0 mils dry

2nd COAT: SERIES 66 HI-BUILD EPOXOLINE - 6.0 mils dry

3rd COAT: SERIES 70 ENDURA-SHIELD - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

INDURALL -

1st COAT (SHOP PRIMER): PERMA-CLEAN PRIMER - 2.0 mils dry

2nd COAT: PERMACLEAN - 6.0 mils dry

3rd COAT: INDURATHANE 4100 - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

KOPPERS -

1st COAT (SHOP PRIMER): 654 EPOXY PRIMER - 2.0 mils dry

2nd COAT: HI-GARD EPOXY - 6.0 mils dry

3rd COAT: 1122 BRS - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

(1)

MATERIAL SCHEDULE

157

TYPE: POLYURETHANE

USE: GALVANIZED METALS

SURFACE PREPARATION: SP-1 WITH MANUFACTURER'S RECOMMENDED PRE-TREATMENT

TNEMEC -

1st COAT (PRIMER): SERIES 66-COLOR HI-BUILD EPOXOLINE - 4.0 - 6.0 mils dry

2nd COAT: SERIES 66-COLOR HI-BUILD EPOXOLINE - 4.0 - 6.0 mils dry

3rd COAT: SERIES 70 ENDURA-SHIELD - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

INDURALL -

1st COAT (PRIMER): H4-1109 VINYL WASH PRIMER - 0.5 mils dry

2nd COAT: PE-50 EPOXY - 5.0 mils dry

3rd COAT: INDURATHANE 4100 - 2.0 mils dry

*MINIMUM 7.5 MILS DRY

VALSPAR -

1st COAT (PRIMER): VAL-CHEM VINYL WASH PRIMER 13-Y-8 - 1.5 mils dry

2nd COAT: 89 SERIES VAL-CHEM HI-BUILD EPOXY - 5.0 mils dry

3rd COAT: 40 SERIES VAL-CHEM URETHANE - 2.0 mils dry

*MINIMUM 8.5 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS SHALL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

MATERIAL SCHEDULE

173

TYPE: EPOXY-POLYAMIDE

USE: EXTERIOR OR INTERIOR PVC PIPE

SURFACE PREPARATION: CLEAN AND DRY

TNEMEC -

1st COAT (PRIMER): SERIES 66-COLOR HI-BUILD EPOXOLINE - 4.0 - 6.0 mils dry

*MINIMUM 4.0 MILS DRY

INDURALL -

1st COAT: PE-54 EPOXY - 4.0 - 6.0 mils dry

*MINIMUM 4.0 MILS DRY

VALSPAR -

1st COAT: 89 SERIES VAL-CHEM HI BUILD EPOXY - 4.0 - 6.0 mils dry

*MINIMUM 4.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

MATERIAL SCHEDULE

217

TYPE: ALIPHATIC POLYURETHANE

USE: EXTERIOR NON-FERROUS METALS

SURFACE PREPARATION: SP-1

TNEMEC -

1st COAT (PRIMER): SERIES 66-COLOR HI-BUILD EPOXOLINE - 4.0 - 6.0 mils dry

2nd COAT: SERIES 74-COLOR ENDURA-SHIELD IV - 2.0 - 4.0 mils dry

*MINIMUM 6.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS SHALL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

MATERIAL SCHEDULE

221

TYPE: ALKYD

USE: EXTERIOR WOOD

SURFACE PREPARATION: AS SPECIFIED FOR WOOD

TNEMEC -

1st COAT (PRIMER): SERIES 36-603 UNDERCOATER - 2.0 mils dry

2nd COAT: SERIES 23-COLOR ENDURATONE - 1.5 - 2.0 mils dry

3rd COAT: SERIES 23-COLOR ENDURATONE - 1.5 - 2.0 mils dry

*MINIMUM 5.0 MILS DRY

AMERON -

1st COAT (PRIMER): AMERCOAT 5401 H.S. - 2.0 - 3.0 mils dry

2nd COAT: AMERCOAT 5401 H.S. - 2.0 - 3.0 mils dry

*MINIMUM 4.0 MILS DRY

VALSPAR -

1st COAT (PRIMER): EXTERIOR FIRST COATER 17-W-4 - 3.0 mils dry

2nd COAT: 20 SERIES - 2.0 mils dry

3rd COAT: 20 SERIES - 2.0 mils dry

*MINIMUM 7.0 MILS DRY

INDURALL -

1st COAT (PRIMER): 101 PRIMER, WHITE H-1400 - 2.0 mils dry

2nd COAT: INDURUST ENAMEL - 2.0 mils dry

3rd COAT: INDURUST ENAMEL - 2.0 mils dry

MINIMUM 6.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

MATERIAL SCHEDULE

238

TYPE: ACRYLIC

USE: EXTERIOR CONCRETE MASONRY

SURFACE PREPARATION: CC-1

TNEMEC -

1st COAT (PRIMER): SERIES 156-COLOR ENVIRO-CRETE - 100 - 150 sq. ft./gal

2nd COAT: SERIES 156-COLOR ENVIRO-CRETE - 4.0 - 6.0 mils dry

*MINIMUM 4.0 MILS DRY

AMERON -

1st COAT (PRIMER): AMERGUARD 147 FILLER

2nd COAT: AMERGUARD 220 - 2.0 - 3.0 mils dry

3rd COAT: AMERGUARD 220 - 2.0 - 3.0 mils dry

*MINIMUM 4.0 MILS DRY

PORTER -

1st COAT (UNDERCOAT): THOROSEAL 2 lbs. per sq. yd. and 1/8-inch dry

2nd COAT: 520 SERIES - 2.0 mils dry

3rd COAT: 520 SERIES - 2.0 mils dry

*MINIMUM 4.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN THE NUMBER OF COATS SHOWN,
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO THE OWNER.

MATERIAL SCHEDULE

247

TYPE: ALIPHATIC POLYURETHANE

USE: EXTERIOR FERROUS METAL

SURFACE PREPARATION: SP-10

VALSPAR -

1st COAT (SHOP PRIMER): VAL CHEM EPOXY PRIMER 13-R-60 - 2.0 mils dry

2nd COAT: 89 SERIES VAL-CHEM HI-BUILD EPOXY - 6.0 mils dry

3rd COAT: 40 SERIES VAL-CHEM URETHANE - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

TNEMEC -

1st COAT (SHOP PRIMER): SERIES 66-1211 EPOXOLINE PRIMER - 2.0 mils dry

2nd COAT: SERIES 66 HI-BUILD EPOXOLINE - 6.0 mils dry

3rd COAT: SERIES 70 ENDURA-SHIELD - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

INDURALL -

1st COAT: PERMA-CLEAN PRIMER - 2.0 mils dry -

2nd COAT: HIGH BUILD PERMA-CLEAN EPOXY - 6.0 mils dry

3rd COAT: INDURATHANE 4100 - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

KOPPERS -

1st COAT (SHOP PRIMER): 654 EPOXY PRIMER - 2.0 mils dry

2nd COAT: HI-GARD - 6.0 mils dry

3rd COAT: 112 BRS - 2.0 mils dry

*MINIMUM 10.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN THE NUMBER OF COATS SHOWN,
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO THE OWNER.

MATERIAL SCHEDULE

444

TYPE: EPOXY

USE: SUBMERGED FERROUS METAL

SURFACE PREPARATION: SP-10

TNEMEC -

1st COAT (PRIMER): SERIES 66-COLOR HI-BUILD EPOXOLINE - 4.0 - 6.0 mils dry

2nd COAT: SERIES 104-COLOR HI-SOLIDS EPOXY - 6.0 - 8.0 mils dry

*MINIMUM 10.0 MILS DRY

VALSPAR -

1st COAT (PRIMER): NONE - SELF-PRIMING

2nd COAT: 78 SERIES HI-BUILD EPOXY - 5 mils dry

3rd COAT: 78 SERIES HI-BUILD EPOXY - 5 mils dry

*MINIMUM 10.0 MILS DRY

INDURALL -

1st COAT (PRIMER): INDURA ZINC-10 H-1080 - 2.0 mils dry

2nd COAT: PE-54 EPOXY - 4.0 mils dry

3rd COAT: PE-54 EPOXY - 4.0 mils dry

*MINIMUM 10.0 MILS DRY

KOPPERS -

1st COAT (PRIMER): NONE - SELF-PRIMING

2nd COAT: HI-GARD - 5.0 mils dry

3rd COAT: HI-GARD - 5.0 mils dry

*MINIMUM 10.0 MILS DRY

*IF MINIMUM MIL THICKNESS IS NOT ACHIEVED IN NUMBER OF COATS SHOWN -
ADDITIONAL COATS WILL BE APPLIED AT NO ADDITIONAL EXPENSE TO OWNER.

Schedule Numbering Guide

First Number

- (1) Interior and weather protected
- (2) Exterior weather exposure
- (3) Submerged in potable water but protected from sunlight
- (4) Submerged in potable water and exposed to sunlight
- (5) Submerged in wastewater

Second Number

- (1) Non-Ferrous Metals
- (2) Wood
- (3) Concrete, Block, Masonry
- (4) Ferrous Metals
- (5) Galvanized Ferrous Metals
- (6) Drywall
- (7) PVC Pipe

Third Number

- (1) Alkyd
- (2) Asphaltic
- (3) Epoxy - Polyamide/Glass Flake
- (4) Epoxy - Amine
- (5) Vinyl
- (6) Coal Tar
- (7) Polyurethane
- (8) Acrylic
- (9) Zinc
- (0) Latex

Final Letter

- S Sewage
- W Potable Water
- F Floors
- C Severe Chemical Exposure

TABLE 1

PIPE IDENTIFICATION AND COLOR CODING

PIPE SYSTEM	PIPE	PAINT COLORS	LETTERS AND ARROWS	STENCIL TEXT
Air (Compressed)	Light green		Black	Air
Air (Process)	Light green with black bands (1)		Black	Air Process
Air, Instrument	Light purple		Black	Air Instrument
Alum	Dark blue with light brown bands (1)		Light brown	Alum
Ammonia Gas	Yellow with dark green bands (1)		Dark green	Ammonia Gas
Ammonia Solution	Yellow with light blue bands (1)		Light Blue	Ammoniation Solution
Chlorine Gas	Yellow with red bands (1)		Red	Chlorine Gas
Chlorine Solution	Yellow		Black	Chlorine Solution
Injector Water	Light grey with purple bands (1)		Light purple	-
Dewatering	Black with orange bands (1)		Orange	Dewatering
Drains (Plant)	Black with white bands (1)		White	Drain
Effluent, Secondary	Light grey with black and white bands (1)		Black	Secondary Effluent
Utility Water	Dark green with yellow bands (1)		Yellow	Utility Water Non-Potable
Filter Effluent	Light grey with white bands (1)		White	Filter Effluent
Filtrate	Black with yellow bands (1)		Yellow	Filtrate
Backwash	Light grey with light green bands (1)		Light green	Backwash Water
Foam Spray Water	Dark green		White	Foam Spray Water
Gasoline	Orange		White	Gasoline
Hydraulic Fluid	Purple		White	Hydraulic Fluid
Lubricating (Oil) (Grease)	Dark blue with red bands (1)		Red	Lubricant (Oil) (Grease)
Mixed Liquor (Aeration Tank Effluent)	Light grey with pink bands (1)		Pink	Mixed Liquor
Thickener Filtrate (Supernatant)	Light grey with dark brown and light brown bands (1)		Light brown	Thickener Filtrate (Supernatant)
Polymer	Pink with dark green bands (1)		Dark green	Polymer
Potable Water	Light blue		White	Potable Water (Cold) (Hot)
Raw Sewage (Wastewater)	Dark grey		Orange	Sewage
Scrubber Water	Light green with dark brown bands (1)		Dark brown	-
Scum	Light brown with pink bands (1)		Pink	Scum
Scum Decant	Light brown with red bands (1)		Red	Scum Decant
Digested Sludge	Dark brown with red bands (1)		Red	Digested Sludge
Sump Drains (Plant)	Light grey with orange bands (1)		Orange	Sump
Return Activated Sludge	Light brown		White	Return Sludge
Thickened Sludge	Light brown with light green bands (1)		Light green	Thickened Sludge
Waste Activated Sludge	Light brown with black bands (1)		Black	Waste Sludge
Vents (Plant)	Black		White	Vent (Plant)

Color Coding General Notes

1. All banding to be 2-inches wide and 4 feet on center.
2. Sample, drain, vent, metering, blowoff, decant, and hot lines shall be painted the same color combination as the piping system from which the line originates unless specified otherwise above. The additional pertinent text shall be applied to the pipe.
3. Insulated pipe, jacketed with canvas, shall be painted with the color combination specified above.
4. Insulated pipe, jacketed with aluminum and/or stainless steel shall have the jacket unpainted. When valves and fittings for such lines are not insulated, the valves and fittings shall be color coded.
5. Building service lines such as plumbing lines, HVAC lines, and electrical conduit, shall not be color coded but shall be painted the same color as the background construction.
6. All sludge lines not otherwise specified above shall be painted dark brown and stenciled as directed by the Engineer.
7. All polymer lines not otherwise specified above shall be painted pink and stenciled as directed by the Engineer.
8. All lettering shall be done in capital letters of approved size and type.
9. Legend symbols shall be applied on piping on every run and spaced not greater than 8 feet apart.
10. Text shall be applied on piping in the middle of pipe runs for runs under 50 feet or in one room, whichever is the least distance. On runs greater than 50 feet, text shall be applied at third points in the run and no more than 35 feet apart.
11. Pumps, chemical tanks and other items of equipment to be painted shall be painted a color corresponding to their service, in accordance with the above schedule.

END OF SECTION

SECTION 10521

PORTABLE FIRE EXTINGUISHERS

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing and installing portable fire extinguishers, including brackets, as specified herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Submit complete operation and maintenance data on the fire extinguishers in accordance with the requirements of the section entitled "Operating and Maintenance Data" of these Specifications.

1.03 STORAGE AND PROTECTION

Fire extinguishers shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

PART 2 PRODUCTS

2.01 GENERAL

- A. Portable fire extinguishers shall be furnished by a reputable, experienced manufacturer of fire protection equipment and, except for pressurized water extinguishers, shall conform to the applicable requirements of USCG, UL, DOT and OSHA. Pressurized water fire extinguishers shall be UL listed and FM approved.
- B. Except for pressurized water extinguishers, all portable extinguishers shall be suitable for operation over a temperature range of -40 to +120 degrees F in an indoor or outdoor environment.
- C. Portable fire extinguishers shall be furnished in the sizes and types shown on the Drawings. Unless otherwise shown or specified, the following ratings and capacities shall apply:
 - 1. Pressurized water fire extinguishers shall be rated 2-A and shall have a 2-1/2 gallon water capacity.
 - 2. Tri-class dry chemical fire extinguishers located in light and ordinary hazard areas shall be rated minimum 2-A; 20-B:C and shall be charged with 6 pounds of ammonium phosphate. Tri-class dry chemical fire extinguishers located in garage and vehicle

maintenance areas, machine shops, refueling areas and other extra hazard areas shall be rated minimum 4A; 60-B:C, and shall be charged with 10 pounds of ammonium phosphate.

3. Carbon dioxide fire extinguishers shall be rated 5-B:C and shall be charged with 5 pounds of carbon dioxide.
4. Halon fire extinguishers shall be rated 10-B:C and shall be charged with 5 pounds of bromochlorodifluoromethane (Halon 1211) or bromotrifluoromethane (Halon 1301).

2.02 PRESSURIZED WATER FIRE EXTINGUISHERS

- A. Pressurized water fire extinguishers shall have a Type 304C stainless steel cylinder, squeeze handle with locking pin, nozzle assembly with pressure gauge and flexible hose.
- B. Extinguisher shall be pressurized with air at a pressure approximately 100 psig. Nozzle assembly shall be equipped with a tapped charging port and integral pressure relief valve.

2.03 TRI-CLASS DRY CHEMICAL AND HALON FIRE EXTINGUISHERS

Tri-class dry chemical and Halon fire extinguishers shall have a drawn aluminum or steel cylinder, squeeze handle with locking pin, nozzle assembly with pressure gauge and heavy-duty corrosion-resistant wall bracket suitable for use in a vibrating environment.

2.04 CARBON DIOXIDE FIRE EXTINGUISHERS

Carbon dioxide fire extinguishers shall have a cold drawn, AISI 4130 steel cylinder conforming to DOT 3AA, squeeze handle with locking pin, chrome-plated brass nozzle assembly, one-piece, moulded discharge horn and heavy-duty, corrosion-resistant wall bracket suitable for use in a vibrating environment.

2.05 IDENTIFYING SIGNS

A laminated plastic identifying sign approximately 10-inches wide x 14-inches high and with a minimum thickness of 1/8-inch shall be provided for each fire extinguisher. The sign shall have a white background and contrasting red characters and markings, and shall be installed with pressure sensitive tape and adhesive. Layout of identifying signs shall be as shown on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

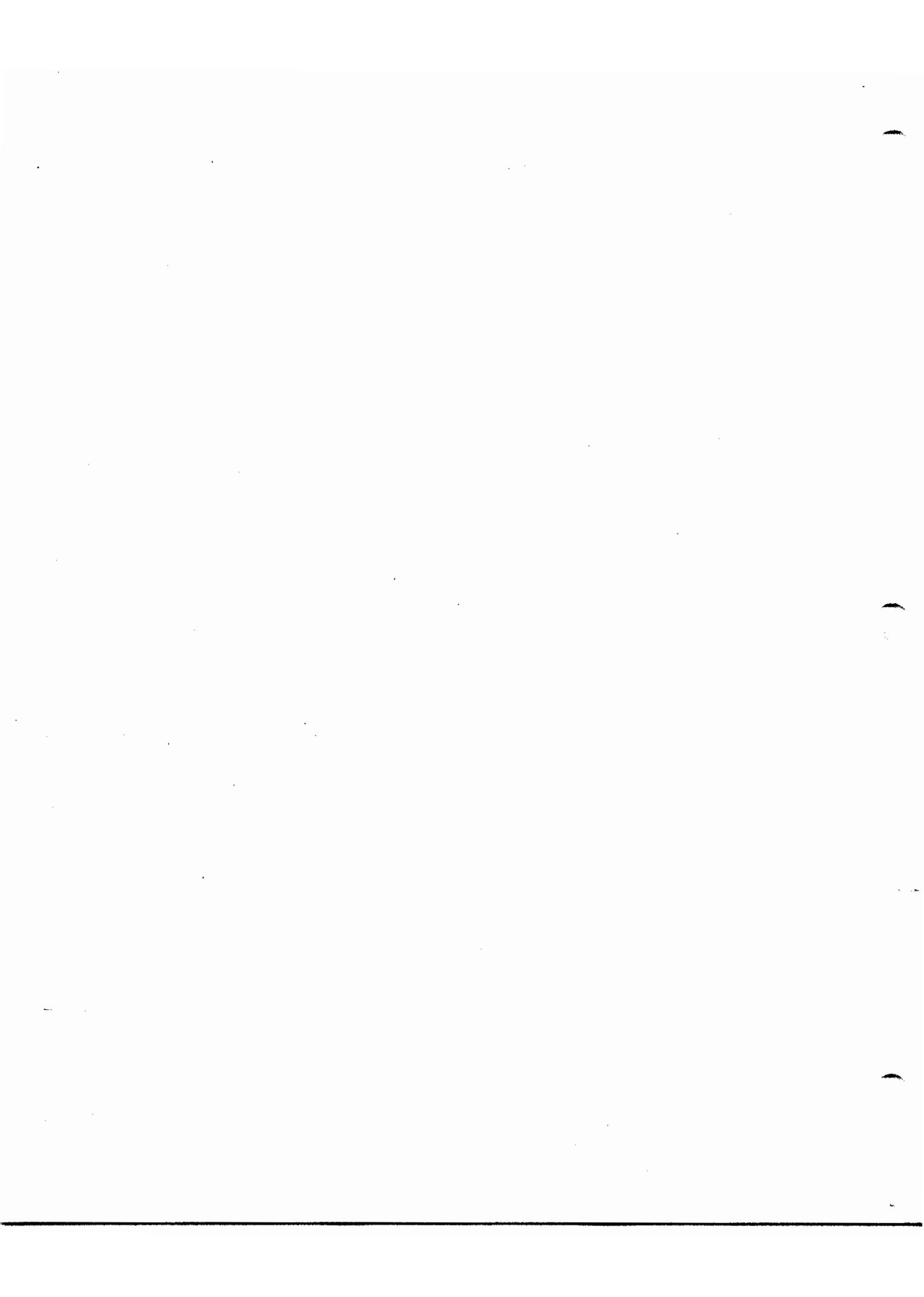
- A. Portable fire extinguishers shall be installed in accordance with NFPA No. 10, Standard for Installation of Portable Fire Extinguishers. Fire extinguishers shall be installed in clearly visible, readily accessible locations, as shown on the Drawings or directed by the Engineer. Travel distances to fire extinguishers inside buildings shall not exceed 50 feet for Class B:C rated units and 75 feet for Class A rated units.

- B. Unless otherwise shown or specified, fire extinguishers, except for pressurized water fire extinguishers, shall be wall mounted on suitable brackets or hangers with the top of the unit approximately 5 feet above the floor or working surface. Fire extinguishers mounted on unfinished masonry, tile, or concrete surfaces shall be secured to a dressed and finished wooden board, approximately 12-inches wide by 24-inches high with a nominal thickness of 1-inch. The board shall be securely anchored to the wall and shall be painted OSHA fire protection red. Pressurized water fire extinguishers shall be installed indoors in flush mounted, metal wall cabinets with hinged doors having glass windows and latching handles.
- C. All portable fire extinguishers shall be fully charged at the time of final acceptance.
- D. Halon and carbon dioxide fire extinguishers shall not be installed in pump station drywells or other similar enclosed areas with limited ventilation.
- E. Identifying signs shall be installed directly over the fire extinguisher with the bottom of the sign approximately six feet above the floor or working surface.

3.02 SURFACE PREPARATION AND SHOP PAINTING

Fire extinguishers and accessories shall be cleaned, shop primed and shop painted in accordance with the requirements of the section entitled "Painting" of these Specifications.

END OF SECTION



SECTION 10810
TOILET ROOM ACCESSORIES

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all materials, labor and equipment required to furnish and install all toilet accessories and precast shower receptors as specified herein and/or shown on the Drawings.

1.02 SUBMITTALS

- A. Complete shop drawings and engineering data shall be submitted to the Engineer in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Submit detailed accessory list and manufacturer's product literature to Engineer for approval.
- C. Submit complete operation and maintenance data on the accessories in accordance with the requirements of the section entitled "Operating and Maintenance Data" of these Specifications.

1.03 STORAGE AND PROTECTION

Accessories shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.04 QUALITY ASSURANCE

The manufacturer shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Toilet room accessories shall be manufactured by Bradley Corporation, Bobrick Washroom Equipment, Inc. or Pocono Metal Products Company, Inc. Model numbers listed in paragraph 2.02 of this Section are used to establish standards of quality and products of equal manufacture are acceptable.

2.02 ACCESSORY SCHEDULE

A. Control Building; Toilet

- I. One Bobrick Model No. B-3944 stainless steel recess mounted towel dispenser and waste receptacle.

2. Over Each Lavatory: One Bobrick Model No. B-290-6024 stainless steel framed mirror and shelf, with galvanized back plate secured with concealed theft-proof hangers.
3. Above Lavatories: One Bobrick Model No. B-12 liquid soap dispensers.
4. At Water Closet: One Bobrick Model B-274 multi-roll tissue holder.
5. At Water Closet: Two Bobrick Model No. B-490 x 48 grab bars.

PART 3 EXECUTION

3.01 INSTALLATION

Install toilet room accessories in strict accordance with manufacturer's recommendations.

3.02 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

END OF SECTION

SECTION 11201

SLIDE GATES

PART 1 GENERAL

1.01 SCOPE

The work covered by this Section includes furnishing all labor, equipment and materials required to install fabricated aluminum slide gates complete with slides and frames, as shown on the Drawings and/or specified herein.

1.02 DESIGN REQUIREMENTS

Slide gates and stop plates shall be reinforced as required for a maximum deflection under the design head of not more than 1/360 of the span of the gate.

1.03 SUBMITTALS

- A. Submit shop drawings and engineering data in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Operation and maintenance manuals shall be furnished in accordance with the requirements of the section entitled "Operating and Maintenance Data" of these Specifications.

1.04 STORAGE AND PROTECTION

Gates and plates shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.05 QUALITY ASSURANCE

The manufacturer shall provide written certification to the Engineer that all equipment furnished complies with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Slide gates and stop plates shall be as manufactured by Waterman Industries, Rodney Hunt, Washington Aluminum Company, Inc., Hydro Gate or Whipps, Inc.

2.02 MATERIALS AND CONSTRUCTION

A. Fabricated Slide Gates

1. Gate slides shall be fabricated from ASTM B 209, Alloy 6061 aluminum plate, minimally 1/4-inch thickness and reinforced with structural shapes sized to withstand the specified seating heads. The slides shall be provided with a pocket for attaching the stem. The pocket shall be attached to the slide by welding and shall be capable of taking the full thrust developed during normal gate operation.
2. The gate seat and angle frame shall be an integral extrusion meeting the requirements of ASTM B 308 or 209, Alloy 6061 assembled by welding to form the waterway opening. The gate frame shall form guides for the slide and holes shall be provided for anchor bolts. The angle frame shall be sufficiently long to retain at least one-half of the vertical height of the slide in the fully open position. The frame shall be suitable for embedding in concrete, unless otherwise shown on the Drawings.
3. A solid rubber seal, ASTM D 200, Grade 1 AA 625, shall be securely fastened to the bottom cross member of the frame with a retainer and threaded fasteners. The top surface of the seal shall be flush with the invert of the gate opening. The seal shall be replaceable without gate disassembly.
4. Fasteners: All anchor bolts, assembly bolts and nuts shall be of ample section to safely withstand forces created by operation of the gate. Quantity and size shall be recommended by the manufacturer. Anchor bolts shall be furnished with two nuts each to attach gates to concrete. Fasteners shall conform to the requirements of ASTM A 320, Grades B8 or B8F and ASTM A 194, Grade 8 or 8F.
5. Self-contained slide gates shall be sufficiently rigid so that no further reinforcing will be required. The yoke to support the operating device shall be formed by members welded or bolted to the top of the guides. The disc and stem shall be removable without disconnecting the yoke.
6. The slide gate shall incorporate ultra high molecular weight polymer bearing bars having an intrinsic viscosity of greater than 14 by test. The bearing bars shall reduce the coefficient of friction to 0.244 from that of metal to metal contact.

B. Stems

1. Operating stems shall be of a size to safely withstand, without buckling or distortion, the stresses induced by normal operating forces. The stems shall be designed to transmit, in compression, at least twice the rated output of the floor stand or bench stand with a 40 pound effort on the crank or handwheel.
2. The threaded portion of the stem shall have machined cut threads of the Acme type.

3. Stems of more than one section shall be joined by bronze couplings, threaded and keyed or bored and pinned to the stems. All threaded and keyed couplings of the same size shall be interchangeable.
4. Manually operated rising stem gates shall be provided with an adjustable, bronze stop collar on the stem above the lift nut.
5. All stems shall be fabricated from 303 or 304 stainless steel and shall not be less than 1-1/2-inches in diameter.
6. Provide a clear, plastic stem cover with mylar position indicator strip.

C. Manual Operator Floor Stands

1. Manual operation shall be by handwheel, minimally 24-inches in diameter or crank-operated floor stands or bench stands as shown on the Drawings. Handwheel operated type shall be without gear reduction; crank-operated type shall have either a single or double gear reduction, depending upon the lifting capacity required. Each type shall be provided with a threaded, cast bronze lift nut to engage the operating stem.
2. Tapered roller bearings or ball thrust bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts.
3. Floor stands shall operate the gates with not greater than 40 pound pull on the handwheel. Gears, where required, shall be steel or cast iron with machine cut teeth designed for smooth operation. The pinion shafts on crank-operated floor stands, either single or double, shall be supported on tapered roller bearings or needle bearings. All components shall be totally enclosed in a cast iron case and cover. Positive mechanical seals, to retain lubricant and exclude moisture and dirt, shall be provided on the operating nut and the pinion shafts where they extend from the cast iron case or gear box. Lubricating fittings shall be provided for the lubrication of all gears and bearings.
4. Floor stands shall include a cast iron pedestal design to position the input shaft approximately 36-inches above the operating floor.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Slide gates shall be installed as shown on the Drawings and/or specified herein.
- B. Slide gate frames and plates shall be checked, prior to installation, for projections or warpage that would promote excessive leakage. Defective gates and plates shall be removed and replaced.

- C. Slide gate frames shall be installed true to the lines and elevations shown and accurately aligned. Frames shall be internally braced and adequately supported during concrete placement and/or installation.

3.02 INSPECTION AND TESTING

Following installation, operating tests will be performed to demonstrate to the Engineer that all slide gates will perform in a satisfactory manner. The Contractor shall make, at Contractor's expense, all necessary modifications, changes and/or adjustments required to ensure satisfactory operation.

3.03 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

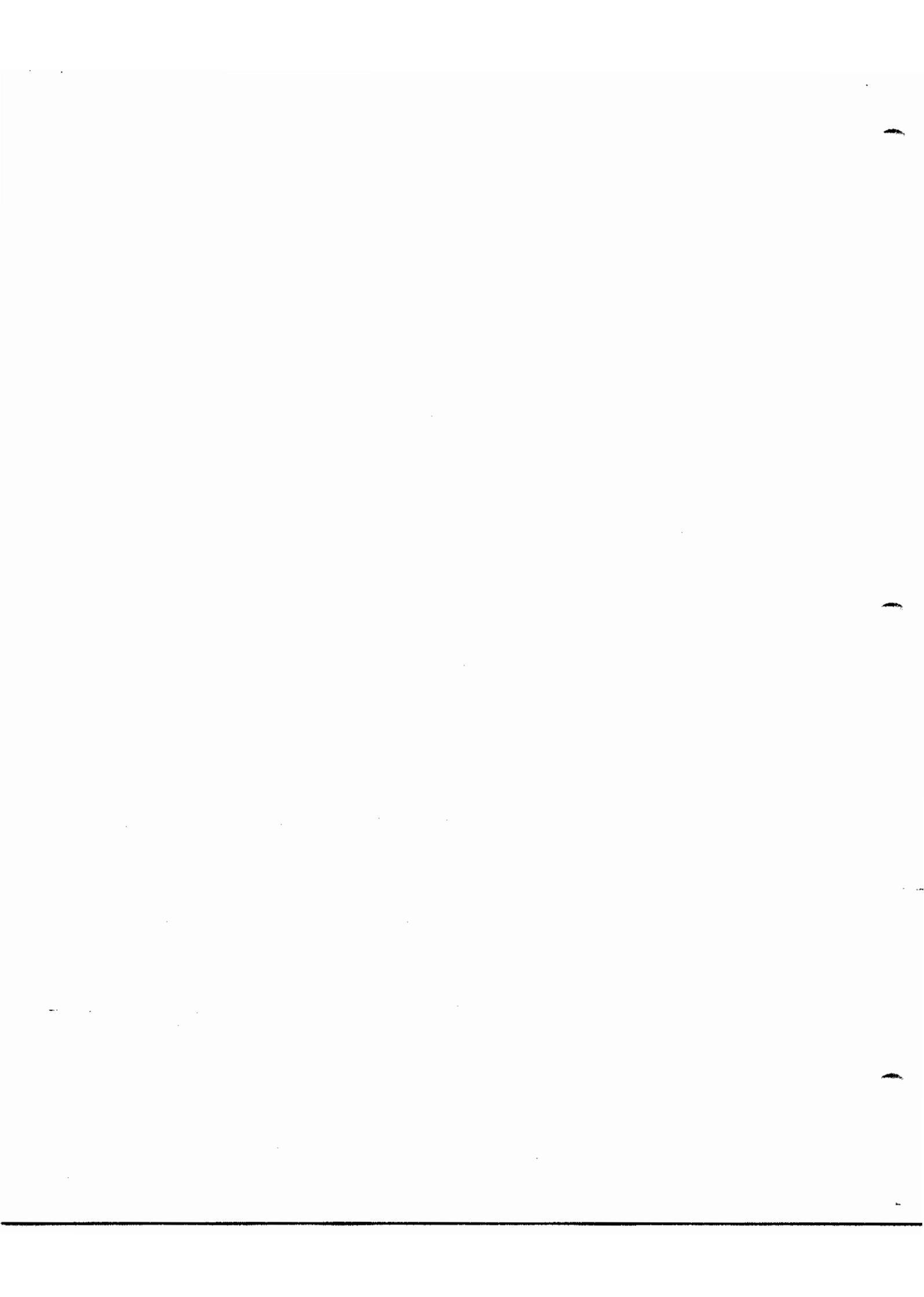
TABLE 1
SLIDE GATE SCHEDULE

<u>Equip. No.</u>	<u>Size (in)</u>		<u>Seating Head (ft)</u>	<u>Unseating Head (ft)</u>	<u>Operator Type</u>
	<u>Width</u>	<u>Length</u>			
SG-1	54	120	10	10	FS
SG-2	54	84	7	7	SC
SG-3	54	120	10	10	FS
SG-4	54	84	7	7	SC
SG-5	54	120	10	10	FS
SG-6	54	84	7	7	SC

FS - Floor stand type operator

SC - Self-contained operator

END OF SECTION



SECTION 11203

SLUICE GATES

PART 1 GENERAL

1.01 SCOPE

Provide all labor, materials, tools, equipment and related items required to furnish and install heavy duty sluice gates required on the Project. Each gate shall be furnished and installed complete with anchor bolts, operating stem, gate lift operator and other appurtenances as specified or needed to make a complete and operable installation.

1.02 QUALIFICATIONS

All sluice gates shall be furnished by a manufacturer fully experienced, (minimum five years), reputable and qualified in the manufacture of the materials to be furnished. Sluice gate shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.03 FACTORY TESTING

- A. Before the final assembly, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made. With the gate fully closed, the clearance between the seating faces shall be checked with a 0.004-inch thickness gauge. If this thickness gauge can be inserted between seating faces, wedging devices must be readjusted or the gate slide or gate frame or both re-machined, until insertion is no longer possible. In the event of re-machining, clearances will again be checked as stated above.
- B. After completion, all seating and wedging surfaces shall be thoroughly cleaned of all foreign materials and final adjustments made. The sluice gate shall then be shop operated from the fully closed to the fully open position to verify that the assembly is workable.

1.04 SUBMITTALS

- A. Submit shop drawings and engineering data in accordance with the requirements of the section entitled "Shop Drawings, Product Data and Samples" of these Specifications.
- B. Operation and maintenance manuals shall be furnished in accordance with the requirements of the section entitled "Operating and Maintenance Data" of these Specifications.

1.05 STORAGE AND PROTECTION

All gates and accessories shall be stored and protected in accordance with the requirements of the section entitled "General Equipment Stipulations" of these Specifications.

1.06 QUALITY ASSURANCE

The sluice gate manufacturer shall provide written certification to the Engineer that all equipment furnished complies with all applicable requirements of these Specifications.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Sluice gates shall be as manufactured by Rodney Hunt, Waterman Industries or Hydro Gate.

2.02 MATERIALS AND CONSTRUCTION

A. General

1. Gates, stems, lifts and other appurtenances shall be the size, type, material and construction as shown on the Drawings and specified herein. Gates shall meet the requirements of AWWA Specifications C-501 (latest revision) or as modified per these Specifications.
2. Sluice gates shall be flange type. Sluice gates shall be the rising stem type with operators mounted on wall thimbles with seating and unseating heads of the sizes as shown in Table 1.
3. All component parts shall be of the type of material shown and interchangeable, where size and material are the same, without grinding, chipping or special fitting in the field. All mating and sliding parts shall be fully machined. All sluice gate parts, including lift, shall be designed for the heads shown, with a minimum safety factor of 5.
4. All materials used in the construction of the gate and appurtenances shall be the best suited for the application and shall be as follows:

<u>Gate Part or Item</u>	<u>#1 (Standard) Bronze Trim</u>	<u>ASTM Standard Number</u>
Anchor Bolts & Nuts	18-8 Stainless (4)	A-582-Type 303 or 276-Type 304
Frame, Slide and Guide Rails	Cast Iron	A-126 Class B

<u>Gate Part or Item</u>	<u>#1 (Standard) Bronze Trim</u>	<u>ASTM Standard Number</u>
Seating Faces	Naval Bronze	B-2-1-Alloy 482
Wedges	Manganese Bronze	B-584-Alloy 865
Fasteners	18-8 Stainless (4)	(Bolts) A-193 Grade B8 (Nuts) A-194 Grade 8
Stem Block	Manganese Bronze	B-584-Alloy 865
Sill Plate	Cast Iron	A-126 Class B
Seal	Rubber	2000-Grade R-62
Retainer	Naval Bronze	B-2-1-Alloy 482
Yoke	Cast Iron	A-126 Class B
Stem	18-8 Stainless (1)	A-582-Type 303 or 276-Type 304

B. Frame and Guide Rails

1. The frame and guide rails shall be of cast iron and cast integrally and shall be machined on all bearing and contact surfaces.
2. Frame and guides shall be designed for the maximum head indicated, with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.
3. Guides shall be of such length as to support at least one-half of the vertical height of the slide when in the full-open position.

C. Slide

1. The slide shall be one-piece cast iron, with integrally cast strengthening ribs where required and a reinforced section to receive the seating faces.
2. The slide shall be designed for the maximum head indicated with a minimum safety factor of 5 with respect to tensile, compressive and shear strength.
3. The slide shall have tongues on each side extending its full length. These tongues shall be accurately machined on contact surfaces. Surfaces of the slide that come in contact with the seat facings and wedges shall be accurately machined. The maximum allowable clearance between the slide and slide guide shall be 1/16-inch.

4. A thrust nut pocket shall be provided above the horizontal center line of the slide reinforced by ribs. The thrust nut pocket shall be drained.

D. Seating Faces

1. Seating faces shall be made of strips of rolled or extruded bronze. They shall be firmly secured in finished grooves in the frame and slide faces in such a way as to insure that they will remain in place, free from distortion and loosening during the life of the sluice gate.
2. These faces shall be of ample section and so finished that the maximum clearance between the seating surfaces, with the slide in the closed position shall be 0.004-inch.

E. Seals

1. Resilient seals for flush bottom gates shall be of natural or synthetic rubber; reclaimed rubber shall not be used.
2. Rubber compounds shall contain no more than 1.5 part of wax per 100 parts of rubber hydrocarbon.
3. Rubber compounds shall be free of vegetable oils, vegetable oil derivatives, animal fats and animal oils.
4. Rubber seals shall be resistant to microbiological attack, copper poisoning and ozone attack.
5. The design of the seal should be as to provide tight shut-off.
6. Seals shall be mounted on the slide or frame and shall be securely held in place with a retainer bar leaving an unobstructed flush invert. The seal shall be replaceable without removal of the gate slide.

- F. Thrust Nut: Gate shall be provided with a thrust nut for connecting the stem to the slide. It shall be of ample design to take the thrust developed during gate operation, in opening and closing direction under the maximum operating head condition loads with a safety factor of 5. The thrust nut and slide shall be constructed to prevent turning off the thrust nut in a pocket in the slide. On non-rising stem gates, the thrust nut shall be threaded but not keyed or pinned to the stem, so that the nut and slide can move up and down the stem, as the stem turns.

- G. Wedging Devices: Sluice gate shall be equipped with adjustable side-wedging devices to provide contact between the slide and frame facings when the gate is in closed position. All faces shall be accurately machined to give maximum contact and wedging action. Wedges shall be fully adjustable and so designed that they will remain in the fixed position after adjustment. On all gates larger than 24-inches in size that will be subject to unseating heads, top and bottom wedging devices shall be provided. If the gates are flush

bottom closure gates, they will be provided with top wedges only. Individual parts of each wedging device shall be removable and replaceable without complete disassembly of the gate or guide.

- H. Assembly Bolts, Studs, Nuts and Anchor Bolts: All assembly bolts, studs, nuts and anchor bolts shall be of such size and spacing as required to provide for the design forces with a safety factor of 5. Bolting on circular, flanged-back gates shall mate with 25 pound or 125 pound drilling as specified in ANSI B16.1. An adequate number of holes shall be provided in the flange on the back of the gate to prevent leakage under the design heads and to resist the shearing action caused by closing and opening forces.
- I. Wall Thimbles: Wall thimbles shall be made of cast iron and shall be furnished by the gate manufacturer. The wall thimble shall provide a rigid mounting, designed to prevent warping of the gate frame during installation.
- J. Stems and Stem Couplings: Operating stems shall be of a size to safely withstand, without buckling or permanent distortion, stresses induced by normal operating forces. Stems shall be fabricated from round bar stock stainless steel meeting the requirements of ASTM A 582, Type 303 or 304 and shall be provided with 29 degrees modified or full acme threads. Stems composed of two or more sections shall be joined by bronze couplings, threaded and keyed to stems, or couplings of the same material as the stems, pinned, bolted or welded and pinned to the stems. Provide a clear, plastic stem cover with mylar position indicator strip.
- K. Stem Guides: Stem guides shall be cast, with bronze bushings, mounted on cast brackets. Guides shall be adjustable in two directions and shall be so constructed that when properly spaced they will hold the stem in alignment and still allow enough play to permit easy operation. Stem guide spacing shall be as recommended by the manufacturer, but in no case shall it exceed a l/r ratio of 200. Brackets shall be attached to the wall by anchor bolts of sufficient strength to prevent twisting or sagging under load.
- L. Manual Operator Floor Stands
 1. Manual operation shall be by crank-operated floor stands as shown on the Drawings. Crank-operated stands shall have either a single or double gear reduction, depending upon the lifting capacity required. A threaded, cast bronze lift nut shall engage the operating stem.
 2. Tapered roller bearings or ball thrust bearings shall be provided above and below a flange on the operating nut to support both opening and closing thrusts.
 3. Floor stands shall operate the gates with not greater than 40 pound pull on the crank. Gears, where required, shall be steel or cast iron with machine cut teeth designed for smooth operation. The pinion shafts on crank-operated floor stands, either single or double, shall be supported on tapered roller

bearings or needle bearings. All components shall be totally enclosed in a cast iron case and cover. Positive mechanical seals to retain lubricant and to exclude moisture and dirt, shall be provided on the operating nut and the pinion shafts where they extend from the cast iron case or gear box. Lubricating fittings shall be provided for the lubrication of all gears and bearings.

4. The removable crank shall be cast iron with a revolving brass or iron grip. Floor stands shall include a cast iron pedestal design to position the input shaft approximately 36-inches above the operating floor.

M. Motorized Actuators: Actuators shall be electric motor driven gear reducer with integral controls and thrust bearing.

1. Each motor operated valve shall include an electric valve actuating unit mounted on and assembled to the valve. The actuator shall be sized to open and close the valve at the operating differential pressure.
2. Each unit shall consist of a motor, reduction gearing, handwheel gearing, operating limit switches and torque limiting switches within one weatherproof enclosure. All valve actuators located outdoors shall have thermostatic strip heater to control condensation.
3. Actuator shall operate the valve from full open to full closed in 60 seconds.
4. The motor shall be high torque, totally enclosed in a NEMA 7 housing. The motor starting torque shall be equal to 2-1/2 times the running torque. It shall have AIEE standard Class B insulation. Grease tight operation shall be assured by the use of dual motor shaft seals.
5. The gearing shall be combined helical and worm gear type, accurately machined. Helical gears shall be alloy steel, hardened and ground. Gearing shall be grease lubricated, with high speed parts on antifriction bearings. An inspection plate on the housing shall be provided to allow inspection of the handwheel declutching mechanism, the motor gears, and for relubrication.
6. This unit shall include a handwheel for manual operation of the valve drive sleeve through direct gearing. The handwheel shall not rotate during electrical operation. The motor shall not rotate during hand operation. In no case will the handwheel ever be connected with the motor. When the unit is being operated manually, it shall be automatically returned to the electric operation when the handwheel is released.
7. The transfer from electric to manual operation shall be accomplished by a declutching lever arm which will disengage the motor mechanically but not electrically. The unit shall be capable of being clutched or declutched when operated electrically with no damage to the clutch or gear mechanism.

8. Position limit switches shall be provided for both open and close positions of travel and shall be connected directly to the valve through continuous gearing, and follow its position at all times. Mechanisms employing intermittent tooth gearing and rotary drive switches are not acceptable.
9. Where required by the instrumentation design, valve actuators shall incorporate a valve position transmitter.
10. A double acting adjustable torque limiting switch shall be provided and be responsive to the mechanical torque developed in sealing, backseating, or by obstruction. The torque switch operates a calibrated dial integrally mounted and directly related to the torque output of the operator. Torque control accuracy shall be within plus or minus 5 percent. The use of torque wrenches for calibration shall not be required.
11. The controls shall consist of a reversing contactor for each unit, mechanical and electrical interlock and thermal overload relays. The contactor shall break all lines to the motor. All controls will operate on 115 volts AC power. Provide a control power transformer if required by the power supply shown on the Drawings. A local pushbutton station shall be provided with open, close, and stop buttons, open and close indicator lights, and remote-local selection switch. All controls and pushbutton station shall be contained in NEMA 4 enclosures.
12. Controls shall provide for remote operation and remote indication of open and close positions.
13. Motorized operators shall be manufactured by Limatorque Corporation or EIM. Motorized operators shall be furnished by the manufacturer of the associated valve.

N. Workmanship

1. All parts in the sluice gate and accessories shall be accurately machined on mating and bearing surfaces. All like parts, except the bronze seating surfaces, shall be interchangeable so that replacement parts can be furnished at any time and attached in the field with a minimum of fitting, chipping or re-machining. All parts shall conform to the design dimensions and shall be free of defects of material and workmanship. All attaching bolt holes shall be drilled accurately to the layout indicated on the Drawings.
2. All casting shall be clean and sound without defect capable of impairing their functions.
3. The seating facings shall be machined to a finish of 63-micro-inches. The applicable standard is ANSI B46.1. All mating surfaces, such as guides-to-frame and frame-to-wall thimble, shall be machined flat.

PART 3 EXECUTION

3.01 INSTALLATION

Sluice gates and equipment shall be installed in accordance with the installation manual furnished by the gate manufacturer.

3.02 SURFACE PREPARATION AND SHOP PAINTING

Sluice gates and associated equipment shall be shop cleaned and painted in accordance with the requirements of the section entitled "Painting" of these Specifications.

3.03 FIELD PAINTING

All cast iron parts of the sluice gate (not in bearing or sliding contact) and stem guides shall be painted in accordance with the requirements of the section entitled "Painting" of these Specifications.

3.04 INSPECTION AND TESTING

- A. Following installation, operating tests will be performed to demonstrate to the Engineer that the sluice gates will function in a satisfactory manner. The Contractor shall make, at Contractor's own expense, all necessary changes, modifications and/or adjustments required to ensure satisfactory operation.
- B. The gate shall be subjected to leakage tests and pass the standard requirements for maximum leakage as specified in AWWA C501.

3.05 CLEANING

Prior to acceptance of the work of this Section, thoroughly clean all installed materials, equipment and related areas in accordance with the requirements of the section entitled "Cleaning" of these Specifications.

TABLE 1
SLUICE GATE SCHEDULE

<u>Location</u>	<u>Size Opening</u>	<u>Seating Head</u>	<u>Unseating Head</u>	<u>Thimble Type</u>	<u>Operator Type</u>
Wetwell No. 1	54" x 72"	33	33	Type F	Motorized
Wetwell No. 2	54" x 72"	33	33	Type F	Motorized
INF-MH-1	72" x 72"	35	35	Type E	Manual
Wetwell No. 1	48" x 48"	33	33	Type F	Manual

END OF SECTION